
Sensory-based and action-based predictions operate to facilitate the unexpected touch at the expense of the expected one

Ziliang Xiong^{*1,2}, Xavier Job¹, and Konstantina Kilteni^{†1,2}

¹Karolinska Institute – Sweden

²Donders Institute for Brain, Cognition and Behaviour – Netherlands

Abstract

Self-generated touch is thought to be reliably predicted and perceptually attenuated given the prediction provided by motor commands. However, outside of action, predictions such as those based on learned temporal associations, are thought to operate in the opposite direction by up-weighting expected inputs rather than down-weighting them. The disparity between these two predictive accounts is particularly pertinent in the tactile domain where studies manipulating both sources of expectations simultaneously are scarce. Here, participants discriminated the touch delivered to their index finger that was either externally or self-generated (action-based). Temporal expectations (sensory-based) were simultaneously manipulated with probabilistic cues signaling the likely onset time of the delivered touch, rendering the expected (i.e., the cue validates the onset) and unexpected condition (i.e., the cue invalidates the onset). We found that temporal expectations modulated the perceptual precision of the externally generated touch, for which the action-based prediction was unavailable. In contrast, the action-based prediction consistently attenuated the perceived magnitude of the self-generated touch compared to the external one, regardless of temporal expectations. All effects were replicated in a second experiment and further explored with an additional baseline condition where a non-predictive cue controlled for temporal expectations. Results showed that the sensory-based effect was driven by the expected touch being downregulated with decreased precision, while the action-based attenuation dominated sensory-based influences. Together, our results suggest that sensory- and action-based predictions operate to facilitate the processing of the unexpected touch in terms of perceptual precision and magnitude respectively, at the expense of the expected touch.

Keywords: Action, based prediction, motor prediction, sensory, based prediction, temporal expectation, self, generated touch, somatosensory attenuation

*Speaker

†Corresponding author: konstantina.kilteni@ki.se