The Role of Active Cue Selection for Visual-Motor Adaptation

Hamza Oueld*[1], Anna Montagnini[2], and Emmanuel Dauce[3]

[1]Institut de Neurosciences de la Timone – Aix-Marseille Université et CNRS – France
[2]Institut de Neurosciences de la Timone – Aix-Marseille Université et CNRS – France
[3]Institut de Neurosciences de la Timone – Aix-Marseille Université et CNRS, Ecole Centrale de Marseille – France

Résumé

Research in motor control has revealed that certain cues are more effective than others in conveying information about the ongoing behavioral context (Howard et al., 2013). Notably, studies on visuomotor adaptation indicate that color cues are ineffective in cue-dependent contextual saccadic adaptation (Azadi and Hardwood, 2014) and anticipatory smooth pursuit eye movements (aSPEM, Carneiro-Morita et al., PhD), though the underlying reasons remain elusive.
This study explores the potential influence of participants' active cue selection on cue effectiveness in a visual motion eye tracking task. Participants tracked a colored dot (Green or Red), displayed at the center of the screen, which disappeared for a fixed interval (gap, 300 ms), then reappeared, and moved horizontally at a speed of 15∘/s either to the right or left. Unbeknownst to participants, the probability of target motion to the right was conditional on the target color and manipulated across experimental blocks (e.g., P(right—Green) = 0.75 and P(right—Red) = 0.25 in one block, with complementary contingencies in another). Their aSPEM was analyzed in two conditions:

1. In the first condition, the dot color choice was predetermined according to a Bernoulli distribution Ber(0.5) in each trial, with no participant action required before the oculomotor tracking phase.

2. In the second condition, participants actively chose the color at the beginning of the trial, encouraged to alternate fairly between Green and Red.

Results indicate that the active selection of the cue color significantly influences cue valence:

- In the first condition, there was no discernible effect on anticipatory velocity ($P > 0.05$) across different direction-bias blocks.

- However, in the second condition, a significant difference emerged ($P < 0.001$), with a higher anticipatory eye velocity for conditions with a greater probability of motion in a specific direction, depending on the cue color. These findings demonstrate that the color cue-conditional probability of target direction can be efficiently integrated into the control

*Intervenant

of oculomotor anticipation when the color cue is actively selected rather than passively observed.
In conclusion, our investigation sheds light on the previously unexplored role of active selection in modulating the effectiveness of informative color cues to control anticipatory smooth pursuit eye movements (aSPEM) in direction-biased contexts. Further work is needed to determine whether this finding is the expression of a general attentional mechanism or is specifically related to motor agency in cue selection.

Mots-Clés: Smooth pursuit, anticipatory eye movements, Learning