

# Mattia Rosso, PhD

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D.O.B: 23/05/1992



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## BIOGRAPHY

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I obtained my Master's degree in Body and Mind Sciences at University of Turin (IT), where I spent one year as research assistant among MANIBUS Lab under the supervision of prof. Francesca Garbarini. During that period of hands-on experience with EEG setup, montage and data processing, I got familiar with behavioral and event-related potentials (ERPs) paradigms for investigating multi-sensory integration, motor control, body and space representation. My main research interest is interaction with music approached from the perspective of psychology and neurosciences, which brought me at IPEM Institute for Systematic Musicology to start a PhD in December 2018.

My work is focused on human rhythmic behavior, and develops along two lines of research. On the one hand, I investigate the behavioral and neural dynamics underlying interpersonal coordination. On the other hand, I develop methods for investigating neural entrainment during synchronization with environmental rhythms. The methods of my research mainly consist of a combination of behavioral and electroencefalography (EEG) analyses from interactive experimental scenarios, with a core focus on multimodal signal processing and design of novel experimental paradigms. My experimental work started with the design of an interactive paradigm for dyadic rhythmic interactions. In my first study, I focused on modality-specific dynamics of spontaneous entrainment, showing how the relevance of kinematics information conveyed via visual coupling shapes the interaction in very consistent manner across dyads. Ongoing extensions of this paradigm include sonification strategies to convey kinematic information via the auditory channel, and manipulation of visuo-spatial perspective via 'body-swapping'.

My training in more advanced neuroscientific methodologies began in 2019 under the supervision of Dr. O.A. Heggli and Professor P. Vuust from the Center for Music in the Brain in Århus (DK), where I spent one month for my first research stay abroad in 2019 and two months for a second stay in 2021. The proposal of the second stay was awarded an FWO Mobility Grant for long research stays abroad. To this date, the collaboration led to a joint publication on a high-impact neuroscientific journal, and a solid ongoing collaboration which is meant to result in further scientific output and extend beyond the duration of my PhD project. Delving into these techniques lead me to collaborating with Lousin Moumdjian from Ghent and Hasselt Universities (BE), investigating auditory-motor coupling in neuropathological populations such as persons with multiple sclerosis and cerebellar ataxia, and Marc Vidal Badia from Ghent (BE) and Granada (SP) Universities on mathematical modelling of intra- and inter-brain dynamics. Such collaborations led me to expand my research in the domains of neurorehabilitation and mathematics, respectively. In the case of L. Moumdjian, I am actively involved as collaborator in her personal FWO postdoc mandate in quality of EEG data analyst and consultant (2022-2025). This resulted in joint publications, ongoing submission to neuroscientific and neurorehabilitation journals, and a series of papers which I will co-author. Furthermore, it established a connection with the lab of Professor B. Morillon at Aix-Marseille University in Marseille (FR), where I had the opportunity to visit and consolidate my knowledge of advanced analysis methods based on cross-frequency of brain activity and rhythmic behaviors (finger-tapping and walking).

In 2019, I was awarded a BOF scholarship for the project 'Human rhythmic interactions in healthy and clinical populations', to extend my investigation to normal and pathological ageing, with the goal of building a fundamental knowledge of the sensorimotor deficit in Alzheimer Disease (AD) and address interventions to improve coordinative and communicative functions in such population. The project is being currently carried out under the co-supervision of Professor Séverine Samson and in the framework of a co-tutelle with the PSITEC research group in Lille (FR). The final outcome of the agreement will consist of the award of a joint-PhD in Art Science and Psychology, foreseen in September 2023. The two disciplines converge in the investigation of the fundamental behavioral and neural dynamics underlying perception and production of rhythm in humans, with a special focus on adaptive behavior to ever-changing environments and interpersonal coordination. The title of the resulting thesis dissertation is "*Human rhythmic interactions. Coordination dynamics and informational coupling*".

During my PhD, I was able to independently carry out and publish a large number of empirical studies, and gathered solid international experience. In a period of 4 years, with the precious collaboration of my team and my broader European network, my work led to a total of 9 peer-reviewed scientific publications in high-impact scientific journals, frequent contributions to international and intercontinental scientific conferences, a number of articles and book chapters in preparation, the consolidation of a tight European network involving top-notch research centers in neuroscience and psychology, and a clearly outlined research program for years to come.

