INTRINSIC CAUSAL NETWORK DYNAMICS OF EMOTION REGULATION TENDENCY REFLECTED IN RESTING-STATE FMRI

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INTRODUCTION

- Emotion regulation tendency - the preference for the selection of one emotion regulation strategy over another (e.g., reappraisal over distraction).
- Reappraisal is more often chosen than distraction when confronted with low-arousing negative stimuli.
  - reappraisal - reinterpretation of a negative stimulus
  - distraction - diverting the attention away from a negative stimulus

RESEARCH AIM

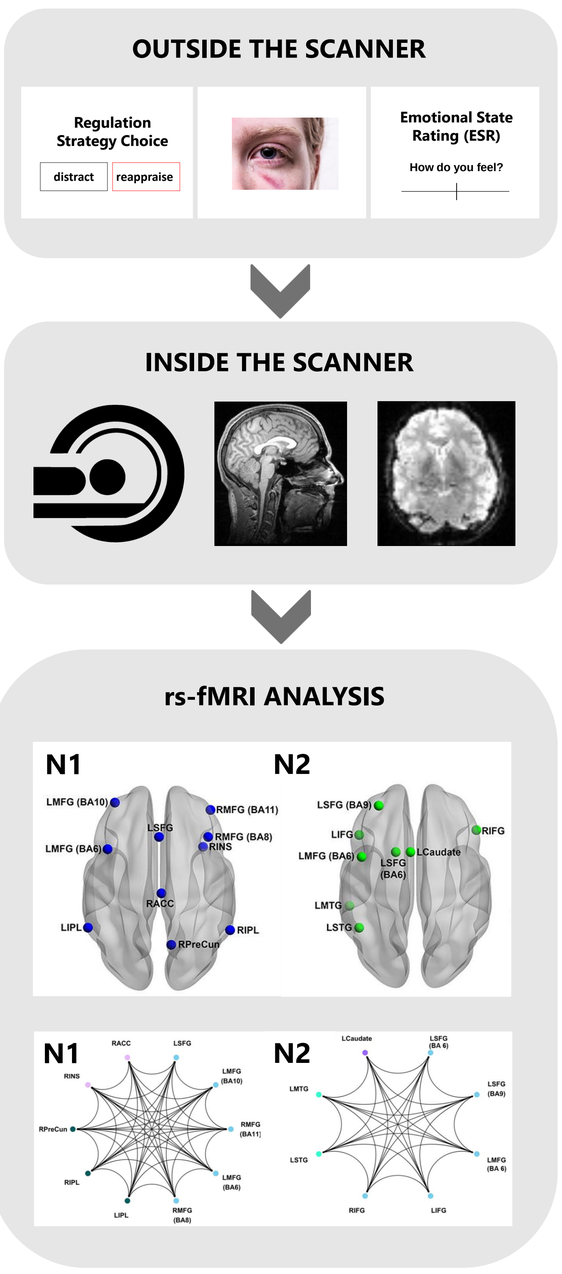
- Examining the relation of the effective connectivity (EC) of the brain in the absence of specific task demands to the individual regulation tendency.
- We hypothesized that the EC of reappraisal-related brain regions at rest would be modulated by the individual tendency to choose this strategy to down-regulate negative emotions.

METHODS

Sample: n = 40 participants (20 female, mean age = 22.53 years, SD = 3.76, range = 18-35)

Stimuli: 60 aversive images from the International Affective Picture System (IAPS, 30 high- and 30 low-intensity images)

fMRI: SIEMENS Magnetom Trio 3.0 Tesla MR scanner with an 8-channel head coil.; multiband EPI sequence (TR = 2.7 s; TE = 30 ms; 42 slices; voxel size = 3.0 × 3.0 × 2.7 mm^3; 2.7 mm slice thickness; field of view = 192 x 192 x 97.5 mm^3; flip angle = 70°; number of rs-fmri volumes: 260)



- Standard emotion regulation task
- Reappraisal or distraction as regulation strategies
- Rating scale for the current emotional state

- 10-minute resting state fMRI scans
- Structural and functional data collection

- Time series extraction from the task-based ROIs
- Two neural networks related to emotion regulation by using reappraisal
- Deterministic spectral dynamic causal modeling (DCM)
- Hierarchical Parametric Empirical (PEB) framework for tendency regression
- Leave-one-out cross validation analysis for regulation tendency prediction

RESULTS

I. Regulation tendency in response to high-intensity stimuli is related to a high degree of connectivity between frontal and parietal regions within N1 and between frontal and temporal regions within N2 (Fig. 1).

