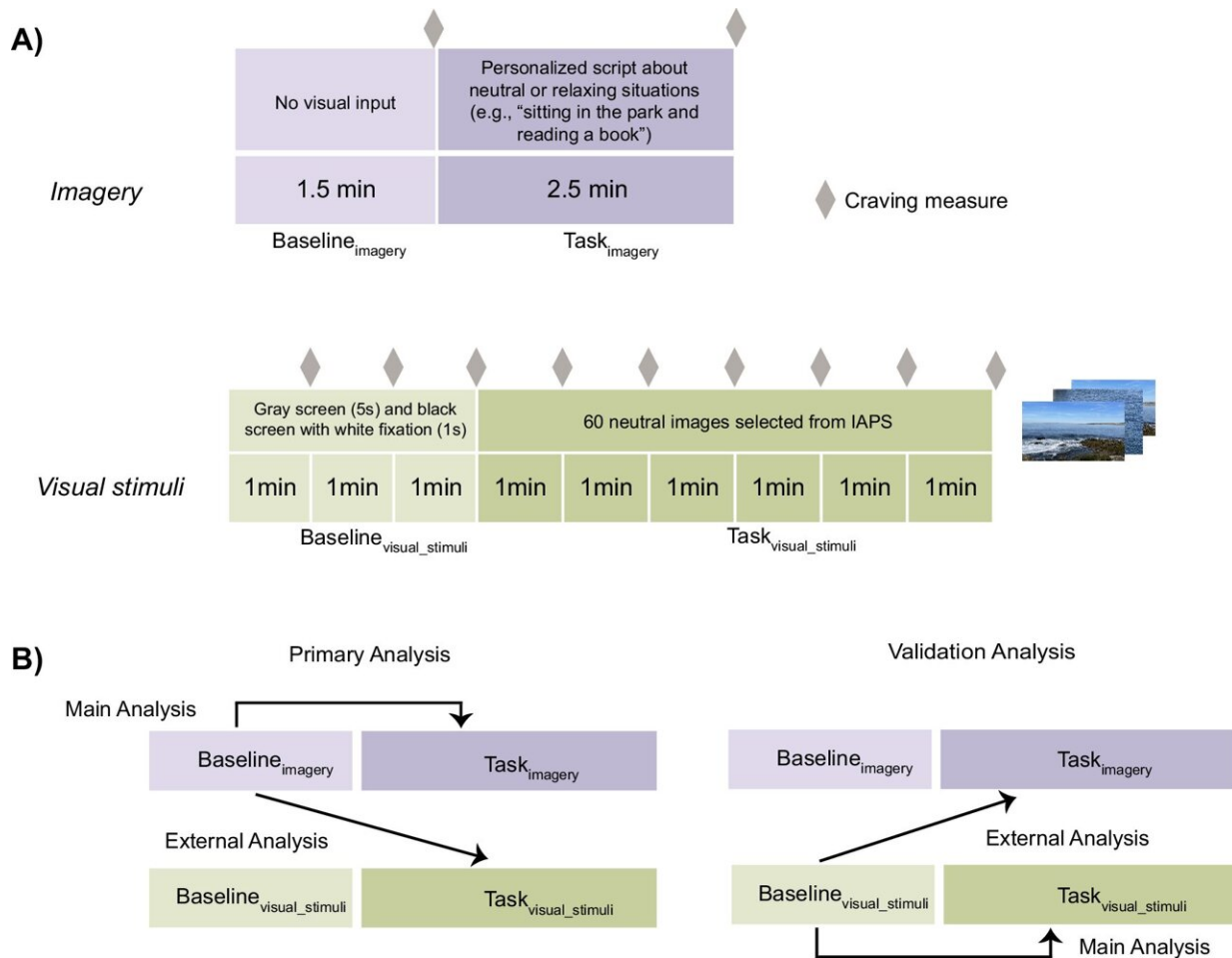


'Sticky' brain activity is linked to stronger feelings of craving

September 9 2024, by Mallory Locklear



Datasets and analysis schematic. Credit: *Molecular Psychiatry* (2024). DOI: 10.1038/s41380-024-02708-0

Communication between regions of the brain is constantly in flux, but the neuroimaging technologies used to analyze these interactions typically provide only a snapshot representing several minutes' worth of changes in brain activity, obscuring moment-to-moment changes. Using a more dynamic approach, Yale researchers were able to observe rapid changes in brain activity—particularly related to the experience of craving.

