

## The Courtois project on neuronal modelling - first data release

Authors:

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### Introduction

An overarching goal of AI was to train Artificial Neural Networks (ANNs) that could learn and behave similarly to humans, by generalizing from a few examples, and transferring knowledge across tasks. We hypothesize that the development of such flexible ANNs could be accelerated by learning from extensive whole-brain neural activity recordings on individual participants engaged in multiple naturalistic tasks. The Courtois Project on Neuronal Modelling (CNeuroMod) aims to fill this gap by collecting 500 hours of functional neuroimaging data on six participants over the next 5 years, using a wide range of naturalistic stimuli, with the explicit goal of training ANNs to imitate both human brain activity and behaviour. The CNeuroMod data is made freely available to the academic community, to advance research at the intersection between AI and neuroscience. This abstract summarizes the content of the CNeuroMod first data release, scheduled for June 2020.

### Methods

FMRI Data is being collected on 6 subjects (3 women), all right-handed, and all are fluent English speakers. Participants undergo regular auditory testing, and have normal, or above normal hearing for their age. Physiological signals (i.e. respiration, pulse, ECG, and skin conductance) are recorded using a Biopac MRI compatible system and amplifiers. Participants wear individualized head cases built by CaseForg to minimize motion. Visual stimuli are projected onto a screen located in the MRI room, via a waveguide. Sound is delivered using S15 Sensimetrics headphone inserts. Sounds is equalized, and then amplified using an amplifier. Subjects wear earmuffs adapted from commercially available model for extra noise attenuation. A custom built fiber optic controller is used to play videogames. FMRI data is acquired using an accelerated simultaneous multi-slice, gradient echo-planar imaging sequence (Xu et al., 2013) on 3T Siemens Prisma MRI scanner with a 64-channel head coil. Anatomical MRI sequences were acquired 4 times over a one year period, covering both brain and cervical spinal cord. Functional and anatomical brain data was preprocessed using the fMRIPrep pipeline (Esteban et al, 2018). For more details regarding sequences and preprocessing, you can visit the CNeuromod documentation website (<http://docs.cneuromod.ca/>).

## RESULTS

The first CNeuroMod data release will have over 30h of fMRI data per subject, split across multiple datasets, listed below. HCP test-retest (*hcprt*) includes 10h of the HCP functional localizer, repeated 15 times. A session was typically composed either of two repetitions of the HCP localizers, or one resting-state run and one HCP localizer. In *Movie10*, participants watched 12h of movies, presented in approximately 10 min segments. Movies were *Wolf of Wall Street*, *The Bourne Supremacy*, as well as two repetitions of *Hidden Figures*, and the *Life* documentary. During *Friends* subjects watched 9h of the first season of the TV show *Friends*. Preprocessed data are formatted in BIDS (Gorgolewski et al, 2016, and available to the community using a registered access system and the DataLad version control tool.

## Conclusion:

The CNeuroMod project will produce one of the largest individual fMRI datasets, using naturalistic stimuli spanning a wide range of cognitive domains. This datasets will be invaluable to scientists trying to train biologically inspired ANNs using human neuroimaging data. Future releases will include MEG, eye tracking and pupillometry recordings, and new datasets with cognitive tasks involving memory and language.

## Acknowledgments

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## Refs:

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