

# Nuno FERREIRA DUARTE

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## CONTACT INFORMATION

- ✉ nferreiraduarte@isr.tecnico.ulisboa.pt
- ✉ nuno.ferreiraduarte@epfl.ch
- 🏠 Personal Website
- 🎓 Google Scholar profile
- 🔄 GitHub account

## RESEARCH INTERESTS

**Integrating in robots human action/intention capabilities:** Human-Robot Interaction, Bio-inspired systems, Motion Planning, Learning; My work focuses on human action understanding from neurological, psychological, and physiological behaviour. The importance non-verbal communication behaviour has on decoding human action intention. Using non-verbal cues as a communication language between humans and robots with the goal of having robots that understand actions and are understood by humans.

## EDUCATION

**Instituto Superior Técnico (IST)**, Portugal  
**École Polytechnique Fédérale de Lausanne (EPFL)**, Switzerland

IST-EPFL Joint-Doctoral Program Ph.D., Electrical and Computer Engineering, April 2023

- Thesis Topic: *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties*
- *Summa cum laude*, Pass with Distinction and Honour
- Advisers: Professor José Santos-Victor, Professor Aude Billard

**Instituto Superior Técnico (IST)**, Portugal

M.S., Electrical and Computer Engineering, August 2016

- *Cum laude*, 16/20
- Thesis Topic: *Multi-UAV Mission Coordination using Signal Temporal Logic Specifications*
- Adviser: Professor Pedro U. Lima
- Area of Study: Systems, Decision and Control

B.S., Electrical and Computer Engineering, August 2014

- Systems, Decision and Control specialization (emphasis on control, modelling and simulation)
- Minor in Computers (programming and algorithms)

## REFEREED JOURNAL PUBLICATIONS

- [1] Nuno F. Duarte, Aude Billard, and José Santos-Victor. The role of object physical properties in human handover actions: Applications in robotics. *IEEE Transactions on Cognitive and Developmental Systems*, pages 1–1, 2022a
- [2] Mirko Raković, Nuno Ferreira Duarte, Jorge Marques, Aude Billard, and José Santos-Victor. The gaze dialogue model: Nonverbal communication in hhi and hri. *IEEE Transactions on Cybernetics*, pages 1–0, 2022
- [3] R. Sanchez-Matilla, K. Chatzilygeroudis, A. Modas, Nuno Ferreira Duarte, A. Xompero, P. Frossard, A. Billard, and A. Cavallaro. Benchmark for human-to-robot handovers of unseen containers with unknown filling. *IEEE Robotics and Automation Letters*, 5(2):1642–1649, 2020
- [4] Nuno Ferreira Duarte, Mirko Raković, Jovica Tasevski, Moreno Ignazio Coco, Aude Billard, and José Santos-Victor. Action Anticipation: Reading the Intentions of Humans and Robots. *IEEE Robotics and Automation Letters*, 3(4):4132–4139, October 2018

