INTRODUCTION & PREDICTIONS

Introduction: Cognitive Reserve, Selective Attention, and Brain Network Connectivity

- Older adults vary in their ability to process adjacent distractors during response selection as measured by a flanker task.
- The Cognitive Reserve (CR) hypothesis proposes that early life experiences, such as greater educational attainment, influence brain functionality (cortically) to buffer the effects of brain aging on cognition (See Fig. 5).
- Broadly, MRI findings suggest cognitive control networks such as the Salience (SN), Fronto-parietal (FPN), and Dorsal Attention Network (DAN) are associated with both selective attention and CR.
- However, it is unclear whether control network (SN, FPN, DAN) FC predicts selective attention performance during distraction demands differently for those with greater CR.

Hypothesis and Predictions
My central hypothesis is that older adults with higher CR (measured as greater educational attainment; See Fig. 5) are buffered from distraction by greater FC in control networks.

P-1) greater control network FC will predict better incongruent flanker trial performance for older adults with higher CR (See Fig. 6A).

P-2) greater control network FC will predict faster adaptive control performance (measured by the congruency sequence effect, CSE) for older adults with higher CR.

P-3) greater Default Mode Network (DMN) FC will not significantly predict a better flanker condition concergency effect, or CSE when moderated by CR (See Fig. 6C).

RESULTS

Tests of Each Prediction

- P-1) revealed a single significant predicted result for SN FC for incongruent trial RT, \( t(4832.02) = -2.05, p = .05 \), analyses.
- P-2) revealed several trending relationships with only FPN reaching our statistical significance threshold, \( t(34.26) = -2.57, p = .01 \).
- P-3) neither DMN models reached our alpha cut-off for the three-way (\( t(4832.02) = -.24, p = .03 \), or two-way CSE (\( t(205.05) = .00 \)) analyses.

CSE Condition Models

- Default Mode Network (DMN):
  - Main Effects: Constant = 403.5, 2.2 = .032, 20.0 = .000, 200.0 = .000, \( t(4832.02) = -1.00 \).
  - Main Effects: Constant = 403.5, 20.0 = .000, 200.0 = .000, \( t(4832.02) = 1.00 \).

- **Significant Control SN Comparison to DMN**

- **Network Topography & Predictions**

- **DISCUSSION**

Summary:
- We conclude that control network FC may differentially predict the processing of high distractor demands depending on CR, measured as educational attainment.
- SN FC predicts better performance for high distractor demands, measured as response time on incongruent trials, for individuals with high CR (See Fig. 4B).
- FPN FC predicts adaptive control, measured as the CSE, for individuals with high CR (See Fig. 7B).
- DMN FC did not predict incongruent response time, or the CSE, although there was trend for both in the hypothesized direction (See Fig. 4D & 7B).

Discussion
- Our results favor the central hypothesis which states greater control network FC serves as a functional buffer for high distractor demands among older adults with greater CR (measured as educational attainment; See Fig. 5 & 6). This finding is in line with prior studies that have highlighted SN and FPN FC as part of a task-invariant CR network. We interpret these results cautiously with respect to how specific the effect is for control compared to the DMN. Strength of effects for each network were not directly compared. It could also be that a greater sample size will reveal a significant finding for DMN FC as a predictor of individual differences in distractor control performance among older adults with greater years of education.

Future Directions:
- Future studies should consider how regional brain subnetworks contribute to the findings reported here. It may be that the task-invariant function of control networks in CR relates to the regional composition of their sub-network communities.

References: (1) Darby et al., 2017 (2) Stern et al., 2012 (3) Rey-Mermet & Gade, 2018 (4) Stern et al., 2018 (5) van Loenhoud et al., 2020 (6) Campbell et al., 2020 (7) Schaefer et al., 2018 (8) Ciric et al., 2017