This more nuanced view, researchers say, provides a better understanding of how [brain activity](#) shifts over time and how it might go awry in neurological disorders.

The findings were recently [published](#) in the journal *Molecular Psychiatry*.

Previous research has shown that activity between brain regions can, among other insights, predict the intensity of a person's "craving," or their strong desire for something such as food or alcohol.

"But on top of identifying what brain regions are involved in craving, I think how people engage these networks of brain regions over time also has implications," said Jean Ye, lead author of the study and a Ph.D. student at Yale School of Medicine (YSM).

"In this study, we wanted to investigate whether people who experience stronger craving engage and stay in certain brain networks more than people with less craving."

Ye works in the labs of Elizabeth Goldfarb, an assistant professor of psychiatry, and Dustin Scheinost, an associate professor of radiology and biomedical imaging, both of YSM and co-senior authors of the study.

For the study, 425 participants—including healthy individuals and

people with [alcohol use disorder](#), cocaine use disorder, [prenatal cocaine exposure](#), or obesity—underwent [functional magnetic resonance](#) imaging (fMRI) while either viewing neutral images (such as landscapes) or descriptions of relaxing situations (sitting in a park or reading a book, for example).

During these periods, participants were also asked to rate their level of craving for alcohol, cocaine, or food on a scale that ranged from no craving at all to very strong craving.

Then, to evaluate brain activity related to craving specifically, the researchers combined two methods. First, they used a portion of the fMRI images—as well as the participants' craving scores—to train a machine learning model that identified brain activity networks related to craving.

The model found two networks: one in which stronger connectivity between brain regions predicted stronger craving ([positive craving network](#)) and another in which stronger connectivity predicted weaker craving ([negative craving network](#)).

Then, the researchers applied a technique to detect rapid changes in activity between pairs of brain regions.

"We saw that people who experienced stronger craving spent more time in the network state that is more positively associated with craving. They seemed to show 'sticky,' persistent engagement of this positive network state," said Ye. "At the same time, they were not dwelling in or engaging as much in the negative craving network state."

The reduced engagement of the negative craving network may be particularly important, researchers say. That network included brain regions involved in sensory processing and initiation of movement.

In previous studies, crosstalk between those regions has been found to be associated with decreased impulsivity and reduced cocaine use. Recruiting the negative craving network, therefore, may lead to more [self-regulation](#) and inhibition of habit-based behaviors linked to substance use.

The combination of getting "stuck" in brain activity linked to strong craving and the inability to tap into the activity linked to a weaker sense of craving suggests an imbalance between cognitive stability and flexibility, said Ye. And that might indicate impaired cognitive control, which is closely linked to substance use.

Another takeaway, said Ye, is that how one engages these types of networks over time plays a key role in experience and behavior. And this is likely true for other states such as stress, which the researchers are looking into now, or rumination, a dwelling on negative thoughts or feelings.

"For instance, we'd like to know whether people at risk for or diagnosed with depression engage in rumination brain networks more and stay engaged for longer periods than those without depression," said Ye. "Those are the kinds of questions we can ask with this approach."

More information: Jean Ye et al, Network state dynamics underpin basal craving in a transdiagnostic population, *Molecular Psychiatry* (2024). [DOI: 10.1038/s41380-024-02708-0](https://doi.org/10.1038/s41380-024-02708-0)

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