Using the Auburn Neural Network App (ANNA) in Prevention Research

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Presentation Outline

Informational Content
- What is ANNA?
- How can ANNA be used for prevention research?
- How does ANNA calculate “traditional” connectivity measures?
- How does ANNA calculate “dynamic” connectivity?
- Questions?

Hands-on Activity
- Demonstration: ANNA in Action.
- Hand-out: Guide to using ANNA.
What is ANNA?

- The Auburn Neural Network App
- Could be “Automated Neural Network Analytics”

- A dual use program:
  - Visualize individual or group level dynamic network functioning.
  - Generate functional connectivity datasets (including dynamic measures).

- Tool for investigating brain-behavior relationships.
Some basic info

- Approach similar to graph theory.
- Plots ROI-ROI connectivity (of desired radius).
- MNI space.
- Bounding box = SPM8.
- Expects a list of ROIs defining two neural networks.
- Colors are Bonferroni corrected.
- Red=Net1; Blue=Net2; Green=Negative Connectivity.
How can ANNA be used for prevention research?

- Task based or resting state.
- ROI-ROI analyses.
- Hypothesis testing/improving model fit.
  - Generate functional connectivity datasets (traditional and dynamic measures).
  - Group and individual differences.
- Network visualization within conditions, individuals, or groups.
- Compare functioning side by side.
- Examine network response to events/stimuli.
How can ANNA be used for prevention research?

- Traditional: average correlation across time.
- Dynamic: combine variance and average correlation estimates to investigate network interaction and the stability of connections over time.

- Dynamic: T-values, Density, Entativity (and absolute value of each).
How does ANNA calculate “traditional” connectivity?

- Regions of Interest (ROIs) entered into ANNA.
  - Two networks in a simple text file list.
- All possible pairwise correlations are calculated.
- Results for each participant “vectorized”; added to dataset.
  - Similar to “graph theory” approach.

- Average network connectivity: Average of all connections within a single network
- Network density: Proportion of significant connections within a network, after correction.
How does ANNA calculate “dynamic” connectivity?

- A “dynamic connectivity” dataset is first created.
- Based on a “window correlation” containing 5 TRs.
- Allows: T-value and density calculations.

- A “dynamic connectivity correlation matrix” is then created.
- Allows: Entativity and other advanced calculations.
- Entativity: extent to which network connections are correlated.
What do they mean?

- **T-value**: tested against 0; extent to which connection was stable (and not = 0).
- **Density**: #Sig TRs/TotalTRs; % of TRs (time) that connection was significant after Bonferroni correction.
- **Entativity**: extent to which network wide connectivity fluctuates with individual connections.
- extent to which the network “acts as one”; “comes online” as connectivity in any one connection increases.
Could also measure

- Network states: number/proportion of times a network is in one state or another (100% dense; 0%; just left; just right, etc.).
- Network efficiency: correlation between connection strength and network entativity
- Extent to which effort produces results (i.e. a network’s emergent property).
- More!
How can you generate your own datasets?

- Open terminal.
- Type command.

- Need more info?: see the “Guide to using ANNA”
Questions?