- [5] Seyed S Mohammadi, Nuno F Duarte, Dimitris Dimou, Yiming Wang, Matteo Taiana, Pietro Morerio, Atabak Dehban, Plinio Moreno, Alexandre Bernardino, Alessio Del Bue, et al. 3dsgrasp: 3d shape-completion for robotic grasp. In *2023 International Conference on Robotics and Automation (ICRA)*, 2023
- [6] Linda Lastrico, Nuno Ferreira Duarte, Alessandro Carfí, Francesco Rea, Fulvio Mastrogiovanni, Alessandra Sciutti, and José Santos-Victor. If you are careful, so am i! how robot communicative motions can influence human approach in a joint task. In *Social Robotics: 14th International Conference, ICSR 2022, Florence, Italy, December 13–16, 2022, Proceedings, Part I*, pages 267–279. Springer, 2023
- [7] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Robot learning physical object properties from human visual cues: A novel approach to infer the fullness level in containers. In *2022 International Conference on Robotics and Automation (ICRA)*, pages 10375–10381, 2022b
- [8] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Learning motor resonance in human-human and human-robot interaction with coupled dynamical systems. In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, pages 3662–3668. IEEE, 2021
- [9] Nuno Ferreira Duarte, Konstantinos Chatzilygeroudis, José Santos-Victor, and Aude Billard. From human action understanding to robot action execution: how the physical properties of handled objects modulate non-verbal cues. In *2020 Joint IEEE 10th International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob)*, pages 1–6, Valparaiso, Chile, October 2020. IEEE
- [10] Nuno Ferreira Duarte, Mirko Raković, Jorge Marques, and José Santos-Victor. Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction. In *Computer Vision ECCV 2018 Workshops*, volume 11131, pages 197–212. Springer International Publishing, 2019a
- [11] Nuno Ferreira Duarte, Mirko Rakovic, and José Santos-Victor. Coupling of Arm Movements during Human-Robot Interaction: the handover case. In *2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, pages 1–6, New Delhi, India, October 2019d. IEEE
- [12] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Biologically inspired controller of human action behaviour for a humanoid robot in a dyadic scenario. In *IEEE EUROCON 2019-18th International Conference on Smart Technologies*, pages 1–6. IEEE, 2019b
- [13] Danilo Nikić, Nikola Ilić, Darko Todorović, Nuno Ferreira Duarte, José Santor-Victor, Branislav Borovac, and Mirko Raković. Eye gaze and body motion synchronization in dyadic interaction
- [14] Mirko Raković, Nuno Duarte, Jovica Tasevski, Joé Santos-Victor, and Branislav Borovac. A dataset of head and eye gaze during dyadic interaction task for modeling robot gaze behavior. *MATEC Web of Conferences*, 161:03002, 2018
- [15] Hugo Simão, João Avelino, Nuno Duarte, and Rui Figueiredo. Geebot: A robotic platform for refugee integration. In *Companion of the 2018 ACM/IEEE International Conference on Human-Robot Interaction*, pages 365–366, 2018
- [16] João Avelino, Hugo Simão, Ricardo Ribeiro, Plinio Moreno, Rui Figueiredo, Nuno Duarte, Ricardo Nunes, Alexandre Bernardino, Martina Čaić, Dominik Mahr, et al. Experiments with vizzy as a coach for elderly exercise. In *Companion*

of the 2018 ACM/IEEE International Conference on Human-Robot Interaction, 2018

CONFERENCE  
TALKS

- [17] N. Ferreira Duarte. "Robot Learning physical object properties from Human Visual Cues:A novel approach to infer the fullness level in containers", in *IEEE 2022 ICRA* in Philadelphia. May 23 - 27.
- [18] N. Ferreira Duarte. "Learning Motor Resonance in Human-Human and Human-Robot Interaction with Coupled Dynamical Systems", in *IEEE 2021 ICRA* in China (Online). May 30 - June 5.
- [19] N. Ferreira Duarte. "From human action understanding to robot action execution: how the physical properties of handled objects modulate non-verbal cues", in *IEEE 2020 RO-MAN* in Chile (Online). October 26–30.
- [20] Nuno Ferreira Duarte, Mirko Raković, and José Santos-Victor. Should robots behave like humans? an approach to analyse non-verbal gaze cues in human-robot interaction. In *ICDL-EpiRob 2019 Workshops*. Presented but no publication, 2019c in Oslo, Norway. August 19–22
- [21] N. Ferreira Duarte. "Coupling of Arm Movements during Human-Robot Interaction: the handover case", in *IEEE 2019 RO-MAN* in New Delhi, India. October 14–18.
- [22] N. Ferreira Duarte. "Biologically Inspired Controller of Human Action Behaviour for a Humanoid Robot in a Dyadic Scenario", in *IEEE 2013 EUROCON* in Novi Sad, Serbia. July 1–4.
- [23] N. Ferreira Duarte. "Studying the human behavior in dyadic interactions and applications to human-robot interactions", *2018 Mind Brain College* in Lisbon, Portugal. November 14–15.
- [24] N. Ferreira Duarte. "Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction", *The 2018 Computer Vision (ECCV) 2018 Workshops* in Munique, Germany. September 8–14.
- [25] N. Ferreira Duarte. "Studying the human behavior in dyadic interactions and applications to human-robot interactions", *The 2018 LARSys Meeting* in Lisbon, Portugal. June 14–15.
- [26] N. Ferreira Duarte. "A dataset of head and eye gaze during dyadic interaction task for modeling robot gaze behavior", *The 2018 Conference* in Saint Petersburg, Russia. April 18–21.
- [27] N. Ferreira Duarte. "GeeBot: A Robotic Platform for Refugee Integration", *The 2018 ACM/IEEE International Conference on Human-Robot Interaction* in Chicago, USA. March 5–8.
- [28] N. Ferreira Duarte. "Experiments with Vizzy as a Coach for Elderly Exercise", *The 2018 ACM/IEEE International Conference on Human-Robot Interaction* in Chicago, USA. March 5–8.

