

PERSONAL INFORMATION

Giovanni Granato



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Sex M | Date of birth 02/10/1992 | Nationality Italian

PROFILE

I'm a **researcher in "Computational Neuropsychology/Psychiatry"** at the Italian **National Research Council (CNR), Institute of Cognitive Science and Technologies (ISTC)**. My training includes **Cognitive Sciences, Neuroscience, Machine Learning, Computational Modeling, Cognitive Robotics**. My research focuses on the **neurocognitive processes underlying human goal-directed flexible cognition** (e.g. Executive Functions). In particular I proposed the concept of **"goal-directed manipulation of internal representations at the basis of flexible cognition"** supported by the "Three-components theory of flexible cognition" (Granato et al., 2022; Granato and Baldassarre, 2021; Granato et al., 2020). In short, I investigate **how artificial and biological agents manipulate their representations to flexibly achieve their goals**. Overall, I adopt the integrated top-down / bottom-up method of **Computational Neuroscience/Neuropsychology/Psychiatry**, thus developing simulated neuro-inspired agents and comparing their cognition and behavior with that of humans. My research is extended to the investigation of goal-directed representations manipulation at the basis of **Consciousness and Metacognition**. At last, my research studies show **applications in AI-based healthcare systems** (e.g. model-based clinical tools), **Machine Learning** (Neuro-inspired ML, Generative Models, etc), **Robotics** (e.g., Machine Consciousness).

WORK EXPERIENCE

**June 2023 - Present** **Researcher Ivl. III (fixed-term)** at "Institute of Sciences and Technologies of Cognition" (ISTC), "Laboratory of Embodied Natural and Artificial Intelligence" (LENAI) at "National Research Council" (CNR).

**Research focus:** "Computational models of brain and behavior, with particular reference to higher cognition, executive functions, metacognition, and consciousness. Study and validation of computational models with data collected in experiments with normo-typical or pathological human participants. Implementation of machine learning pipelines for data analysis with particular reference to EBRAINS research infrastructure. Contribution to the training and innovation activities of the "EBRAINS-Italy Training and Innovation Centre (ETIC)" based in Rome.

**October 2022 - May 2023** **Post-doc research Fellowship** at "Institute of Sciences and Technologies of Cognition" (ISTC), "Laboratory Of Computational Embodied Neuroscience" (LOCEN) at "National Research Council" (CNR).

**Research focus:** "Computational models of the brain system supporting flexible goal-directed behaviour"

- September 2022 - Present**    **Research consultancy** for the project “Terza missione” at the Social and Cognitive Neuroscience laboratory (ISCNL), Dept. of Psychology, “Sapienza, University of Rome”
- Topic:** “Participatory research in Autism”
- November 2022**    **Consultancy/teaching** in Educational Robotic for “Italiacamp srl”
- Topic:** “Impact and elements of Autonomous Robotics” (target: *Middle adults*)
- October 2022**    **Consultancy/teaching** in Educational Robotic for “Italiacamp srl”
- Topic:** basic elements of Robotics (target: *Middle school teenagers*)
- June 2022 - July 2022**    **Consultancy and collaboration** as “STEAM Training Specialist in Educational Robotics” at “Italiacamp srl”
- June 2019 - September 2022**    **Research Fellowship** at “Institute of Sciences and Technologies of Cognition”, laboratory of “Computational Embodied Neuroscience” at “National Research Center”.
- Research focus:** “Computational models of the brain system supporting flexible goal-directed behaviour”
- January 2019 - May 2019**    **Research collaboration** at “Institute of Sciences and Technologies of Cognition”, laboratory of “Computational Embodied Neuroscience” at “National Research Center”.
- Research focus:** “Computational models of goal-directed behaviour and cognitive flexibility”
- October 2016 - December 2017**    **Research consultancy** at the social and cognitive neuroscience laboratory (SCNL), Dept. of Psychology, “Sapienza, University of Rome”
- Topic:** “Virtual reality and Autism”
- April 2016 - July 2018**    **Experimental thesis** at “Institute of Sciences and Technologies of Cognition”, laboratory of “Computational Embodied Neuroscience” at “National Research Center”
- Title:** “Consciousness and Goal-directed Behavior: from theoretical neuroscience to computational models”

