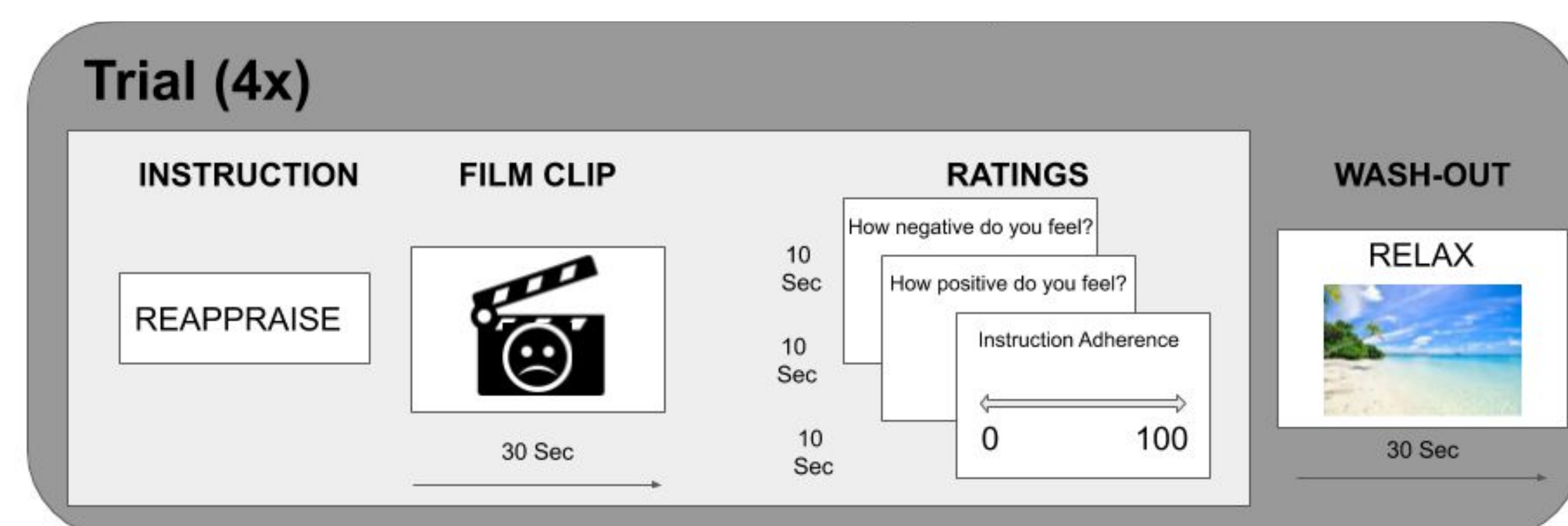


Introduction

- Reappraisal is an effective emotion regulation strategy that relies on cognitive control.¹
- Lateral prefrontal cortex (LPFC), a central hub of the cognitive control network, activates during reappraisal to down-regulate amygdala response to negative stimuli.²
- LPFC-amygdala functional connectivity during instructed reappraisal predicts task success^{3,4} and self-reported use of reappraisal in younger adults.^{5,6}
- Resting-state functional connectivity (RSFC) between frontal regions and amygdala is correlated with greater self-reported reappraisal use in adults.^{1,5}
- Lateral PFC-amygdala resting connectivity strength is associated with cardiac biomarkers of emotion regulation for younger, but not older adults; medial PFC-amygdala connectivity is predictive for all ages⁷.
- The relationship of resting connectivity of lateral and frontal PFC to amygdala and reappraisal task success across age has yet to be investigated.
- **Hypothesis:** RSFC between the LPFC and the amygdala will predict reappraisal success in a behavioral task; however, this relationship will be moderated by age.

