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Thesis abstract

First impressions bias on sound sequence learning on multiple timescales: an order-driven phenomenon in auditory mismatch negativity

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Humans are prone to systematic biases in perception that impact rationality in judgement. First-impression bias occurs when judgement is overly affected by information presented during an initial encounter. Using the amplitude of a specific brain response, the mismatch negativity (MMN), our team discovered that the brain is prone to this bias effect during the very early stages of sound-sequence learning preceding knowing awareness. In our research program, we aim to determine which experimental conditions expose or modify first-impression bias effects on sound-pattern learning on multiple timescales. Predictive coding models assume the brain is hierarchically organised and uses perception to make inferences about the sensory world whilst updating predictions about incoming sensory information. Recurring comparisons between bottom-up input and top-down predictions consider environmental noise, and determine the inferential modelling process. MMN, an event-related response evoked by violating regularity in a structured sound sequence, is an example of a prediction error signal. Its presence informs on prediction model content whereas its amplitude informs on model confidence (or precision). Prediction error amplitude to a pattern violation is largest when model confidence is very high and may require engagement of additional, higher-order resources. First-impression bias shows that the network uses contextual information at sound sequence onset to modulate MMN amplitude to probabilistic changes thereafter. Our data show that first-impression bias is a remarkably robust and long-lasting phenomenon that can be interrupted if participants undertake an attention-demanding task whilst hearing multi-timescale sequences or are provided with accurate foreknowledge about sound structures before sequence exposure. In interpreting these data, we discuss how models assuming only local sound probabilistic information drives the MMN-generating process cannot explain bias effects on MMN amplitude. Rather, the bias is a striking example of a hierarchical inference process incorporating attentional resources that considers the potential relevance of sound information and its stability over time.

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