## PROJECTS

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- June 2023 - Present**    **EBRAINS-Italy (European Brain ReseArch INfrastructureS-Italy)**
- Activities:** management and training activities, and scientific production (“Computational models of brain and behavior, with particular reference to higher cognition, executive functions, metacognition, and consciousness”)
- September 2022 - Present**    **Project “Terza Missione: Ascoltare la comunità autistica per migliorare la conoscenza dell’autismo, l’accessibilità degli studenti autistici all’università e la ricerca scientifica sull’autismo” (La Sapienza, University of Rome)**

**Activities:** autistic research consultancy and participation in the workgroup “participatory research in Autism”

**April 2019 - April 2021**    **GOAL Robots (Goal-based Open-ended Autonomous Learning Robots)**

**Activities:** scientific production (“Neuro-inspired computational models of goal-directed behavior with potential applications in Robotics/Cognitive Robotics”)

## PARTICIPATION IN SCIENTIFIC COMMITTEES AND OTHER POSITIONS

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**March 2024 - Present**    **Member of the “EBRAINS-Italy Training and Innovation Committee (ETIC)”**

**Roles:** Definition of the ETIC training offer, management of the training and technological transfer activities

**November 2023 - Present**    **Member of the “Italiacamp association”**

**Roles:** Teaching and dissemination in the AI/Robotics fields

## EDUCATION AND TRAINING

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**April 2019 - October 2022**    **PhD in “Computer science” (“Computational Neuropsychology”) at “School of Computer Science, Electronics and Mathematics”, University of Plymouth, United Kingdom**

**Project title:** “Flexible goal-directed manipulation of representations: computational models of healthy and pathological human cognition”

**Topics:** Machine learning, Deep learning, Generative models, Artificial neural networks, Clinical Neuropsychology, Computational Neuroscience/Neuropsychology, Neuro-robotics

**October 2018 - April 2019**    **Advanced School in Artificial Intelligence at “CNR-ISTC”**

**Project title:** “Flexible goal-directed behavior and internal attention: building blocks for consciousness ”

**Topics:** Machine learning, Artificial neural networks, Agent-based models, Computational Neuroscience/Neuropsychology

**October 2015 - July 2018**    **Master's degree in “Cognitive Neuroscience and Psychological Rehabilitation” at University of Rome “La Sapienza”, Dept. of Medicine and Psychology, Faculty of Psychology**

**Thesis title:** “Consciousness and Goal-directed Behavior: from theoretical neuroscience to computational models”

**Topics:** Cognitive Neuroscience, Neuropsychology, Systemic Neuroscience, Neurobiology, Computational Neuroscience/Neuropsychology

**October 2012 - July 2015**    **Bachelor's Degree in “Psychological Sciences and Techniques” (curriculum: “Cognitive Processes”) at “University of Florence”, Faculty of Psychology**

**Thesis title:** “Emergence of a consciousness from a hyper-connected neuronal system: neurobiological models and hypotheses ”

**Topics:** General psychology, Psychobiology, Developmental psychology, Work psychology, Psychodynamics, Psychometrics, Physiological psychology, Research methodology, Developmental psychobiology, Cognitive neuropsychology