In October 2023, I embarked on my postdoc project in collaboration with IPEM at Ghent University (BE) and the Center for Music in the Brain at Århus University (DK), extending my research from dyadic to group interactions and advancing neuroimaging analysis methods in the domain of rhythm perception and production. In the daily practice, I am keeping up my never-ending study of neural signal processing, developing and publishing novel analysis techniques. The know-how acquired so far allows me to implement experiments in autonomy within and beyond the facilities offered by IPEM (ASIL Art Science and Interaction Lab), including portable solutions to export the experimental settings among the facilities offered by our international partners.

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## EXPERTISE

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- Degrees:
  - PhD in Psychology (Lille University) - *September 2023*
  - PhD in Art Sciences (Ghent University) - *September 2023*
  - Master's degree in "Body and Mind Sciences" (University of Turin): 110/110 summa cum laude - *July 2018*
  - Bachelor in "Psychological science and techniques" (University of Turin): 110/110 - *September 2015*
  
- Computing skills:
  - Matlab (advanced)
  - Arduino (intermediate)
  - RStudio (beginner-to-intermediate)
  - Python (beginner-to-intermediate)
  
- Research:
  - Electroencephalography (EEG) (advanced): implementation and synchronization for multimodal recordings, processing, multivariate analysis methods (GED, PCA, ICA), cross-frequency coupling (FM, AM), brain-behavior coupling, hyperscanning methods (intra- and inter-brain)
  - Magnetoencephalography (MEG) (beginner): setup, data acquisition, preprocessing, source reconstruction, co-registration with MRI
  - Signal processing (intermediate-advanced): filter design, source separation, dimensionality reduction
  - Complexity methods (intermediate-advanced): embedding, joint/cross-recurrence quantification analysis
  - Movement data processing and analysis (finger-tapping, gait, motion capture)
  - Synchronization analysis methods
  - Dyadic interaction
  - Experimental design
  
- Languages:
  - Italian (native speaker)
  - English (C1-C2)
  - Spanish (C2)
  - Dutch (B2)
  - French (B1)

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## RESEARCH STAYS ABROAD

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**Center for Music in the Brain**  
Aarhus University (DK)  
Prof. Dr. Peter Vuust, Prof. Dr. Peter Keller

2-16 Dec 2023

**Laboratoire PSITEC (Psychologie : Interactions, Temps, Emotions, Cognition)**  
Université de Lille (FR)  
Prof. Séverine Samson

1 Dec 2022 – 1 May 2023

**Institut national de la santé et de la recherche médicale (INSERM)**  
Aix Marseille Université (FR)  
Prof. Dr. Morillon Benjamin

14 – 20 Feb 2022

**Center for Music in the Brain**  
Aarhus University (DK)  
Prof. Dr. Peter Vuust, Dr. Ole Adrian Heggli

1 Sep – 1 Nov 2021

**Center for Music in the Brain**  
Aarhus University (DK)  
Prof. Dr. Peter Vuust, Dr. Ole Adrian Heggli

29 Oct – 29 Nov 2019

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## AWARDED GRANTS

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- *Fonds Wetenschappelijk Onderzoek (FWO) international mobility grant*  
Personal grant for a 2-months research stay at Aarhus University (DK)  
1<sup>st</sup> April - 1<sup>st</sup> June 2024
- *'Meet the Jury' grant (Ghent University)*  
for organization of Synposium 2023
- *Fonds Wetenschappelijk Onderzoek (FWO) international mobility grant*  
for oral presentation at ICMPC-17 (August, 2023 – Tokyo, JP)
- *ICMPC&SEMPRE travel award*  
for oral presentation at ICMPC-17 (August, 2023 – Tokyo, JP)
- *Fonds Wetenschappelijk Onderzoek (FWO) international mobility grant*  
Personal grant for a 2-months research stay at Aarhus University (DK)  
1<sup>st</sup> September - 1<sup>st</sup> November 2021
- *Bijzonder Onderzoeksfonds (BOF)*  
Personal PhD mandate (4 years)  
'Human rhythmic interactions. Coordination dynamics and informational coupling.'  
October 2019 – October 2023

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## SCIENTIFIC OUTPUT

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### **International A1 peer-reviewed publications**

*Total of 9 articles; 5 as first author; 4 as second author, H-index 4.*

Vanbilsen, N., Kotz, S. A., **Rosso, M.**, Leman, M., Triccas, L. T., Feys, P., & Moumdjian, L. (2023). Auditory attention measured by EEG in neurological populations: systematic review of literature and meta-analysis. *Scientific Reports*, 13(1), 21064.  
[Impact Factor 4.997. Q1 Multidisciplinary (11/120)].

**Rosso, M.**, van Kerrebroeck, B., Maes, P. J., & Leman, M. (2023). Embodied perspective-taking enhances interpersonal synchronization: A body-swap study. *iScience*, 26(11).  
[Impact Factor 6.1. Q1 Multidisciplinary].