Methods



- **Participants**
- N= 298, Age: 18-88 ($m=54.3$ $SD= 18.6$), 50% females from the Cam-CAN dataset⁸
 - 8 minute resting state fMRI scan and Behavioral Emotion Regulation task

- **Behavioral Emotion Regulation Task:** 8 Blocks: 4 film trials/block

Strategies

- **WATCH:** view film naturally without regulating
- **REAPPRAISE:** Decrease negative affect by reinterpreting meaning

Stimuli: Positive, Negative, and Neutral film clips (30 Sec)

4 Conditions:

- WATCH positive, negative, neutral
- REAPPRAISE negative

Rating: negative affect, positive affect, instruction adherence post-trial

Scan Parameters

T1-weighted structural scan:

- TR=2250 ms, TE =2.99 ms; TI =900 ms; flip angle =9 degrees
- FOV =256mm x 240mm x 192mm; Voxel size =1mm isotropic
- GRAPPA acceleration factor =2 (4 min, 32 secs)

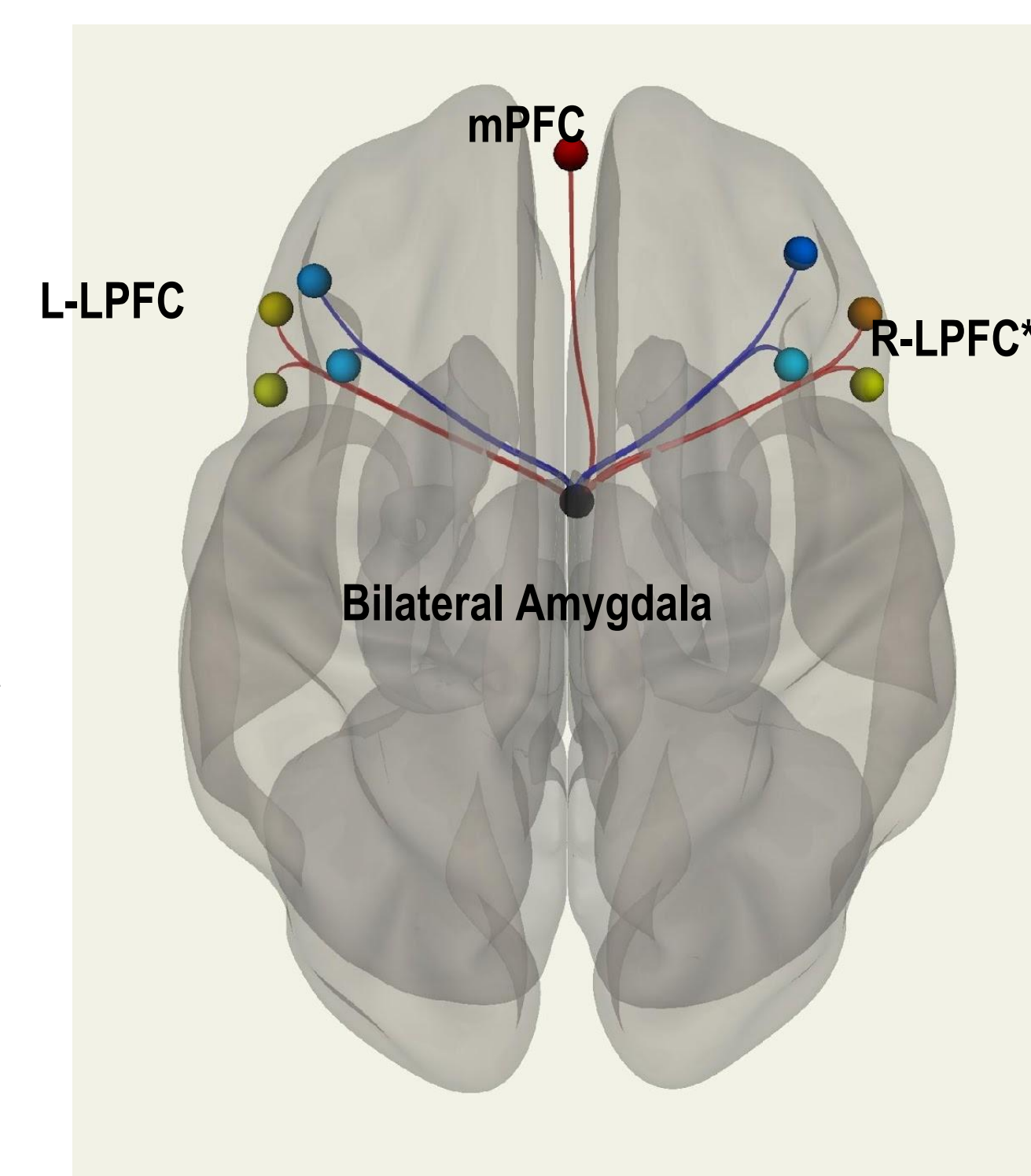
T2*-weighted fMRI Resting State scan - eyes-closed (8 min 40s)