## RESEARCH CONTRIBUTIONS

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### Publications

- **Granato, G.**, Costanzo, R., Borghi A. M., Carruthers, S., Mattera, A., Rossell, S., & Baldassarre, G. (2024). **Flexible Goal-directed Cognition and Inner-speech in Schizophrenia Spectrum Disorders: from Clinical Data to Computational Modeling, and Backward**. “Under review” in *Comprehensive Psychiatry*. Pre-print: <https://www.researchsquare.com/article/rs-3611379/v1>
- Cavallo A., Mattera A., **Granato G.**, Baldassarre G. (2023). **Emergence of neuronal ensembles in a chaotic corticostriatal circuit**. In 2023 Conference on Cognitive Computational Neuroscience.
- **Granato, G.** & Baldassarre, G. (2023). **A Neurocomputational Account of Flexible Goal-directed Cognition and Consciousness: The Goal-Aligning Representation Internal Manipulation theory (GARIM)**. “Under Review” in *Neural Networks*. Pre-print: <https://arxiv.org/pdf/1912.13490.pdf>
- **Granato, G.** (2022). **Flexible goal-directed manipulation of representations: computational models of healthy and pathological human cognition** (Doctoral dissertation, University of Plymouth).
- **Granato, G.**, Borghi, A. M., Mattera, A., & Baldassarre, G. (2022). **A computational model of inner speech supporting flexible goal-directed behaviour in Autism**. *Scientific reports*, 12(1), 1-15.
- **Granato G.**, Cartoni E, Da Rold F, Mattera A, Baldassarre G (2022) **Integrating unsupervised and reinforcement learning in human categorical perception: A computational model**. *PLoS ONE* 17(5): e0267838.
- Mattera, A., Cavallo, A., **Granato, G.**, Baldassarre, G., & Pagani, M. (2022). **A Biologically Inspired Neural Network Model to Gain Insight Into the Mechanisms of Post-Traumatic Stress Disorder and Eye Movement Desensitization and Reprocessing Therapy**. *Frontiers in Psychology*, 3681.
- **Granato G.**, Baldassarre G. (2022). **Manipulation of internal representations underlying flexible human goal-directed behaviour: supporting Computational Psychiatry and towards Machine Consciousness**. Poster session presented at “The symposium: from cortical microcircuits to consciousness (CORTICON)”
- **Granato, G.**, & Baldassarre, G. (2021). **Internal manipulation of perceptual representations in human flexible cognition: A computational model**. *Neural Networks*, 143, 572-594.
- **Granato, G.**, Borghi, A. M., & Baldassarre, G. (2020). **A computational model of language functions in flexible goal-directed behaviour**. *Scientific reports*, 10(1), 1-13.
- Baldassarre, G., & **Granato, G.** (2020). **Goal-Directed Manipulation of Internal Representations Is the Core of General-Domain Intelligence**. *Journal of Artificial*



General Intelligence, 11(2), 19-23.

- **Granato, G., & Baldassarre, G. (2019). Goal-directed top-down control of perceptual representations: A computational model of the Wisconsin Card Sorting Test.** In 2019 Conference on Cognitive Computational Neuroscience (pp. 2019-1168).
- Baldassarre, G., Lord, W., **Granato, G., & Santucci, V. G. (2019). An embodied agent learning affordances with intrinsic motivations and solving extrinsic tasks with attention and one-step planning.** *Frontiers in neurobotics*, 13, 45.
- **Granato G., Baldassarre G. (2018). Goal-directed imagination and cognitive flexibility: A computational model of the Wisconsin Sorting Card Test.** Poster session presented at "The Eighth International Symposium on Biology of Decision Making (SBDM)"

### Seminars and Speeches

- (08/03/2024; Rome, Italy) **"Project Terza Missione: Ascoltare la comunità autistica per..."**, workshop on **"Autismo e Ricerca Partecipativa - Online Workshop"**.

**Speaker presentation:** "The italian autism participatory research working group"

- (26/09/2023; Palermo, Italy) **Research Infrastructure EBRAINS-Italy**, workshop on **"The EBRAINS-Italy Research Infrastructure for Neuroscience challenges"**.

**Speaker presentation:** "Modeling Flexible goal-directed cognition: an automated research toolbox."

- (18/07/2023; Rome, Italy) **"Poste Italiane"**, seminar on **"Transizioni di vita, disabilità e vulnerabilità nell'organizzazione come comunità"**.

**Invited speaker presentation:** "Autism/Asperger in organizations: from disability to life changes"

- (28/06/2019; Rome, Italy) **"Fondazione Mondo Digitale"**, seminar on **"Vagone FMD. da 01 a 100: aperitivo con l'innovazione"**.

