THE UNIVERSITY of ADELAIDE

THE STRUCTURE OF SEQUENTIAL EFFECTS

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Abstract

Research into sequential effects has a long and rich history spanning almost one hundred years. In their most general definition sequential effects can simply be considered a dependence of behaviour on the past sequence of events, and are of the most pervasive phenomena in psychology. Some form of sequential effects has been observed in multiple perceptual and cognitive tasks, and across different modalities. In addition, sequential effects have also been observed in electrophysiological studies, with a great deal of similarity observed between EEG and behavioural results, making this a relevant topic for both psychology and neuroscience. This gives sequential effects a great deal of potential as a doorway for elucidating the relationship between human behaviour and neuronal activity, between the mind and the brain.

Yet perhaps in part because of the great diversity of domains in which sequential effects are observed, this is an often fragmented field of research, with a multitude of experimental paradigms used, often leading to some confusion as to how different results are related to each other. One of the main objectives of this work is therefore to begin to unify the field into one coherent whole, and to do so at both a computational and process levels. To begin with, Chapter 2 addresses the computational nature of sequential effects in terms of different types of statistics humans use in different circumstances. In Chapter 3 it is shown that the most results described before in the literature can be explained by only three components, including a wealth of individual differences which had been largely ignored so far.

On a more theoretical level it could be argued that there is a degree of redundancy between the various mathematical models of sequential effects proposed over the years. Models are usually fit to isolated datasets, when it is well known that even minor experimental manipulations can lead to different results, making it unclear how conclusions extend to other settings. Moreover, by virtue of their common mathematical structure, most models of sequential effects suffer from similar difficulties in reproducing key empirical observations. This, together with other considerations, motivates an entirely different approach to modelling sequential effects proposed in Chapter 4. The framework suggested is based on the physics of oscillatory motion, being continuous-time in nature and able to incorporate space, reflecting the fact that both time and space have been found empirically to play a role in sequential effects.

More generally there are two central proposals which unify this dissertation. Firstly that sequential effects are the consequence of two main independent components possibly related to the separate processing of stimuli and responses. Secondly that sequential effects reflect some form of filtering implemented through interaction with an oscillatory system.

Declaration by author

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