Alessandra **Brondetta**

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SUMMARY

Ph.D. candidate and Research Associate at the Institute of Cognitive Science at Osnabrück University, where I work on computational models of cognition and social dynamics. My main focus is on exploring cognitive flexibility, task-switching, and belief dynamics using dynamical systems and large language models, combining insights from cognitive science, artificial intelligence, and complex systems physics. Before that, I completed my M.Sc. in Physics of Complex Systems and B.Sc. in Physics at Università di Torino. Along the way, I've interned at Brown University and the CENTAI Institute in Torino.

SKILLS

Programming Languages: Python, C++, Wolframe.
Software: Numpy, PyTorch, TensorFlow, SciPy, Scikit-Learn, NetworkX, ROOT, LaTeX, Mathematica, Microsoft Office.
Relevant Graduate Coursework: Dynamical Systems, Chaos Theory, Stochastic Processes, Data Mining, Neural Networks, Biology, Complex Systems in Neuroscience, Complexity in Social Systems.

PROJECTS

2024 **Mentevo Python Lybrary**
Python library for simulating and analyzing task-switching behavior and cognitive control in multi-agent dynamical systems. It was developed as part of my Master thesis and Ph.D. research and is designed to support both theoretical exploration and experimental customization.

2023–2024 **Flexibility-Stability Trade-Off in Groups of Cognitive Agents - Master's Thesis**
Investigated the impact of individual cognitive heterogeneity in the balance between flexibility and stability on task switching group performance through extension of dynamical models and numerical simulations. This work led to a publication in *COGSCI 2024*.

2021 **Data Mining Project**
Developed a supervised machine learning algorithm to discriminate Reddit users based on gender, achieving second place in a class of 50 on the final leaderboard on Kaggle.

2020 **Mathematical Modeling of Branching Processes - Bachelor's Thesis**
Exact analytical solution of a two-type branching process, recalculating in details all the mathematical steps of a previously published model of a real biological stochastic process: cell division in the skin's epidermal layer of mice.

EDUCATION

2020–2024 **MSc in Physics of Complex Systems** **Università di Torino, Torino, Italy**
Completed a Master's degree, concentrating on the theoretical and computational aspects of complex systems. Advanced skills in analyzing and modeling complex phenomena across various fields.
Coursework: Data Mining (Machine Learning, Python), Deep Learning, Numerical Algorithms for Physics (C++), Dynamical Systems, Stochastic Processes, Statistical Mechanics, Complex Systems in Neuroscience, Molecular Biology, Complex Systems in Biology, Complexity in Social Systems, Quantum Computing and Nonlinear Waves and Turbulence.
Final Grade: 110/110 cum laude.

2016–2020 **Bachelor in Physics** **Università di Torino, Torino, Italy**
Completed a Bachelor's degree in Physics; expertise in mathematical analysis, classical and modern physics, scientific laboratory and problem solving skills.
Coursework: Mathematical Analysis 1-2-3, Geometry and Linear Algebra 1-2, Classical Mechanics (with Lab), Thermodynamics (with Lab), Electromagnetism (with Lab), Chemistry, Climate Physics, Astrophysics Elements, Physics of Living Matter, Introduction to Nuclear Physics (with Lab), Structure of Matter (with Lab), Introduction to Probability, Introduction to Programming in C++, Quantum Mechanics, Mathematical Methods for Physics, Rational Mechanics.
Final Grade: 103/110.

2011–2016 **Secondary – School Diploma at Scientific High School** **Liceo Scientifico O.Grassi, Savona, Italy**
Solid first education in mathematics, physics, chemistry and biology, as well as in the humanities subjects. Acquisition of basic skills useful to continue with an academic pathway.
Final Grade: 100/100.

EXPERIENCE

2025–Present **Student Supervision** **Institute of Cognitive Science, Osnabrück University, Germany**
Supervising students through lab rotations and thesis's research project within the Cognitive Science curriculum.

09/2024–Present **Research Associate** **Institute of Cognitive Science, Osnabrück University, Germany**
Conducting scientific research at the intersection of cognitive science and collective behavior, focusing on dynamical systems modeling, in the research group of Junior Professor Sebastian Musslick.

04/2023–07/2023 **Research Intern** **Carney Institute, Brown University, Providence, RI, USA**
Exploration and study of dynamical models addressing the cognitive stability-flexibility trade-off both at individual and group level. Research under the guidance of Assistant Professor Sebastian Musslick.

2023–2024 **Research Intern** **CENTAI Institute, Torino, Italy**
Conducted Master's thesis research on computational models of neural systems, focusing on network dynamics and cognitive processing, under the supervision of Prof. Giovanni Petri.

PUBLICATIONS

2024 **On the Benefits of Heterogeneity in Cognitive Stability and Flexibility for Collaborative Task Switching**
Proceedings of the Annual Meeting of the Cognitive Science Society, Vol. 46
Brondetta, A., Bizyaeva, A., Lucas, M., Petri, G., Musslick, S. *COGSCI 2024*.

PRESENTATIONS

10/2024 **Research Presentation for NTU Singapore** **Online Presentation**
Presented my Master's thesis research at the Dynamical Systems group meeting led by Professor Victoria Leong at NTU Singapore.

07/2024 **Poster Presentation at COGSCI 2024** **Rotterdam, The Netherlands**
Presented a poster based on my conference paper at the annual Cognitive Science Society meeting.

07/2023 **Research Presentation at Princeton University** **Princeton University, Princeton, NJ, USA**
Delivered a talk on my Master's thesis research to Professor Jonathan D. Cohen's research group.

LANGUAGES

Italian - Native, **English** - Fluent, **French** - Novice, **German** - Beginner

2015 **Certification**
Cambridge English Level 1 Certificate in ESOL International (First)
First Certificate in English (Level B2).