# Can Neurophysiologic Synchronies Be Detected During Collaborative Teamwork?


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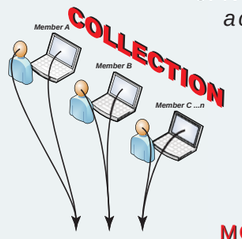
## Methods

1. *Experimental Protocol: Teams of 3 complete a computer based task on substance abuse*

2. *Vectors for neural network clustering are generated from EEG engagement and/or workload measures*

3. *Neural synchronies are mapped across the collaboration event.*




**PROCESSING**

**Temporally Align:**

- Neurophysiologic Metrics (EEG)
- Mouse Clicks
- Coded Video Events
- Coded Audio Events

**MODELING**

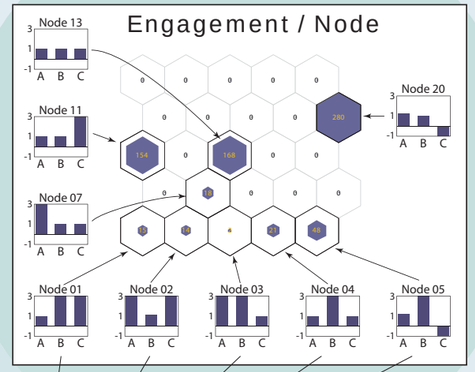
Engagement

| *Epoch* | A | B | C | |
|---|---|---|---|---|
| *1* | -1 | -1 | -1 | *- None Engaged* |
| *2* | 1 | 1 | 1 | |
| *3* | 1 | 1 | 1 | |
| *4* | -1 | 1 | 3 | |
| *5* | 3 | 3 | 3 | *- All Highly Engaged* |

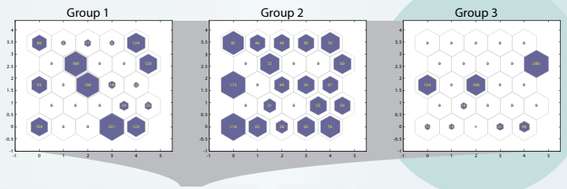
± One Quartile Coding

Neural Network Event Clustering

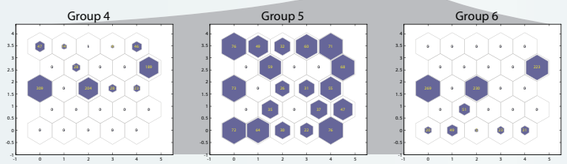

We have explored using neurophysiologic synchronies as an approach for developing a deeper understanding of how teams collaborate when solving real-world problems. Six teams of three students solved medical simulations while measures of mental workload (WL) and engagement (E) were generated by electroencephalography (EEG). Levels of high and low WL and E were identified for each member at each epoch and the vectors consisting of these measures were clustered by self organizing artificial neural networks. The resulting cognitive teamwork patterns, termed neural synchronies, were different across six teams. When the neural synchronies were compared across the team members of individual teams, segments were identified where different synchronies were preferentially expressed. These studies suggest that non-random patterns of neurophysiologic synchronies may be observed across teams and members of a team when they are engaged in problem solving.


Six Groups Tested on the Combined Network

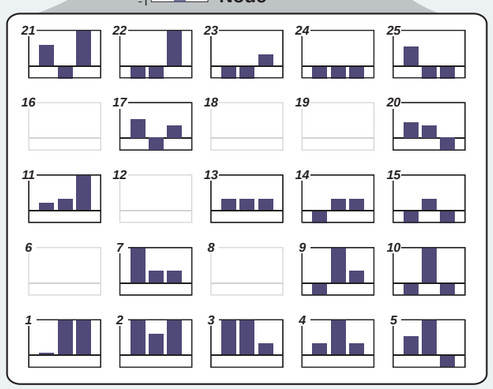



## Different Teams Express Different Proportions of Neural Synchronies

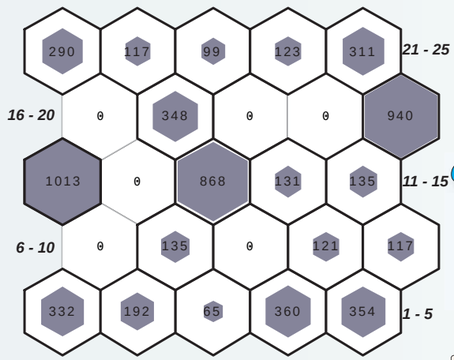



## Neural Synchronies and Frequency Distribution

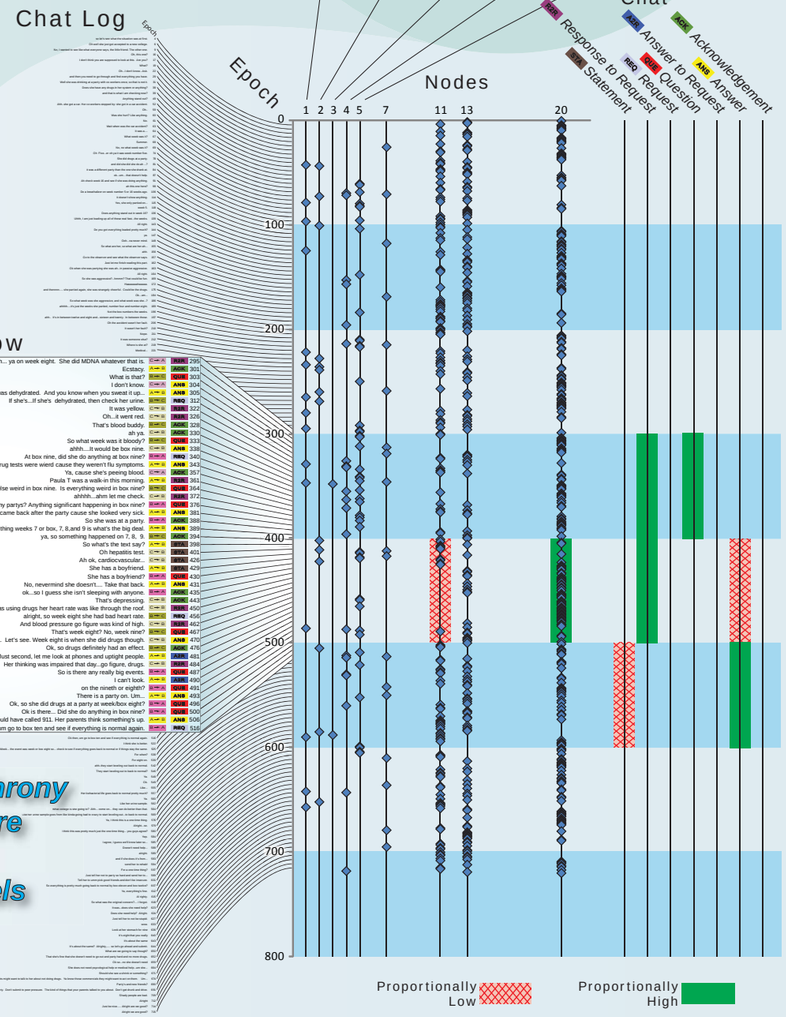
Engagement at Node




Epoch Distribution per Node (101 minutes of teamwork)




Chat Log




Decision Window

## Changes in Neural Synchrony and Chat Dynamics are Associated with Evolving Mental Models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