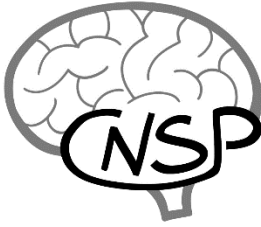




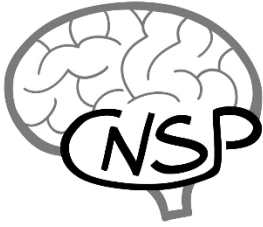
**Cognition and Natural Sensory Processing
Workshop 2023**
(18–19th September)



Cognition and Natural Sensory Processing Workshop

Workshop programme (Irish standard time)*

Day 1 (Monday 18 th September)	
Session 1 (4.00pm)	<i>Investigating sensory and cognitive processing with natural paradigms</i> <i>Chair: Aaron Nidiffer and Giovanni di Liberto</i>
(4.00pm)	Introduction and welcome
Keynote (4.10pm)	Lucas Parra – Narratives synchronize body and mind (40 mins + 20 mins Q&A)
(5.10pm)	<i>Giovanni Di Liberto</i> – updates for the CNSP resources, sponsorship, goings on (15)
(5.25pm)	<i>Giorgio Piazza</i> - Non-native Directed Speech Supports L2 Learners' Cortical Tracking of Speech (15)
Break (5.40pm)	(please set up the CNSP resources before Session 2 if you haven't done so already)
Session 2 (6.00pm)	<i>mTRF-Toolbox tutorial: Encoding and decoding models for neural signal analysis</i> <i>Chair: Steph Haro and Mick Crosse</i>
Tutorial (6.00pm)	Aaron Nidiffer – Encoding/decoding models, multivariate analysis, models validation, etc. in the MATLAB mTRF-Toolbox
End time (8.00pm)	Any lingering Q&As
Day 2 (Tuesday 19 th September)	
Session 3 (4.00pm)	<i>Novel directions on models for neural signal analysis in natural sensory scenarios:</i> <i>Chair: Giorgia Cantisani and Aaron Nidiffer</i>
(4.00pm)	Welcome for the day
Keynote (4.10pm)	Micha Heilbron – Generative AI as a window into the predictive brain (30+10)
Talk 1 (4.50pm)	Marlies Gillis – Linguistic speech tracking by the brain (20+5)
Talk 2 (5.15pm)	Ole Bialas – Fundamentals of TRF-analyses in Python (20+5)
Break (5.40pm)	(please set up any resources before Session 4 if you haven't done so already)
Session 4 (6.00pm)	<i>CNSP community tutorials: Encoding and decoding models for neural signal analysis</i> <i>Chair: Giorgia, Mick, Steph, and Aaron</i>
Track 1 (6.00pm)	Marlies Gillis – Linguistic speech tracking by the brain
Track 2 (6.00pm)	Ole Bialas – Fundamentals of TRF-analyses in Python
End time (8.00pm)	(2h max. The duration will depend on the Q&A)



Cognition and Natural Sensory Processing Workshop

The CNSP initiative aims to develop and collect resources, such as analysis scripts and publicly available neural data, for the study of cognition and natural sensory perception. In doing so, we propose a standardised pipeline for recording, analysing, storing, sharing, and comparing datasets involving natural sensory processing, such as speech/music perception and watching movies. The CNSP workshop 2023 will provide the fundamental insights on the standardised pipeline and analysis scripts via a set of tutorials delivered by organisers, as well as giving space to other tutorials from researchers in the field, providing a comparison of current methodological techniques, as well as proposing new approaches for the field. This second edition of the CNSP workshop will also feature two international keynote speakers, who have contributed significantly to the field. The workshop will also include a discussion of future directions, both on the methodological development and on the standardisation and data sharing aspects, defining future directions for the CNSP initiative. Please visit our website at <https://cnsppworkshop.net>.

Background:

In recent years, research in that domain demonstrated the importance of studying perception in real-world scenarios involving naturalistic tasks. Recent advances in computational resources, neural signal processing and machine learning led to the development of research frameworks to quantify neurophysiological activity under such naturalistic conditions. The possibility of carrying out these realistic experiments is ground-breaking, as it leads to datasets that are particularly information rich and suited to being re-analysed from a variety of angles. Recent attempts to share that type of datasets led to a valuable yet heterogeneous set of publicly available resources, whose strengths are diminished by the lack of a clear domain-specific standardised pipeline and resource sharing approach. The CNSP initiative is collecting and standardising that set of resources, as well as developing and sharing numerous original standardised analysis scripts that serve as tutorials and blueprint for researchers that are transitioning into this rising field of research. This material is designed to be accessible to researchers from a variety of disciplines. Nevertheless, while this makes it easier to analyse the data, researchers must have the appropriate understanding of the core methodological aspects of this analysis pipeline, which is provided in the form of tutorials during the CNSP workshop. In addition, the CNSP workshop 2023 will host international two keynote speakers at the top of this field of research, two talks that have been selected based on an open call for submission, and an invited speaker who is an expert in open science from the neighbouring area of bioinformatics.