**Rosso, M.**, Moens, B., Leman, M., & Moumdjian, L. (2023). Neural entrainment underpins sensorimotor synchronization to dynamic rhythmic stimuli. *NeuroImage*, 120226  
[Impact Factor 7.4. Q1 Neuroimaging (2/14), Q1 Cognitive Neuroscience (5/96)].

**Rosso, M.**, Heggli, O. A., Maes, P. J., Vuust, P., & Leman, M. (2022). Mutual beta power modulation in dyadic entrainment. *NeuroImage*, 257, 119326.  
[Impact Factor 7.4. Q1 Neuroimaging (2/14), Q1 Cognitive Neuroscience (5/96)].

**Rosso, M.**, Maes, P. J., & Leman, M. (2021). Modality-specific attractor dynamics in dyadic entrainment. *Scientific Reports*, 11(1), 1-13.  
[Impact Factor 4.997. Q1 Multidisciplinary (11/120)].

**Rosso, M.**, Leman, M., & Moumdjian, L. (2021). Neural entrainment meets behavior: the stability index as a neural outcome measure of auditory-motor coupling. *Frontiers in Human Neuroscience*, 15.  
[Impact Factor 3.473. Q2 Behavioral neuroscience (29/79)].

Vidal, M., **Rosso, M.**, & Aguilera, A. M. (2021). Bi-Smoothed Functional Independent Component Analysis for EEG Artifact Removal. *Mathematics*, 9(11), 1243.  
[Impact Factor 2.884. Q1 Mathematics (75/378)].

Dell'Anna, A., **Rosso, M.**, Bruno, V., Garbarini, F., Leman, M., & Berti, A. (2021). Does musical interaction in a jazz duet modulate peripersonal space?. *Psychological Research*, 85(5), 2107-2118.  
[Impact Factor 2.956. Q1 Arts and Humanities (43/306), Q2 Experimental and Cognitive Psychology (44/148)].

Van Kerrebroeck, B., **Rosso, M.**, & Maes, P. J. (2020). Linking embodied coordination dynamics and subjective experiences in musical interactions: a renewed methodological paradigm. *DOCUMENTA*, 38(1), 38-60.

### **A1 peer-reviewed papers under consideration**

*Total of 1 article; 1 as first author*

**Rosso, M.**, Gener, C., Moens, B., Maes, P. J., & Leman, M. (*under rev.*). Perceptual coupling in human dyads: kinematics does not affect interpersonal synchronization. *iScience*.  
[Impact Factor 6.1. Q1 Multidisciplinary].

### **A2 peer-reviewed publications**

*Total of 1 article; 1 as co-author.*

Moumdjian, L., **Rosso, M.**, Moens, B., De Weerd, N., Leman, M., & Feys, P. (2022). A case-study of a person with multiple sclerosis and cerebellar ataxia synchronizing finger-taps and foot-steps to music and metronomes. *Neuroimmunology Reports*, 2, 100101.

### **Scientific conferences (as organizer)**

*SYNCPOSIUM 2023. Current perspectives on the modelling of rhythmic interactions.*

Invited keynote speakers: Prof. *Peter Keller* (Aarhus University, DK), Prof. *Peter Vuust* (Aarhus University, DK), Prof. *Marc Leman* (Ghent University, BE), Prof. *Pieter-Jan Maes* (Ghent University, BE), Prof. *Sylvie Nozaradan* (BE), Prof. *Benjamin Morillon* (FR), Prof. *Sonja Kotz* (Maastricht University, NL), Prof. *Séverine Samson* (Lille, FR), and Dr. *Lise Hobeika* (Lille, FR).

Amount of registrations: 129 (hybrid format).

### **Scientific conferences (as presented)**

*Timing Research Forum, October 4<sup>th</sup> – 6<sup>th</sup> 2023 – Lisbon (PT)*

Rajendran, V., Sierra, F., Criscuolo, A., **Rosso, M.** “Rhythmic synchronization in and out of the brain, from single interval estimations to interpersonal interaction. A cross-species and translational perspective.”  
(Symposium)

*ICMPC17 – APSCOM7, Augustus 24<sup>th</sup>-28<sup>th</sup> 2023 – Tokyo (JP)*

**Rosso, M.**, Maes, P., Leman, M. “Dyadic rhythmic interactions. Coordination dynamics and informational coupling”.  
(Oral presentation)

*Sysmus, September 7-9<sup>th</sup> 2022 – Ghent (BE)*

**Rosso, M.**, Leman, M., Moudjian, L. “Event-related frequency adjustment. A methodology for investigating neural entrainment”.  
(Oral presentation)

