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Millisecond-Scale Motor Encoding in a Cortical Vocal Area[1] ILYA NEMENMAN, Emory University, CLAIRE TANG, University of California, San Francisco, DIALA CHEHAYEB, Emory University, KYLE SRIVASTAVA, Georgia Institute of Technology and Emory University, SAMUEL SOBER, Emory University — Studies of motor control have almost universally examined firing rates to investigate how the brain shapes behavior. In principle, however, neurons could encode information through the precise temporal patterning of their spike trains as well as (or instead of) through their firing rates. Although the importance of spike timing has been demonstrated in sensory systems, it is largely unknown whether timing differences in motor areas could affect behavior. We tested the hypothesis that significant information about trial-by-trial variations in behavior is represented by spike timing in the songbird vocal motor system. We found that neurons in motor cortex convey information via spike timing far more often than via spike rate and that the amount of information conveyed at the millisecond timescale greatly exceeds the information available from spike counts. These results demonstrate that information can be represented by spike timing in motor circuits and suggest that timing variations evoke differences in behavior.

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