- TR =1970 milliseconds; TE =30 milliseconds; flip angle =78 degrees
- FOV =192 mm x 192 mm; Voxel-size =3x3 mm x 4.44 mm
- 261 volumes, 32 axial slices; slice thickness= 3.7 mm
- Inter-slice gap of 20% degrees.

Funding: from the Biotechnology and Biological Sciences Research Council (BBSRC), followed by support from the Medical Research Council (MRC) Cognition & Brain Sciences Unit (CBU) and the European Union Horizon 2020 LifeBrain project.

Connectivity Analysis

- Connectivity Analyses were run via Matlab CONN Toolbox¹⁰
- Structural T1 scans were registered to the resting state functional Scan
- Normalization performed with 8mm smoothing
- **ROI Masks:**
 - **Bilateral Amygdala (AMG):** Conjunction of left and right Amygdala Harvard-Oxford anatomical masks¹¹
 - **Left LPFC, Right LPFC, and MPFC:** Separate masks based on Harvard-Oxford atlas
- RSFC between Bilateral Amygdala and each area of PFC were extracted from each subject in CONN.

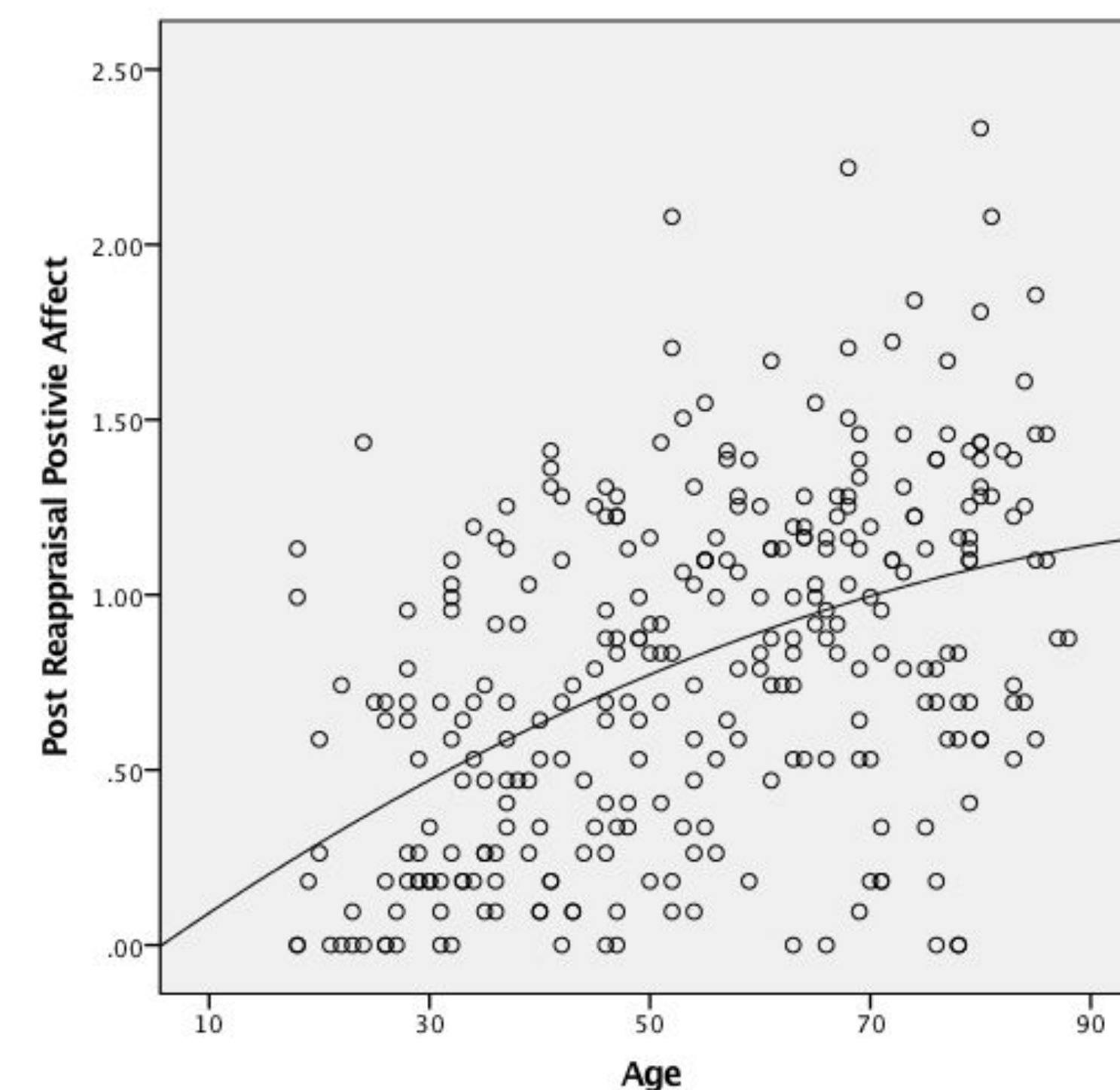


Results

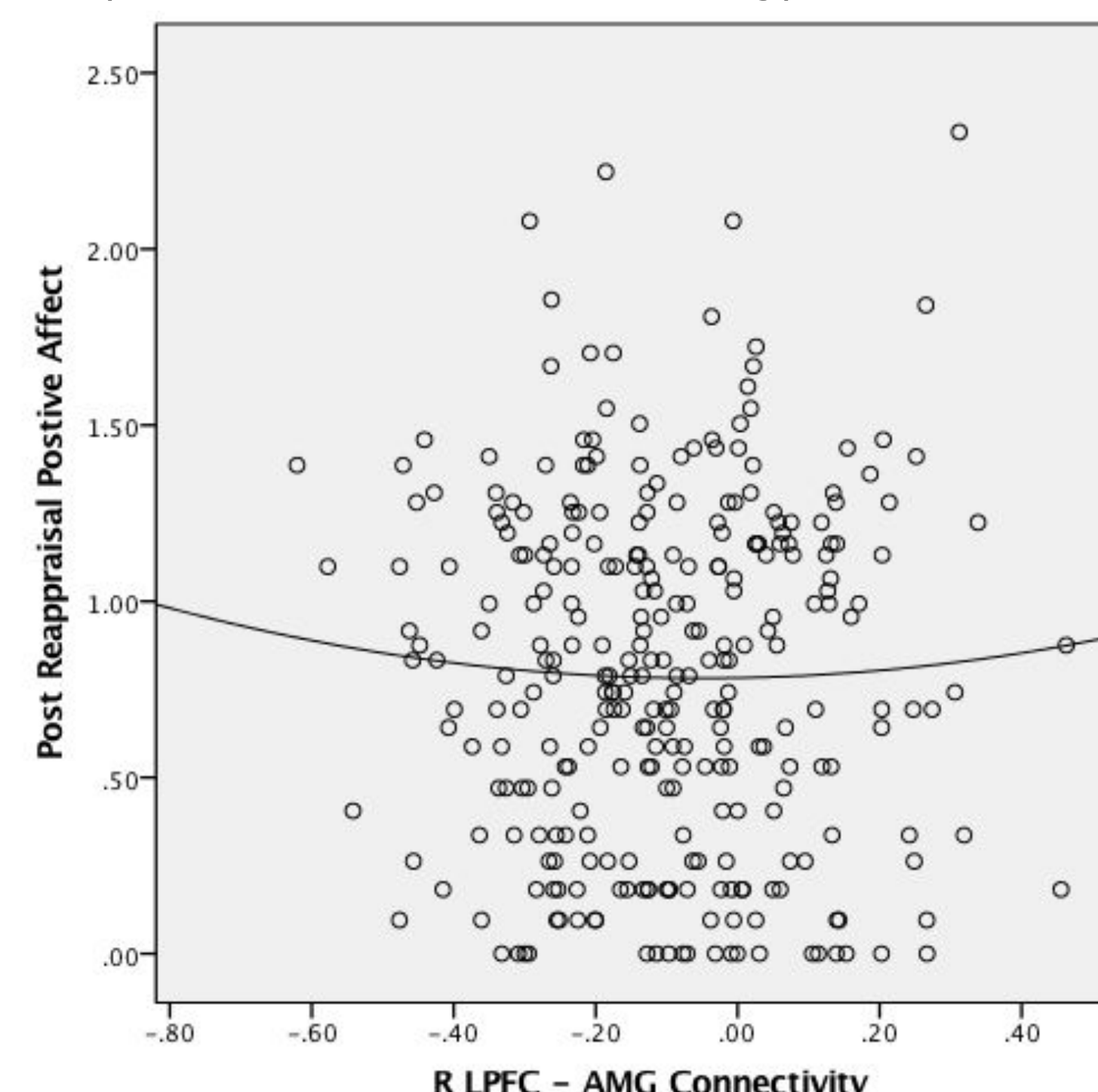
Univariate GLMs of Age x Connectivity on self-reported post-reappraisal positive affect

