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SUB-OPTIMAL LEARNING OF TACTILE-SPATIAL PREDICTIONS IN PATIENTS WITH COMPLEX REGIONAL PAIN SYNDROME

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ABSTRACT

In Complex Regional Pain Syndrome (CRPS), tactile sensory deficits have motivated the therapeutic use of sensory discrimination training. However, the hierarchical organisation of the brain is such that low-level sensory processing can be dynamically influenced by higher-level knowledge, e.g. knowledge learnt from statistical regularities in the environment. It is unknown whether the learning of such statistical regularities is impaired in CRPS. Here, we employed a hierarchical Bayesian model of predictive coding to investigate statistical learning of tactile-spatial predictions in CRPS. Using a sensory change-detection task, we manipulated bottom-up (spatial displacement of a tactile stimulus) and top-down (probabilistic structure of occurrence) factors to estimate hierarchies of prediction and prediction error signals, as well as their respective precisions or reliability. Behavioural responses to spatial changes were influenced by both the magnitude of spatial displacement (bottom-up) and learnt probabilities of change (top-down). The Bayesian model revealed that patients' predictions (of spatial displacements) were found to be less precise, deviating further from the ideal (statistical optimality) compared to healthy controls. This imprecision was less context-dependent, i.e. more enduring across changes in probabilistic context and less finely-tuned to statistics of the environment. This caused greater precision on prediction errors, resulting in predictions that were driven more by momentary spatial changes and less by the history of spatial changes. These results suggest inefficiencies in higher-order statistical learning in CRPS. This may have implications for therapies based on sensory re-training whose effects may be more short-lived if success depends on higher-order learning.