Bocconi

07 OCTOBER 2025
12:00 PM

Bocconi University
Room COMMON ROOM
Via Röntgen 1, Milano (2° floor)

The representational geometry of emotional states in the amygdala

Speaker

Daniel Salzman
Professor
Columbia University

Abstract

Neuroscientists have traditionally characterized neuronal response selectivity to reveal how the brain represents emotional states. For instance, neurons in basolateral amygdala (BLA) respond selectivity to positive and negative valence. However, emotions involve more than valence, and it is unclear how BLA encodes all relevant variables. If each neuron encodes one variable, then readouts of different variables would not interfere with each other, and readouts would also generalize across conditions. But can these computational properties be realized if neurons lack specialization? We tested this by presenting stimuli to mice that elicited two responses: tremble and ingress into a burrow, reflecting fear and flight to safety. BLA inactivation eliminated differential responses to aversive and neutral stimuli without eliminating responses themselves, suggesting BLA signals valence, not motor commands. However, two-photon imaging revealed that neurons exhibit mixed selectivity for stimulus identity, valence, tremble and/or ingress. Despite this, BLA population activity represented valence, tremble and safety within low-dimensional geometries, reflecting linear mixed selectivity and enabling generalization across conditions. Further, tremble and valence coding directions were orthogonal, eliminating interference between readouts. Thus BLA can achieve specialized readouts of variables describing emotional states with particular representational geometries, not requiring neurons with specialized selectivity.

Università Bocconi
DEPARTMENT OF COMPUTING SCIENCES