The neural mechanisms of asking creative questions

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THE COGNITIVE COMPLEXITY LABORATORY

Introduction

Divergent thinking is a core component of creativity, commonly assessed through tasks like the **Alternative Uses Task (AUT)**. The **Alternative Questions Task (AQT)**, a novel measure, similarly taps into creative ideation but emphasizes open-ended question asking.

While both tasks engage creative cognition, they may rely on distinct underlying processes. This study compares brain connectivity during AQT and AUT using functional connectivity analysis.

Method

Participants: 37 participant (10 female; mean age = 25. 32 y; SD= 3.56; mean years of formal education= 15 y, SD=1.41 y) were recruited

MRI recording and analysis: MRI was performed on a 3T Siemens Magnetom Prisma Fit MRI system (Siemens Medical Systems) using a 64-channel head coil, at the Technion MRI center.

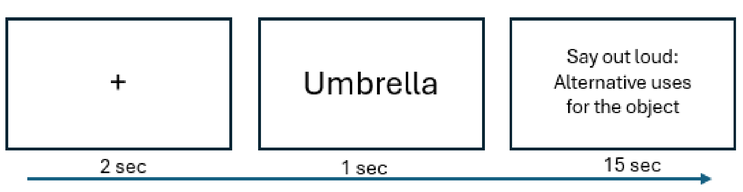
Data was preprocessed using a custom methodology of fMRIPrep and Functional connectivity was assessed using the functional connectivity (CONN) toolbox in MATLAB

Participants completed 3 tasks. Each task began with the presentation of common objects and was identical in structure, except for the final component. In the final part of each task, participants were instructed to either generate:

1.**Alternative Questions (AQT)** - participants are asked to generate creative and unusual questions

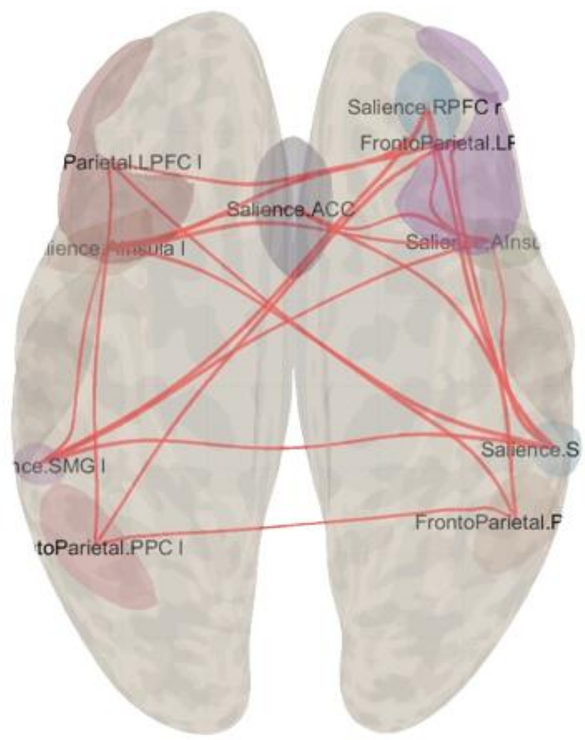
2.**Alternative Uses (AUT)** - participants are asked to generate alternative uses

3.**Characteristics (OCT)** - control

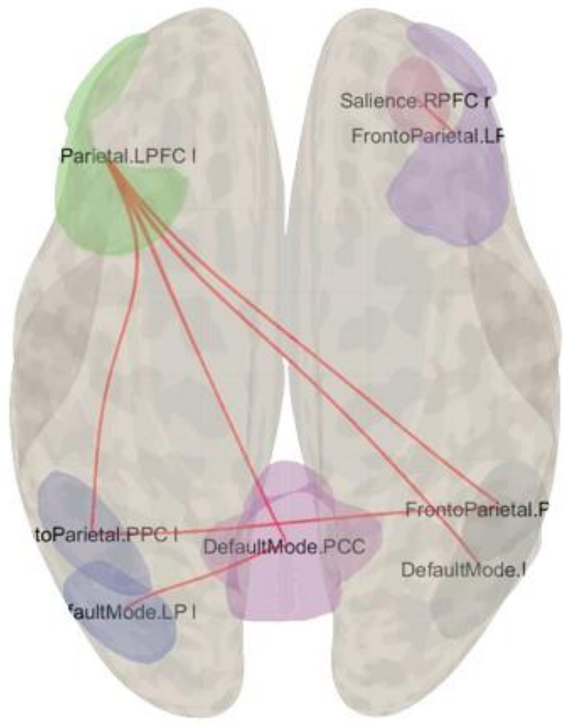


Neural Results (Task-Control)

Alternative Questions (AQT)



Alternative Uses (AUT)



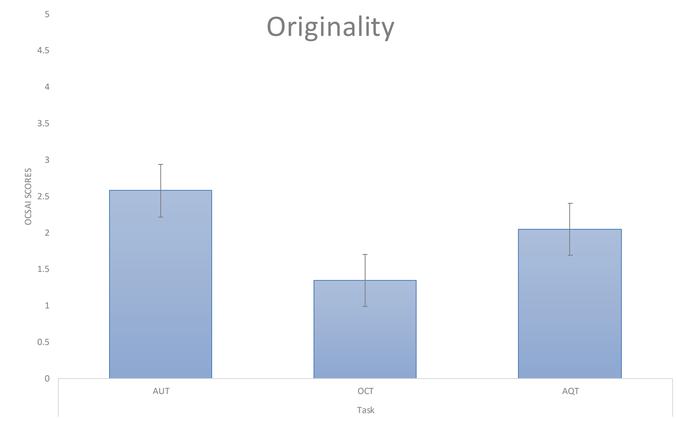
While both the AQT and AUT engage divergent thinking, they recruit distinct neural networks.

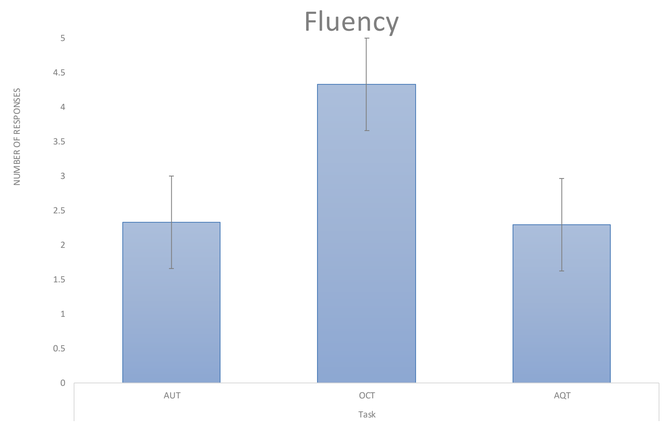
Positive correlations with the Default Mode Network (DMN) were observed during the AUT, reflecting its role in internally driven, associative ideation.

In contrast, the AQT showed no such DMN connectivity, suggesting that question generation may rely less on spontaneous thought and more on goal-directed, externally oriented processes.

This dissociation highlights the unique cognitive demands of creative questioning compared to generative ideation.

Behavioral Results inside the scanner





The behavioral results serve as a manipulation check, demonstrating the classic creativity trade-off: fluency and originality are typically inversely related.

AQT and AUT produced comparable levels of both fluency and originality, suggesting that question generation (AQT) can be as productive and original as idea generation (AUT).

Our findings further supports AQT as a valid divergent thinking measure.

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