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Can brain state be manipulated to emphasize individual differences in functional connectivity?

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Abstract

While neuroimaging studies typically collapse data from many subjects, brain functional organization varies between individuals, and characterizing this variability is crucial for relating brain activity to behavioral phenotypes. Rest has become the default state for probing individual differences, chiefly because it is easy to acquire and a supposed neutral backdrop. However, the assumption that rest is the optimal condition for individual differences research is largely untested. In fact, other brain states may afford a better ratio of within- to between-subject variability, facilitating biomarker discovery. Depending on the trait or behavior under study, certain tasks may bring out meaningful idiosyncrasies across subjects, essentially enhancing the individual signal in networks of interest beyond what can be measured at rest. Here, we review theoretical considerations and existing work on how brain state influences individual differences in functional connectivity, present some preliminary analyses of within- and between-subject variability across conditions using data from the Human Connectome Project, and outline questions for future study.

Keywords: fMRI, functional connectivity, individual differences, brain state, scan condition, resting state, task, Human Connectome Project

Highlights:

- Rest is the default for studying individual differences in functional connectivity
- But certain tasks may improve the ratio of within- to between-subject variability
- We review work on how scan condition influences individual differences
- Preliminary results using HCP data show individual differences change with task
- Using certain tasks over rest may improve sensitivity of imaging-based biomarkers

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