Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Metastable neural dynamics mediates expectation[1] LUCA MAZZUCATO, GIANCARLO LA CAMERA, ALFREDO FONTANINI, State Univ of NY- Stony Brook — Sensory stimuli are processed faster when their presentation is expected compared to when they come as a surprise. We previously showed that, in multiple single-unit recordings from alert rat gustatory cortex, taste stimuli can be decoded faster from neural activity if preceded by a stimulus-predicting cue. However, the specific computational process mediating this anticipatory neural activity is unknown. Here, we propose a biologically plausible model based on a recurrent network of spiking neurons with clustered architecture. In the absence of stimulation, the model neural activity unfolds through sequences of metastable states, each state being a population vector of firing rates. We modeled taste stimuli and cue (the same for all stimuli) as two inputs targeting subsets of excitatory neurons. As observed in experiment, stimuli evoked specific state sequences, characterized in terms of 'coding states', i.e., states occurring significantly more often for a particular stimulus. When stimulus presentation is preceded by a cue, coding states show a faster and more reliable onset, and expected stimuli can be decoded more quickly than unexpected ones. This anticipatory effect is unrelated to changes of firing rates in stimulus-selective neurons and is absent in homogeneous balanced networks, suggesting that a clustered organization is necessary to mediate the expectation of relevant events. Our results demonstrate a novel mechanism for speeding up sensory coding in cortical circuits.

[1]NIDCD K25-DC013557 (LM); NIDCD R01-DC010389 (AF); NSF IIS-1161852 (GL)

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Date submitted: 13 Nov 2016 Electronic form version 1.4