1. What is the difference btw monocular and binocular rivalry?

Their main difference is whether the patterns are superimposed. In monocular rivalry, two physically superimposed patterns that are dissimilar in colour and orientation compete for perceptual dominance (only one image pattern) (p1). In binocular rivalry, the alternations in perception occur when two different images are presented to the two eyes (more than one images) (p2).

2. Why is binocular rivalry an important psychophysical paradigm for studying the neurobiology of conscious awareness?

Binocular rivalry is an important psychophysical paradigm for studying the neurobiology of conscious awareness because it describes a phenomenon by which alternating visual percepts dominate conscious awareness for several seconds at a time (p1), rather than the two images meld into a single coherent view. during the suppression phases of rivalry, perceptually speaking, it is a visual figure that disappears from conscious awareness (p9). This provides us an opportunity to try to understand conscious awareness by studying the fluctuating neural states. Studying the mechanisms that mediate the dissociation between unchanging visual stimulation and fluctuating conscious awareness is important to learning the neural correlates of conscious visual awareness.

3. How do stimulus strength, attention, and visual context similarly/differentially modulate the dominance and suppression in binocular rivalry? What does this imply about the underlying neural processes that give rise to binocular rivalry?

Stimulus strength mainly modulates the suppression phase of a target, but has little effect on its dominance phase; the “stronger” competitor has an advantage in overall predominance (p3), as indexed by the percentage of total viewing time for which it is dominant; it tends to have an abbreviated period of suppression. With prolonger practice, attention can extend dominant period (p3); it does so by boosting the effective strength of stimulus during dominance phase. Note that voluntary attention works only during dominance, whereas involuntary attention continues to work during suppression. Visual context modulate a target during dominance but not during suppression; target embedded in the meaningful, congruent context tends to predominate relative to the same target in the incongruent context (p3). The differential effect of stimulus strength and context on the perceptual predominance of a pattern is strong evidence that dominance and suppression rely on distinct neural processes (p3). Notice that the bottom-up information seem to modulate the suppression phase of a target, whereas the top-down effect of voluntary attention and context amplify salience during dominance.

4. EEG does not normally have the spatial resolution to resolve the individual competing images presented to the two eyes during binocular rivalry. What clever method was used by Brown & Norcia (1997) to identify the dominance/suppression phases of the competing stimuli in the steady-state visually-evoked potential (a component of EEG signal).
Brown & Norcia (1997) designed an EEG experiment that linked fluctuations in VER (visual evoked responses) amplitude with shifts in dominance and suppression measured in real time. They repeatedly modulated the contrast of two dichoptically viewed, orthogonally oriented grating at slightly different rates, thereby “tagging” the VER waveforms associated with the two rival gratings (p5). Because the stimuli were gratings moving at different rates, they were able to identify the waveforms associated with each rate --tagging. The resulting tagged waveforms associated with the tao grating showned conspicuous, inversely related modulations in amplitude, and the modulations were tightly phase-locked to the observers’ perceptual reports of dominance and suppression (p5).

5. (Extra) Does binocular rivalry involve competition btw the eyes, or competition btw images? Reference experimental evidence to support your answer.

Whether the binocular rivalry involve competition btw the eyes, or btw images is unresolved during suppression phases (p9). The perceptual grouping evidence (Fig 2c, p3) of interocular grouping suggests that dominance is distributed and not isolated to one eye at a time. But several other pieces of evidence indicate that suppression operates more generally than this. It is possible to swap the two rival targets btw the eyes, placing the dominant target in the eye viewing the suppressed one, and vice versa. When this happens, observers reliably experience an immediate switch in dominance, indicating that a given region of the eye was dominant, not a particular stimulus (p9).

6. (Extra) What has been learned about the neural concomitants of binocular rivalry from visual adaptation experiments?

The neural concomitants of binocular rivalry that involve local motion adaptations show that suppression has no effect on visual adaptation aftereffects (p4). For aftereffects that are triggered by global motion adaptation, rivalry suppression is reduced in magnitude. These results support the idea that the mechanisms responsible for suppression are cortical, possibly after V1, and engage different visual areas(p5).

7. (Extra) Area FFA and PPA’s fMRI BOLD responses to dominant-face and dominant-house during binocular rivalry were found to be similar to those evoked by non-rivalrous, alternating presentations of face and house images. What does this imply about the role FFA/PPA play in binocular rivalry? I.e. rivalry resolved before, during, or after stimulus information processed through these two areas?

This result implies that rivalry is resolved before stimulus information is processed through these two areas. The FFA and PPA respond preferentially to faces and scenes, respectively, and report nearly identical activity in the rivalrous and non-rivalrous conditions, suggesting that rivalry has already been resolved before signals reach this stage of processing (p6).