Keynote Speakers

Narratives synchronize body and mind



Lucas C. Parra is Harold Shames Professor of Biomedical Engineering at the City College of New York (CCNY) and Affiliate Member of [Radiology at Memorial Sloan Kettering Cancer Center](#) (2020-). He received his Ph.D. in Physics from the [Ludwig-Maximilians-Universität](#) in 1996 with research in the area of machine learning under the guidance of [Gustavo Deco](#). Prior to joining [CCNY](#) he worked on medical imaging at [Siemens Corporate Research](#) (1995-1997) and acoustic signal processing at [Sarnoff Corporation](#) (1997-2003).

Generative AI as a window into the predictive brain



Micha Heilbron is an Assistant Professor of Cognitive AI at the University of Amsterdam (UvA), based at Amsterdam Brain and Cognition ([ABC](#)). He works at the intersection of cognitive science and AI, primarily studying how brains and artificial systems understand language and make sense of the world. He obtained a PhD at the Donders Institute and the [Max Planck Institute for Psycholinguistics](#) in Nijmegen (NL) under the supervision of Floris de Lange and Peter Hagoort, respectively. He was previously a post-doc in the [Predictive Brain Lab](#) at the [Donders Institute](#) and also trained in London (UCL) and Paris (ENS & UPMC).

2022 CNSP Project Update

Non-native Directed Speech Supports L2 Learners' Cortical Tracking of Speech



Giorgio Piazza is a PhD candidate at BCBL (Basque Center on Cognition, Brain, and Language, Donostia-San Sebastián, Spain). His research primarily focuses on socially mediated speech and phonetic changes induced by listener-oriented speech, with a specific interest in how these changes affect second language (L2) perception and learning. Lately, he spent a research stay at Di Liberto's Lab (Trinity College Dublin), where he investigated non-native listeners' neural responses to L2 speech. In his leisure time, he enjoys playing rugby and practising old-way vogue.

Hands-on Tutorials

Linguistic speech tracking by the brain

Marlies Gillis

This workshop introduces a framework for assessing the brain's ability to track linguistic elements while perceiving continuous speech. When we listen to speech, our brain time locks to the rhythm of specific speech features, a phenomenon known as neural tracking (Brodbeck & Simon, 2020). Traditionally, studies examining neural tracking have concentrated on features derived from speech acoustics. However, this workshop promotes the utilisation of linguistic speech features—those that capture speech content—for determining linguistic speech tracking.

Linguistic speech features quantify the level of novel linguistic information within phonemes or words. An example of such a feature is "word surprisal," which evokes a negative brain response approximately 400 ms after word onset. This aligns with findings from studies investigating the N400 event-related brain potential (ERP) response, which is usually explored in controlled sentence or word contexts. This suggests that linguistic tracking facilitates the exploration of higher-level language processing using ecologically valid continuous speech stimuli.

Nonetheless, a challenge emerges: linguistic features correlate with acoustic features. Daube et al. (2019) demonstrated that acoustic speech features can account for apparent responses to linguistic phoneme categories. Consequently, without accounting for acoustic properties, analyses of speech tracking may yield spurious significant linguistic speech tracking findings. To address this, our focus will be on a subtraction-based approach to determine linguistic tracking while controlling for speech acoustics.

Linguistic speech tracking opens avenues to comprehend whether and how individuals understand speech. The workshop introduces the methodology for determining linguistic speech tracking and how to create linguistic speech features.



Marlies Gillis is a post-doc at ExpORL (Department of Neurosciences, KU Leuven, Belgium). During her PhD, she focused on finding neural responses associated with speech comprehension. During her postdoc position, she is investigating the neural responses to speech in children with and without dyslexia, aiming to find neural markers for dyslexia (the latter project is in collaboration with the Center for Research in Cognition and Neurosciences, ULB, Belgium). Currently, her favourite band to listen to is the Menzingers.