HIGH-INTENSITY STIMULI

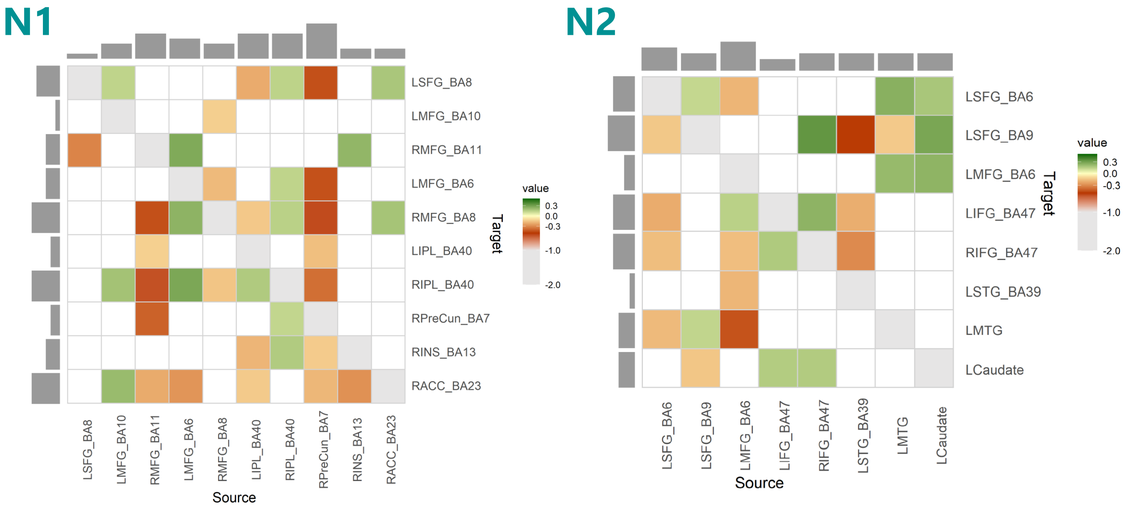


Figure 1 | Spectral dynamic causal modeling results. EC within the two networks when calculated with the regulation tendency as covariate (left: high-intensity N1; right: high-intensity N2). Effects shown in color survived a 99% posterior confidence criterion. Green/red colors indicate a higher/lower connectivity in relation to the covariate. Grey bars indicate the number of inputs/outputs to/from one region.

II. The same pattern of result is even more pronounced for regulation tendency in response to low-intensity stimuli in both networks (Fig. 2).

LOW-INTENSITY STIMULI

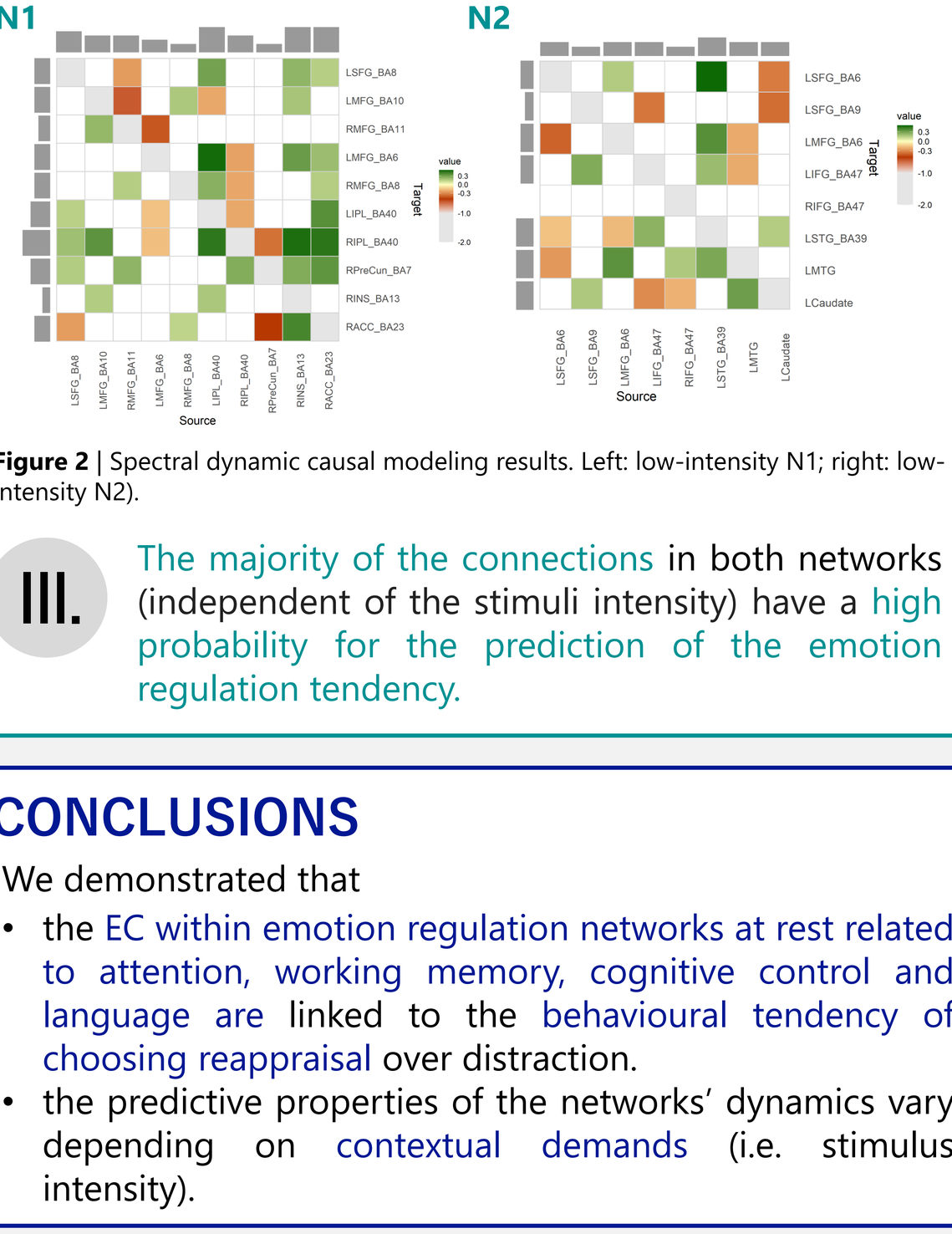


Figure 2 | Spectral dynamic causal modeling results. Left: low-intensity N1; right: low-intensity N2).

III. The majority of the connections in both networks (independent of the stimuli intensity) have a high probability for the prediction of the emotion regulation tendency.

CONCLUSIONS

We demonstrated that

- the EC within emotion regulation networks at rest related to attention, working memory, cognitive control and language are linked to the behavioural tendency of choosing reappraisal over distraction.
- the predictive properties of the networks' dynamics vary depending on contextual demands (i.e. stimulus intensity).

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