- Left LPFC-AMG
- R LPFC-AMG
- MPFC-AMG

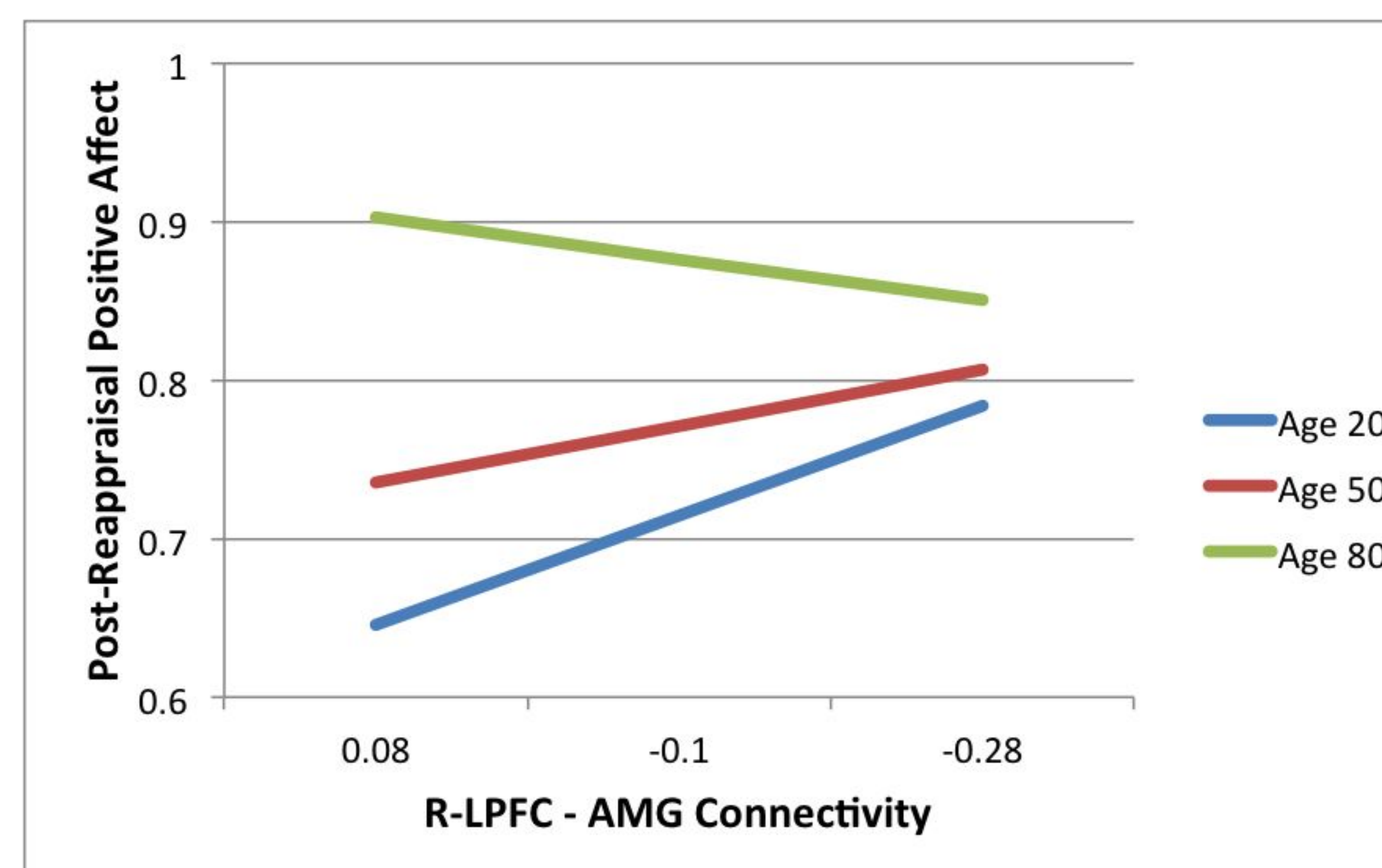
- Covaried for instruction adherence and positivity bias (neutral watch affect rating)



