Immediate neural plasticity: examining the effects of trial history on neural activity in the present trial as measured by MEG

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We constantly monitor and flexibly adjust current actions based on preceding events. Such historical influences can be observed in behavioral and neural changes based on trial history. In response to the instruction to perform an antisaccade (AS) compared to a more automatic prosaccade (PS), the frontal eye field (FEF) shows decreased neuronal activity that correlates with increased saccadic latency. In a previous fMRI study, a prior AS vs. PS was associated with further reductions in FEF activation during a current AS. What is the basis of this historical effect? It may reflect carry-over effects of inhibition due to the prior AS. Trial history may also interact with present task demands. To examine these effects, we exploited the high temporal resolution of magnetoencephalography (MEG). We studied 21 healthy participants performing an intermixed PS/AS task and examined the effects of a prior AS versus a prior PS on FEF activation both in the interval that preceded the current trial and in response to the instruction to perform an AS in the current trial. At a 200-ms interval preceding the current trial, there was more FEF activation associated with a prior AS. We interpret this to reflect increased inhibitory input. In response to the instruction of the current trial, a prior AS reduced FEF activation and slowed saccadic latencies. These activation changes based on trial history represent a form of immediate neural plasticity that may contribute to guiding behavior on the basis of context.