Neuromatch 2020

We interpret visual scenes by making eye-movements to different locations to accumulate evidence. Recent work (Yang et al. 2016) showed that humans make goal driven eye-movements in a gaze contingent paradigm of a visual categorization task so as to maximize information about the correct category. Other studies investigating temporal integration of information in the absence of eye-movement have shown that humans are often biased to overweigh early evidence (“primacy effect”, Nienborg et al. 2009, Kiani et al 2008, Lange et al. 2020). We recently showed that a perceptual confirmation bias drives this effect and arises from approximate online inference in a hierarchical model in which expectations influence sensory inferences (Lange et al. 2020). In this study, we investigated whether similar biases exist due to biased eye-movements. Are saccades to peripheral stimuli biased by existing beliefs about the correct category?
To test this hypotheses, we designed two 2AFC experiments. In Experiment 1, the subject first fixated on a band passed gabor stimulus either oriented +45 degrees or -45 degrees while two or three stimuli (fixed per trial, random across trials) appeared in the periphery and the subject had to saccade to one of them. After three such saccades, the subject had to report the orientation in majority. In Experiment 2, a subject saw 18 black horizontal/vertical ellipses on a gray background and made eye-movements freely for 1.5 secs before choosing the orientation in majority.

In both experiments we found evidence that subjects are biased to saccade to targets that confirm their belief about the correct category. The pattern of subject responses can be explained by an approximate inference model of information maximization (extending Yang et al. 2016).

VSS 2020

We interpret visual scenes by making eye-movements in different locations and accumulating corresponding evidence. A recent work (Yang et al 2016) showed that humans make goal-driven eye-movements in a gaze-contingent paradigm of a visual categorization task so as to maximize information about the correct category while incorporating the already acquired evidence about the scene. Other studies investigating temporal integration of information have shown that humans are often, but not always, biased to overweight early evidence ("primacy effect", Nienborg et al. 2009, Kiani et al 2008). In the present study we therefore ask: are we biased to rely on accumulated foveal vision information when selecting locations to saccade to based on peripheral vision of possible evidence targets? Unlike in previous studies, we allow subjects to choose the saccade locations instead of revealing experimenter decided specific locations.

We design two experiments in 2AFC paradigm: in Experiment 1, the subject first fixates on a band passed gabor stimulus either oriented +45 degrees or -45 degrees while two or three stimuli (fixed per trial, random across trials) appear in the periphery and the subject is allowed to saccade to one of them. After three such saccades, the subject has to report the dominant orientation. In Experiment 2, a subject sees 18 black ellipses on a gray background screen some of which are vertical and some are horizontal and is allowed to make eye-movements freely for 1.5 secs before choosing which orientation dominates.

In both experiments we find evidence that integrated information from already fixated locations drive eye movement such that the next fixation is at a location whose evidence confirms the belief about the correct category based on evidence already integrated. Our results investigate the role of active vision on perceptual decision making, here saccades, attempting to close the action-perception loop.