Main effect of age on post-reappraisal positive affect
B= 0.004, SE= 0.001, $p < 0.001$



Main effect of R LPFC-AMG connectivity strength on positive affect
B= -0.419, SE= 0.159, $p = 0.009$



Age x Connectivity Interaction on post-reappraisal positive affect.
B= 0.009, SE= 0.004, $p = 0.02$, $R^2 = 0.7$

R LPFC-AMG negative functional connectivity predictive of positive affect for younger and middle aged adults, but predictive of less positive affect for older adults

Discussion

- Older adults demonstrated greater post-reappraisal positive affect scores, replicating previous behavioral studies supporting increased ER and positivity bias with age.^{12,19}
- Extending on previous findings⁴ - LPFC-AMG was predictive of regulatory success for middle aged and younger adults, but not older adults, in a momentary behavioral reappraisal task.
- *Regulatory model of anxiety* suggests PFC-AMG structural connectivity is mechanism of inhibitory emotion regulation.¹⁷
- PFC-AMG connectivity may represent a need to reappraise and engage with distressing stimuli during reappraisal, and PFC-AMG decoupling may be an indication of more successful emotion regulation.¹⁸

Future Directions & Implications

- While mPFC-AMG connectivity was not predictive of reappraisal success across the lifespan, future work should investigate this relationship in older adults only.
- This investigation explored resting-state functional connectivity, and should be replicated in an fMRI version of the behavioral task used.
- Future studies should clarify whether alternative PFC-AMG subnetworks may support reappraisal ability for older adults compared to other age groups, in line with Selective Optimization and Compensation of Emotion Regulation (SOC-ER)¹⁶
- The medial PFC (mPFC) has been shown to be involved in reappraisal^{7,13}, and preserved in older adults^{13,14}, thus may warrant further investigation.

Limitations

- The data reported represented only 298 of the 700 (42%) participants in the total Cam-CAN study. There may be systematic biases among those who were able to complete an fMRI scan and an emotion regulation task.
- ROIs were atlas based in MNI-space and not hand-traced or segmented for each individual in functional space. This may lead to greater error for older adults, who tend to have more structural heterogeneity than the younger adults

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