# Disentangling the roles of dimensionality and cell classes in neural computations

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**Abstract**

The description of neural computations in the field of neuroscience relies on two competing views: (i) a classical single-cell view that relates the activity of individual neurons to sensory or behavioural variables, and focuses on how different cell classes map onto computations; (ii) a more recent population view that instead characterises computations in terms of collective neural trajectories, and focuses on the dimensionality of these trajectories as animals perform tasks. How the two key concepts of cell classes and low-dimensional trajectories interact to shape neural computations is however currently not understood. Here we address this question by training artificial neural networks on a variety of neuroscience tasks, and reverse-engineering these networks. To perform reverse-engineering, we introduce an innovative, theoretically grounded methodology that allows us to link network's structure, dynamics and function. In particular we can control for the dimensionality of neural activity, as well as the number of cell classes necessary for solving each task. We show that dimensionality determines the phase-space available for dynamics that implement input-output mappings, while having multiple cell classes allows networks to flexibly switch between different types of dynamics in the available phase-space. We discuss the implications of these results for the analysis of neural recordings in systems neuroscience.

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