Sequential Effects in Response Time Reveal Learning Mechanisms and Event Representations

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Binary choice tasks such as two-alternative forced choice show a complex yet consistent pattern of sequential effects, whereby responses and response times depend on the detailed pattern of prior stimuli going back at least five trials. We show this pattern is well explained by simultaneous incremental learning of two simple statistics of the trial sequence: the base rate and the repetition rate. Subtler aspects of the data that are not explained by these two mechanisms alone are explained by their interaction, via learning from joint error correction. We also find that these learning mechanisms are dissociated into stimulus and response processing, as indicated by event-related potentials, manipulations of stimulus discriminability, and reanalysis of past experiments that eliminated stimuli or prior responses. Thus sequential effects in these tasks appear to be driven by learning the response base rate and the stimulus repetition rate. Connections are discussed between these findings and previous research attempting to separate stimulus- and response-based sequential effects, and research using sequential effects to determine mental representations. We conclude that sequential effects offer a powerful means for uncovering representations and learning mechanisms.

Keywords: sequential effects, two-alternative forced choice, incremental learning, event-related potential, representation

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