Contextual saccadic adaptation : you can see it but you can't learn from it

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Résumé

Contextual saccadic adaptation is investigated using a variant of the double-step saccade adaptation paradigm, wherein the direction of the intra-saccadic step (ISS) is signaled by two distinct contexts. For some contexts the simultaneous induction of two separate saccadic adaptations has been reported.
In a first study (n=80), we assessed the influence of context type on contextual saccadic adaptation by comparing eight different types of contexts. All experimental sessions used the same contextual adaptation procedure, with the sole difference being the context used. Evidence of robust learning was observed when using the first-step amplitude as a cue, whereas no contextual learning took place when using any of the other seven types of cues. This suggests that predicting the ISS direction is challenging and significantly influenced by the nature of the context, even for highly salient contexts perfectly correlated with the ISS direction.

To ensure that our results were not linked to a lack of attention, we added two experiments (n=16). Using two of our inefficient contexts, we added a perceptual report into the experimental design: participants were prompted to report the last contextual cue they perceived about every ten trials. Remarkably, participants exhibited near-perfect perceptual report, despite the absence of contextual motor learning. This dissociation between perceptual report and motor learning provides compelling evidence that attending the contextual cues is insufficient for effective contextual learning.

We then aimed at evaluating the significance of saccade planning for contextual learning in a second study. Here, the contextual cue was the position of a second saccade target. Participants (n=32) engaged in four experiments designed to disentangle the execution and planning of this second saccade: (1) Full condition: a fixation target appear then stepped. Simultaneously, a second target appeared and participants were instructed to perform a sequence of saccades toward the two targets. The position of the second target signaled the ISS of the first one. (2) Perceptual condition: the task was identical as in the full condition with the exception that participants were explicitly instructed to not execute the second saccade toward the second target. (3) Execution-only condition: Again, the task was identical to the full condition, with the exception that the second target appeared during the first saccade to prevent saccade planning. (4) Planning-only condition: Here, the second target was extinguished during the first saccade, thereby preventing the participant from executing it.

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Notably, the planning and full conditions yielded similar learning outcomes, even though the second saccade was planned but not executed in the planning-only condition. Furthermore, no learning occurred in both the perceptual and execution-only conditions. These results confirm that only planned saccades may serve as a motor cue for efficient contextual saccade adaptation.

Mots-Clés: Saccadic adaptation, Contextual learning, Saccade, Motor learning