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**Talk Title:**

To fuse or not to fuse

**Abstract:**

Reward has been shown to invigorate performance across both simple and complex motor tasks, highlighting that it is a powerful tool for enhancing human behaviour. However, it is unknown why reward-based improvements in simple discrete tasks are lost once reward is removed, but appear long lasting for more complex sequential actions. Bridging these divergent results, we suggest that reward-driven performance gains are only maintained if they are accompanied by improvements in kinematic efficiency. We propose that this is possible during sequential actions through fusion; a naturally slow and difficult to achieve process in which neighbouring movements' blend together leading to both improved performance, smoothness and efficiency. To explore this possibility, a novel sequential reaching task was designed in which reaches could be performed as a sequence of discrete or fused movements. Importantly, reward-based invigoration of either solution would lead to similar performance gains. However, improvements in movement efficiency, through increased smoothness, would only occur with fusion. Across two experiments, rewarded participants showed invigorated sequential reaching performance (speed) and improved movement efficiency (fusion & smoothness). These performance gains were maintained across multiple days even in the absence of reward. Therefore, fusion provides a mechanism by which reward can invigorate complex movements, increase efficiency and lead to long-term improvements in performance. Finally, it has been suggested that fusion reflects the development of new a 'motor primitive' in which the sequential action is represented throughout the brain as a holistic (single) action. However, recent neuroimaging work indicates that the individual movements maintain their independence. Pilot results form a 'stopping paradigm' attempts to address this divergent literature.

**Biographical Information:**

Dr Galea took up an independent research fellow post at the University of Birmingham, funded by the 'Birmingham Fellows' scheme, before becoming a Senior Lecturer in 2016 and

a Reader in 2020.