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Pratik Mutha

Jibaben Patel Chair Associate Professor
Biological Engineering,
IIT Gandhinagar, India

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To Err is Human, to Learn is Divine – Dissociable error-sensitive mechanisms in human sensorimotor learning

Abstract: Humans must often perform actions under challenging conditions. For instance, a golfer may have to tee off against a constant breeze, or a dancer may have to perform while wearing a heavier-than-usual costume. Such "perturbations" induce a variety of errors in our actions; for instance, they can create a mismatch between the intended and actual sensory consequences of action (sensory prediction error) or result in a failure to accomplish the intended task goal (task performance error). Using a combination of computational modelling and behavioural experiments, we probed how humans adapt future actions when they encounter these two error sources. Our findings fail to support the hypothesis that performance failures induce implicit updates to action plans. They rather indicate that task errors, and possibly, the failure to obtain a rewarding outcome, trigger time-consuming strategic processes that are verbally-sensitive. We also find that sustained task success reduces or eliminates strategy use during learning. In contrast, we note that sensory prediction errors set in motion slower, relatively rigid implicit processes that remain impervious to verbal instruction. We suggest that flexibly combining these two mechanisms could be a way for the sensorimotor system to optimize how much and how rapidly we learn from errors.

Brief Bio: *Pratik Mutha is an Associate Professor in Biological Engineering and the Center for Cognitive and Brain Sciences at IIT Gandhinagar. He received his undergraduate degree from the College of Engineering, Pune and his Masters and PhD from Penn State University in the United States. After a 4-year postdoctoral stint at the New Mexico Veterans Affairs Healthcare System, he joined IIT Gandhinagar in late 2013. Dr. Mutha's research interests lie in understanding the neural control of human movement. More recent work in his lab is focused on uncovering the neural systems that mediate motor learning, for which he relies on tools of behavioral experimentation, computational modeling, and non-invasive brain stimulation.*