*Rhythm production and perception workshop, June 22-25<sup>th</sup> 2021 – Oslo (NO)*

**Rosso, M.**, Leman, M., Moudjian, L. “Neural entrainment meets behaviour: the Stability Index as a neural outcome measure of auditory-motor coupling”.  
(Oral presentation)

*Neuromusic VII, June 18-21<sup>th</sup> 2021 – Aarhus (DK)*

**Rosso M.**, Heggli O.A., Maes P.J., Vuust P., Leman M. “Drifting metronomes. Cooperation and competition in dyadic entrainment”.  
(Poster presentation)

*ANT Neuromeeeting, January 15-18<sup>th</sup> 2020 – Beaune (FR)*

**Rosso M.** “Interactive settings for interactive brains”.  
(Poster presentation)

### **Seminars and invited talks**

“Social cognition in coupled systems: in-group and out-group dynamics in interpersonal synchronization” – *Center for Music in the Brain, Aarhus University (DK) - December 11<sup>th</sup> 2023*

“Event-related frequency adjustment (ERFA): a methodology for investigating neural entrainment” - *Timing Research Forum (virtual journal club) November 29<sup>th</sup> 2023 (online)*

“Dyadic rhythmic interactions. Coordination dynamics and informational structures.” *In ‘Rhythm, synchronization, social interactions’ seminar - PSITEC lab, University of Lille (FR) – April 3<sup>rd</sup> 2023*

“Human rhythmic interactions and their dynamics” – *BAND Lab, University of Maastricht (NL) - November 7<sup>th</sup> 2022*

“Human rhythmic interactions and their dynamics” - *Department of Psychology, University of Turin (IT) - October 14<sup>th</sup> 2022*

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## TEACHING experience

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- Lectures
  - ‘Music psychology’ at Ghent University (Prof. Marc Leman): ay 2019/20 – 2020/21 – 2021/22
- Internships: training and supervision
  - Master’s student Jan de Tremerie (Jan 2021 – Apr 2021 )
  - Master’s student and lab assistant Canan Nuran Gener (Apr 2020 – Apr 2021) – University of Padova (IT), Department of Psychology
- Master’s thesis supervisions
  - ‘Human musicality and the roots of empathy: neural basis, evolution and integration.’  
Canan Nuran Gener  
University of Padova (IT) - Gent University (BE)  
Defended in April 2022
- Workshops
  - “Interactive settings for interacting brains. Dual-EEG approaches in music research”.  
Sysmus, September 7-9th 2022 – Ghent (BE)

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## SPECIALIZED EDUCATION

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- Doctoral Training Program – Ghent (BE)  
Ghent University Doctoral Schools - aa.yy. 2019-2023
- “Linear algebra for neuroscientists”  
Radboud summer school – Nijmegen (NL), 14-19/08/2022  
Lecturer: Mike x Cohen
- FLAMES Summer School 2020
  - Module 06: Generalized linear models
  - Module 12: Time series analysis
- “Getting started with High-Performance Computing 2018-2019” (part 2)  
Ghent University Doctoral Schools - 3-5/06/2019  
Transferrable skills training (Research and Valorization cluster)
- “Sound & Listening on the edge of Music, Performance, Film and New Media”

- UDEMY:
  - “A deep understanding of deep learning”
  - “PCA & multivariate signal processing, applied to neural data”
  - “Complete linear algebra: theory and implementation in code”
  - “Master the Fourier transform and its applications”
  - “Master statistics & machine learning: intuition, math, code”
  - “Signal processing problems, solved in MATLAB and in Python”
  - “MATLAB onramp 2021: coding, concepts, confidence, and style”
  - “Master MATLAB through Guided Problem Solving”
  - “Master Python programming by solving scientific projects”
  - “Complete neural signal processing and analysis: Zero to hero”
  
- IPEM Think Tanks  
Weekly lab meetings: 2018-2023
  
- Attended conferences and seminars
  - “Neuro-sense & sense-ability. Sensing and data processing technology for the brain” - KU Leuven (BE) – 1-2/4/2019
  - UBL CONNEX: “The neuroscience of musical entrainment: insights from EEG frequency-tagging” – Sylvie Nozaradan. Université Libre de Bruxelles (BE), 12/12/2018

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### PUBLIC appearances

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- ‘Universiteit van Vlanderen’ – featured in “Can music help with physical rehabilitation?” by L. Moundjian.
  
- ‘Rode Neuzen’ - VTM (Vlaamse televisie maatschappij) on 4/12/202