INVITED TALKS

- [29] Ferreira Duarte, N. From human action understanding to robot action execution: how the physical proper-ties of handled objects modulate non-verbal cue. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, April 14, 2020.
- [30] Ferreira Duarte, N. A Dataset Design for Human-Human and Human-Robot Collaboration. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, March 12, 2019.

- [31] Ferreira Duarte, N. On going work of my Ph.D. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, January 29, 2019.
- [32] Ferreira Duarte, N. Studying the human non-verbal communication behavior in dyadic interactions and applications to human-robot interactions. In: *LASA, EPFL, Lausanne, Switzerland*, September 21, 2018.
- [33] Ferreira Duarte, N. Action Alignment from Gaze Cues in Human-Human and Human-Robot Interaction. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, September 4, 2018.
- [34] Ferreira Duarte, N. A Dataset of Head and Eye Gaze during Dyadic Interaction Task For Modeling Robot Gaze Behavior. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon* May 8, 2018.
- [35] Ferreira Duarte, N. GeeBot - A robotic platform for refugee integration. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, January 16, 2018.
- [36] Ferreira Duarte, N. Action Anticipation: Reading the Intentions of Humans and Robots. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, October 17, 2017.
- [37] Ferreira Duarte, N. “Facilitating Intention Prediction for Humans by Optimizing Robot Motions” paper by Manuel Lopes. In: *Vislab, Institute Systems and Robotics (ISR), University of Lisbon*, March 28, 2017.
- OTHER PUBLICATIONS
- [38] Ferreira Duarte, N. *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties*. PhD thesis, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, 2023.
- [39] Ferreira Duarte, N. *Non-verbal Communication between Humans and Robots: Imitation, Mutual Understanding and Inferring Object Properties*. PhD thesis, Instituto Superior Técnico, Lisbon, Portugal, 2023.
- [40] Ferreira Duarte, N. *Multi-UAV Mission Coordination using Signal Temporal Logic Specifications*. Master’s thesis, Instituto Superior Técnico, Lisbon, Portugal, 2016.
- PAPERS IN PREPARATION
- [41] Linda Lastrico, Nuno Ferreira Duarte, Alessandro Carfí, Francesco Rea, Fulvio Mastrogiovanni, José Santos-Victor, Alessandra Sciutti. Like Robots, Like Humans: Pupil Dilation during Collaborative Object Manipulation
- [42] Linda Lastrico, Nuno Ferreira Duarte, Alessandro Carfí, Francesco Rea, Fulvio Mastrogiovanni, Alessandra Sciutti, José Santos-Victor. Expressing and Inferring Action Carefulness in Human-to-Robot Handovers
- TEACHING EXPERIENCE
- École Polytechnique Fédérale de Lausanne**, Switzerland
- Teaching Assistant* **February 2020 to October 2020**
- Assisted Applied Machine Learning instructional team.
  - Provided support to fourth-year engineering students (MICRO-455).
  - Assisted students in Practical and Lab sessions.