**Speaker presentation:** "Flexible goal-directed behaviour and internal attention"

### Reviewing activity

- **International journals:**
  - **"Neural Networks"** (topic: neuro-inspired Machine Learning)
  - **"Scientific Reports"** (topic: Neuro-robotics, Neuroscience)
  - **"Frontiers in Artificial Intelligence"** (topic: linguistic, computational modeling)
  - **"Frontiers in Psychiatry"** (topic: executive functioning, computational modeling)

- **International conferences:**
  - **“Cognitive Computational Neuroscience conference 2023”**  
(topics: Various)
  - **“Cognitive Computational Neuroscience conference 2019”**  
(topics: Various)
- **Project fundings:**
  - **“La Sapienza, university of Rome”**

## Collaborations

- **Centre for Mental Health at Swinburne University of Technology**  
(PI: Susan Rossell)  
Country: Australia  
Referent: Sean Carruthers  
  
**Topic:** “Computational models of flexible cognition in Schizophrenia”
- **Consciousness, Cognition, and Computation Group** (CO3, PI: Axel Cleeremans)  
Country: Belgium  
Referent: Axel Cleeremans  
  
**Topic:** “Metacognition and flexible goal-directed behavior”
- **ItaliaCamp, srl**  
Country: Italy  
Referent: Riccardo Santilli  
  
**Topic:** “Educational Robotics”
- **Social and Cognitive Neuroscience Laboratory** (SCNL, PI: Salvatore Aglioti)  
Country: Italy  
Referent: Iliaria Minio Paluello  
  
**Topic:** “Participatory research in Autism”
- **Body Action Language Lab** (BALLAB, PI: Anna Borghi)  
Country: Italy  
Referent: Anna Borghi  
  
**Topic:** “Inner speech and Flexible goal-directed Behaviour in healthy, pathological and divergent conditions”.
- **Social and Cognitive Neuroscience Laboratory** (SCNL, PI: Salvatore Aglioti)  
Country: Italy  
Referent: Iliaria Minio Paluello  
  
**Topic:** “Participatory research in Autism”, “Virtual reality and Autism”

**Supervisions**

- Costanzo R. (2022/2023). **MA thesis** at "University of Rome La Sapienza, Department of Medicine and Psychology".  
  
**Topics:** "Models of Executive Functions and Inner-Speech in Computational Psychiatry".
- Tortora L., De Bei F., Biris I. (2020). **Project at "Advance School of Artificial Intelligence" (ASAI)**.  
  
**Topics:** "ML applications in Computational Psychiatry (DNN supporting clinical diagnosis of Autism)".
- Fabrizio Carlo (2020). **Project at "Advance School of Artificial Intelligence" (ASAI)**.  
  
**Topics:** "Models human working memory with ML methods (LSTM)".
- Buttinelli Alessandro (2019). **Project at "Advance School of Artificial Intelligence" (ASAI)**.  
  
**Topics:** "Models of Inner-Speech in human flexible cognition"
- Muratore Paolo (2019). **Project at "Advance School of Artificial Intelligence" (ASAI)**.  
  
**Topics:** "Development of Neuro-inspired algorithms in Machine Learning"

**PERSONAL SKILLS**

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**Mother tongue** Italian

**Other languages**

	COMPARED		PARLATO		WRITTEN PRODUCTION
	Listening	Reading	Interaction	Production	
English	B 2	C 1	B 2	B 2	C 1
Levels: A1 / A2: Basic user - B1 / B2: Intermediate user - C1 / C2: Advanced user <a href="#">Common European Framework Reference of Languages</a>					

**Computer skills**

- General:
  - European Computer Driving License ECDL "Advanced" level
  - PC Assembly
- Operating systems used:
  - Windows
  - Linux
- Programming languages used:
  - Python
  - Scratch for Educational Robotics

- MatLab
- C ++
- R
- Latex
- PHP
- SQL
- VBA

**Personal interests**

- Consciousness
- Individual behavior of living beings
- Humans interactions
- Neuropsychology/Psychiatry
- Technology:
  - Applied Sciences
  - Robotics
  - Domotics
- Videogames (Real Time Strategy, RTS)
- PC Assembling

**Personal data**

I authorize the processing of my personal data pursuant to the Legislative Decree June 30, 2003, n. 196 "Code regarding the protection of personal data".