Fundamentals of TRF-analyses in Python

Ole Bialas

Temporal response functions are simple, yet versatile, models for neural responses to continuous speech. One of the most commonly used tools for fitting these models is the Matlab mTRF-toolbox. We recently wrote an implementation in Python, called mTRFpy, that replicates and expands the original toolbox. In this workshop, we will introduce mTRFpy and address essential aspects of TRF-analyses like regularisation, overfitting and statistical inference. We will also explore how model performance depends on the amount of training data as well as the number of model parameters and how generalised TRF models can be used to mitigate a lack of training data. The workshop does not require prior knowledge of TRF analyses or Python. We will provide the data and an online notebook (Google account required) to follow along, but more experienced participants are encouraged to bring their own data! Anyone who wants to familiarise themselves with mTRFpy before the workshop may [visit the project's website](#).



Ole Bialas is a postdoctoral research fellow at the University of Rochester's Department of Biomedical Engineering where he studies the role of invariant categories, such as Phonemes, in the cortical processing of speech. He is also interested in developing open and accessible statistical methods and software for neuroscience. He obtained his PhD at the University of Leipzig in Germany where he studied the cortical encoding of auditory space.

The Organisers



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Postdoctoral Associate
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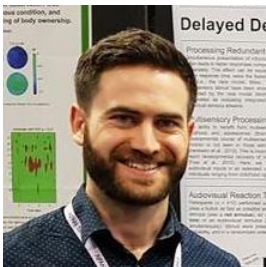
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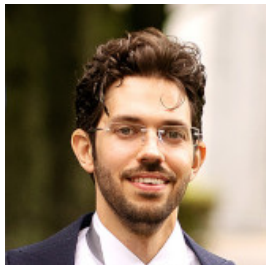
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Nottingham Trent University
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Resources

Check out our resource page at <https://cnspworkshop.net>

We will do our best to continue updating and maintaining that web page in the future.

Resource preparation guidelines: You should all have been invited to the document already. If not, please contact us. Here is the [link to the document](#).

Datasets and scripts: [Click here to download](#) the zip file containing the folder structure archive and [click here to to download](#) the CNSP dependencies. Unzip the archive. The datasets and scripts that you will download should be placed into this folder structure. We are also sharing the following datasets: [LalorNatSpeech](#), [LalorNatSpeechReverse](#), [diliBach](#), [musicImagery](#) and many others. Please download at least the datasets *LalorNatSpeech* and *diliBach*, which will be used on Day 1. Please refer to the [resource preparation guidelines](#) for further information.

Tutorial scripts: These scripts will be available on our resource page at <https://cnspworkshop.net>

Zoom webinar: You will receive an invitation to the scheduled Zoom calls on Monday and Tuesday

Video recordings will be available after the workshop on the CNSP website (only for the presentations where the speakers agreed to the recording).

Follow us at:

cnspworkshop@gmail.com

<https://cnspworkshop.net>

Twitter: [@CnspWorkshop](#)

Slack: [CNSP workshop](#) (click to join workspace)

<https://community.cnspworkshop.net>

and on the CNSP google group (the link is on our website). We will keep up to date about future developments as well as future editions of the CNSP-Workshop.

Acknowledgements

We thank [mBrainTrain](#) for sponsoring for their generous contribution to the CNSP workshop 2023, which will be used to support a student or postdoc to visit TCD (or another institution) and carry out a project in the CNSP domain. We also thank Trinity College Dublin for offering their resources for managing the registration for the workshop.



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We thank Jasmine Florentine for designing the CNSP logo! Check out her work on her [website](#)

We would like to thank Edmund Lalor, who has supervised four out of six organisers at some point in their careers, served on the PhD committee of a fifth, and has greatly influenced the work that led to this workshop. We would like to thank Jonas Obleser, Nima Mesgarani, Jonathan Simon, Jens Hjortkjær, Lien Decruy, and Usha Goswami for their early feedback and support in CNSP, as well as all the speakers of CNSP2021 and 2022, whose contributions are now part of the CNSP resources (see video section). We would also like to thank all the speakers of CNSP2023 for their key contributions to this workshop. We also thank Jeremy Yeaton and Sara Carta for their help with the testing of the tutorial scripts and guidelines. Finally, thank you all for your participation! We really hope that this initiative and workshop have been helpful and will continue to be helpful with future editions. We aim to maintain and update such resources in the foreseeable future with the help of the CNSP community. Please get in touch if you would like to contribute in any way to this initiative. Thank you!

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