Brain networks for engagement, vision, choice, and action

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Behavior arises from neuronal activity, but it is not known whether the active neurons are concentrated in a few brain regions or distributed across many regions. We trained mice to report decisions about visual stimuli, and used high-density probes to record from >30,000 neurons across 42 brain regions. Task engagement could be predicted by a characteristic pattern of activity in a set of brain regions. During engagement, visual signals starting in the visual pathway invaded a wide set of brain regions. A majority of neurons in nearly all brain regions responded at the time of action. However, neurons encoding choice prior to action were rare and inhabited only a few regions of forebrain and midbrain. These results reveal computations performed by neuronal populations distributed across the brain, and define distinct brain-wide networks supporting engagement, vision, choice, and action.