



# 112. FUNCTIONAL CONNECTIVITY MRI ANALYSIS IN INFANCY - IS AWAKE RICHER?



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## Introduction

The majority of infant functional MRI (fMRI) studies have examined the developing brain in an asleep (resting) state. However, awake fMRI (task-fMRI) is considered to measure a wider range of neural circuits compared to asleep fMRI. Although considered practically challenging, this study aimed to investigate whether awake infant fMRI might yield richer data possibly containing stronger features allowing classification using supervised (labelled) machine learning.

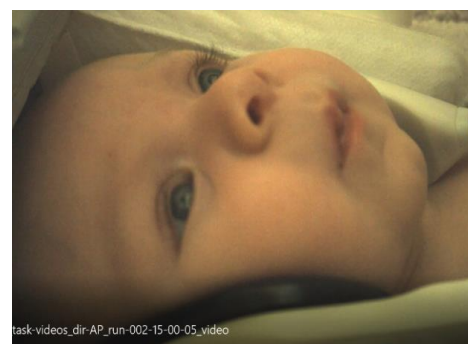
## Methods

100 infants (aged 2 months corrected) recruited as part of the FOUNDCOG Project watched videos while in the MRI. Region-of-interest extraction of fMRI data was achieved using a 400 parcel 7 network atlas.

Functional connectivity (FC) was calculated asleep and awake using Pearson partial correlation (motion as covariant). To classify 'preterm versus term' a Support-Vector-Machine (linear) classifier was used to calculate balanced accuracy scores using awake and asleep data respectively.



Fig 1: Awake infant fMRI scan



## Results

Of 100 infants scanned 76 infants (17 born preterm <34 weeks gestation, 59 born term) contributed both awake and asleep runs in the same session. Motion (median framewise displacement) was not significantly different between 'preterm vs term' groups in either asleep or awake states.

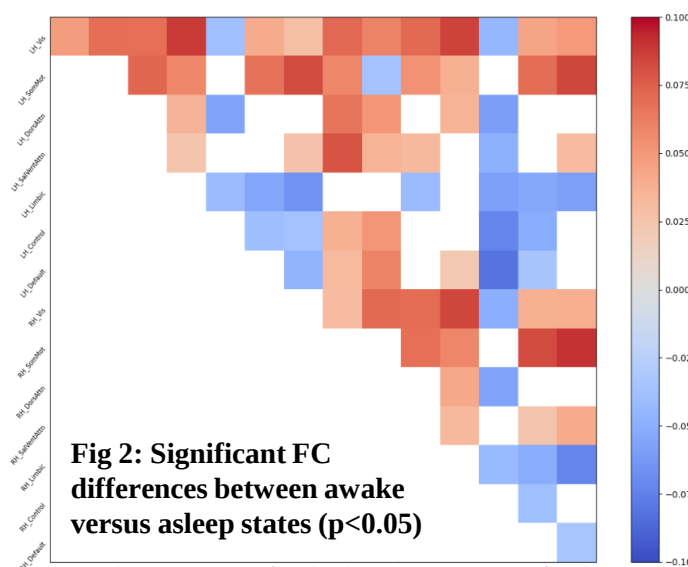


Fig 2: Significant FC differences between awake versus asleep states ( $p < 0.05$ )

Group average FC showed significantly increased limbic network connectivity when asleep, versus increased visual, somatomotor and salience/ventral-attention networks when awake.

The visual, control and dorsal-attention networks contributed significantly towards the stimulus-evoked component.

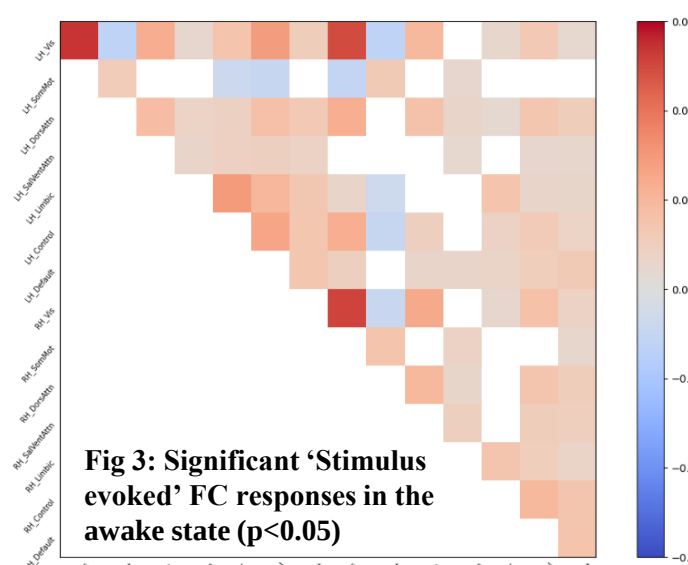


Fig 3: Significant 'Stimulus evoked' FC responses in the awake state ( $p < 0.05$ )

Machine learning classification of 'preterm vs term' achieved moderate accuracy and no significant difference was seen between the awake vs asleep states. Stimulus-evoked FC was an inaccurate predictor.

|                 | Accuracy | SD   | p-value |
|-----------------|----------|------|---------|
| Asleep          | 0.66     | 0.04 | 0.001   |
| Awake           | 0.64     | 0.04 | 0.002   |
| Stimulus-evoked | 0.52     | 0.04 | 0.22    |

Table 1: Accuracy scores using machine learning classifier – 'Preterm vs Term' for asleep, awake, and stimulus-evoked states

## Conclusion

- ✓ Aged 2 months corrected seems an opportune time to acquire awake infant fMRI.
- ✓ A machine learning classifier can classify 'preterm vs term' gestation using either awake or asleep state FC data with moderate accuracies.
- ✓ The stimulus-evoked activity does not appear to lend towards a richer awake state (when used for classification of 'preterm vs term').
- ✓ Further work will analyse whether state (awake/asleep) FC can contribute towards classification of other clinical parameters.