PROFESSIONAL SERVICE	<p><b>Referee Service</b></p> <ul style="list-style-type: none"> <li>• <i>IEEE International Conference on Advanced Intelligent Mechatronics</i></li> <li>• <i>IEEE International Symposium on Intelligent Systems and Informatics</i></li> <li>• <i>IEEE International Conference on Robotics and Automation</i></li> <li>• <i>IEEE/RSJ International Conference on Intelligent Robots and Systems</i></li> <li>• <i>IEEE International Conference on Development and Learning</i></li> <li>• <i>IEEE International Conference on Human Robot Interaction</i></li> <li>• <i>The International Journal of Robotics Research</i></li> <li>• <i>Journal of Frontiers in Robotics and AI</i></li> <li>• <i>Journal John Benjamins - Interaction Studies</i></li> <li>• <i>Journal of Interaction Studies</i></li> <li>• <i>International Journal of Social Robotics</i></li> </ul>
PROFESSIONAL MEMBERSHIPS	<p>Institute for Electrical and Electronics Engineers (IEEE), Member, 2016–present</p> <ul style="list-style-type: none"> <li>• IEEE Robotics and Automation Society (2021–present)</li> </ul>
OTHER MEETING ATTENDANCE	<p><b>Invited Participant</b></p> <ul style="list-style-type: none"> <li>• LarSys Annual Meeting 2022, July, 2022</li> <li>• LarSys Annual Meeting 2022, July, 2019</li> <li>• LarSys Annual Meeting 2022, July, 2018</li> <li>• 3rd Meeting Mind-Brain College Lisbon, October 19–20, 2017</li> </ul>
APPLICATION AREAS	<p>Human-Human Interaction, Human-Robot Interaction, Non-verbal Communication, Eye-tracking, Motion-tracking, Grasping, Physical Human-Robot Interaction, Human-inspired Modelling</p>
HARDWARE AND SOFTWARE SKILLS	<p>Computer Programming:</p> <ul style="list-style-type: none"> <li>• C++, Python, UNIX shell scripting, GNU make</li> </ul> <p>Robot Programming:</p> <ul style="list-style-type: none"> <li>• ROS, YARP</li> </ul> <p>Numerical Analysis:</p> <ul style="list-style-type: none"> <li>• MATLAB</li> </ul> <p>MATLAB skill set:</p> <ul style="list-style-type: none"> <li>• Linear algebra, Monte Carlo analysis, nonlinear numerical methods, polynomials, statistics, <math>N</math>-dimensional filters, visualization</li> </ul> <p>Information/Internet Technology:</p> <ul style="list-style-type: none"> <li>• Networking (UDP, TCP)</li> </ul> <p>Desktop Editing and Productivity Software:</p> <ul style="list-style-type: none"> <li>• Vim, PyCharm, Gedit</li> <li>• <math>\text{\TeX}</math> (<math>\text{\LaTeX}</math>, <math>\text{\BibTeX}</math>),</li> <li>• Microsoft Office, LibreOffice, Apple iWork</li> <li>• GIMP, Mathcha.io</li> </ul> <p>Operating Systems:</p> <ul style="list-style-type: none"> <li>• Microsoft Windows family, Apple OS X, Linux, Ubuntu, Fedora, and other UNIX variants</li> </ul>
EXPERTISE	<p>Mathematics:</p> <ul style="list-style-type: none"> <li>• Applied Mathematics, Differential Equations, Linear Algebra, Calculus,</li> </ul>

Sensors and Actuators:

- Pupil-Labs Eye-tracker glasses, Pupil Capture, Pupil Record
- OptiTrack 12 camera system, OptiTrack bar, OptiTrack Motive,
- Myo EMG

Robots:

- KUKA iiwa
- Kinova gen-3
- iCub

Control Theory and Engineering:

- Linear and Nonlinear Systems Theory, Dynamic Optimization, Multivariable Control Theory, Biomimicry, Bioinspiration

Communications and Signal Processing:

- Probability, Random Variables, Stochastic Processes, Estimation, Networks

Machine Learning and Engineering:

- Clustering, Component Analysis, Gaussian Mixture Modelling Regression, Markov Models, Neural Networks, among others

#### AWARDS

FCT: Foundation for Science and Technology (Portugal)

- PhD Scholarship, 2016–2020

Research Intern at Caltech (United States)

- SURF: Summer Undergraduate Research Fellowships, 2015

#### REFERENCES AVAILABLE TO CONTACT

**Dr. José Santos-Victor** (e-mail: [jasv@isr.tecnico.ulisboa.pt](mailto:jasv@isr.tecnico.ulisboa.pt); phone: +351 21.8418.294)

- Full Professor, Department of Electrical and Computer Engineering, Instituto Superior Técnico
- ◊ Instituto Superior Técnico, ISR - Torre Norte Av. Rovisco Pais, 1049-001 Lisboa, Portugal
- ★ *Dr. Santos-Victor was my PhD co-supervisor.*

**Dr. Aude Billard** (e-mail: [aude.billard@epfl.ch](mailto:aude.billard@epfl.ch); phone: +41 21 693 54 64)

- Full Professor, Institute of Electrical and Micro Engineering, EPFL
- ◊ EPFL STI IMT LASA, ME A3 393 (Bâtiment ME) Station 9, CH-1015 Lausanne
- ★ *Dr. Billard was my PhD co-supervisor.*