

# PAOLA ARDÓN

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## RESEARCH INTERESTS

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My doctoral research seeks to improve classical robotic grasping by using machine learning reasoning techniques. In particular, I focused on technical gaps to improve autonomy for grasp and manipulation planning and then leveraged my solutions to endow a robot to 'intelligently' interact with objects and other agents. Looking forward, I envision making an impact by continuing my work on robust and reliable techniques that facilitate a robot to autonomously perform grasping and manipulation tasks. Specifically, I visualise my own research group whose focus of study would span across (i) **task planning** specially for multiple sequential tasks, (ii) **task constraints understanding** when collaborating with others, and (iii) **human-centered techniques** that allow us to smoothly achieve a collaborative task.

## EDUCATION

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### PhD in Robotics and Autonomous Systems

- Thesis: Robotic Grasp Affordances.
- Supervisors: Professor Katrin Lohan, Dr. Ron Petrick and Professor Subramanian Ramamoorthy.
- Duration: 3 years.

### CDT in Robotics and Autonomous Systems

University of Edinburgh & Heriot-Watt University  
Edinburgh, UK  
*Expected end date: August 2021*

### MSc in Robotics and Autonomous Systems

- Thesis: Towards Robust Grasping Techniques.
- Supervisors: Professor Katrin Lohan and Professor Subramanian Ramamoorthy.
- Duration: 1 year.

### CDT in Robotics and Autonomous Systems

University of Edinburgh & Heriot-Watt University  
Edinburgh, UK.  
*Graduated with distinction. September 2018*

### MSc in Computer Vision and Robotics, Erasmus Program

- Thesis: Reaching and Grasping of Objects by Humanoid Robots through Visual Servoing.
- Supervisors: Dr. Mauro Dragone and Dr. Mustafa Suphi Erden.
- Duration: 2 years.

### Heriot-Watt University, University of Girona and University of Bourgogne

UK, Spain and France  
*Graduated with distinction. June 2017*

### B.S. in Electrical and Computer Engineering - minor in Business

- Thesis: NASA Lunar Regolith Excavator.
- Supervisors: Dr. Will Holmes and Dr. Tim Gilmour.
- Duration: 4 years.

### John Brown University

Arkansas, USA  
*Graduated Cum Laude. May 2013*

## SCHOLARSHIPS AND GRANTS

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- The Engineering and Physical Sciences Research Council (EPSRC) (£ 3,000) Early career research grant for academic visit at University of Washington. June 2019
- Scottish Informatics and Computer Alliance (SICSA) (£ 6,920) Early career research grant for academic visit at University of Washington. August 2019
- Scottish Informatics and Computer Alliance (SICSA) (£ 500) - Travel grant. March 2019
- Scottish Informatics and Computer Alliance (SICSA) (£ 500) - Travel grant. September 2018
- James Watt Doctoral Scholarship (£ 142,000) - Based on academic excellence and research potential. August 2017
- VIBOT Erasmus Mundus Scholarship (€ 47,000) - Based on academic excellence. June 2015
- Walton Scholarship Program (US\$ 130,000) - Based on academic excellence. January 2009

## AWARDS

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- Advanced Robotics at Queen Mary (ARQ) best paper award at Conference Towards Autonomous Robotic Systems for the article '**Learning and Composing Primitive Skills for Dual-arm Manipulation**'. June 2019  
London, UK
- Best Paper Award finalist at Conference Towards Autonomous Robotic Systems for the article '**Reasoning on Grasp-Action Affordances**'. June 2019  
London, UK
- NASA Third place in the Systems Engineering Paper for Lunabotics Mining Competition. Spring 2013  
Florida, USA
- NASA Second place in the Project Presentation for Lunabotics Mining Competition. Spring 2013  
Florida, USA

## RESEARCH PROJECTS

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- **PhD Research on Robotic Grasp Affordances:** Investigate on action affordances for indoor environment objects to improve reaching and grasping behaviours. Current
- **EPSRC ORCA Hub Project:** Research Assistant working on the integration and optimisation of the different robotic platforms and algorithms involved in the development of the project. Additionally, in charge of the teleoperation capabilities for grasping and manipulation. Current
- **Master thesis on Visual Servoing and Grasping:** Designed and implemented a visual servoing system to grasp objects. May-August 2017
- **SLAM and Object Recognition** MSc Group project - Implemented visual SLAM with object recognition based on ERL - service robots competition rules. August-December 2016
- **Lunabot NASA Project:** Undergraduate Final project - Lunabotics Mining Competition Project (LMC) organised by NASA. Designed a fully functional prototype of a mining robot that works on lunar simulated environment collecting regolith. Focused on wireless communication, control and autonomy, and IMU system. January-June 2013
- **Solar Panel Heater:** Undergraduate Group project - Designed the electrical system for a solar panel heater. In charge of Solar tracking system, settings, monitoring temperature, and user interface features. January-April 2012

## ACADEMIC LEADERSHIP

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### Project supervising

- Co-supervising on the Royal Academy of Engineering CoviBot project, partnership between UK and Latin America Universities, to create robotic strategies for monitoring and disinfection of COVID-19 environments. Current
- Co-supervising a master student project at Interstate University of Applied Science of Technology Buchs (NTB) on creating recognition for grasping methods in dynamic industrial setups. May-August 2020
- Co-supervising a master student project at Heriot-Watt University on creating user-operated cognitive consoles deployable on robotic digital twins environments. May-August 2019

### Teaching

- Teacher Assistant at John Brown University-Engineering Department: 2012-2013  
For average classes of 30 students on the following courses:  
Electromagnetism, Electrical circuits, Concepts of Electrical Engineering, and Algebra.

### Reviewing

- Reviewer for numerous conferences (4) and journals (2). Current

## Research Collaborations

Academic visit to the Human-Centre Lab at University of Washington to collaboratively design a robot-human handover framework for people with arm mobility impairments. Supervised by Dr. Maya Cakmak.

June 2019-October 2020

## Invited Talks

- Invited Speaker at University of Washington. Seminar on Grasp Affordances for Assistive Robots. February, 2020  
Washington, USA
- Invited Speaker at University of Applied Science of Technology Buchs (NTB). Workshop on Cyber Physical Systems. November, 2019  
Buchs, Switzerland

## System Demonstrations and Outreach

- System demonstration for “Task allocation and planning for offshore mission automation” in 2020 ICAPS. October 2020
- Outreach to young adults at UK London Royal Society July 2019
- Outreach to Edinburgh parliament members about research in robotics. October 2018
- Outreach to elementary and high school students at UK Glasgow TEDx Talk. May 2018
- Outreach to young adults at UK Edinburgh Science Festival. September 2017

## TEACHING, COMMUNICATION AND LEADERSHIP COURSES

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- Took a Pitch Masters Class to improve communication skills when presenting scientific material. September 2018
- Took a Creativity at Home workshop to learn techniques to promote creativity when designing a project. April 2018
- Took a Leadership course to learn techniques to help students in emotional and physical distress. August 2010

## SKILLS

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- Languages: Spanish (mother tongue) and English (high level).
- Programming languages: Python, MATLAB, C++, SQL, C NIOS II, AHDL, VHDL.
- Well handling of revision control systems (*git*, *cmake*); organisational frameworks, open source frameworks and cross -platforms (*Qt*, *openCV*, *Mevislab*, *ITK*, *PBRT*); robotics operative systems (*ROS*, *NaoqiSDK for Aldebaran*); electrical engineering software interfaces (*Quartus II*); general engineering software (*Solid-Works and Derive*). Additionally, handling of: *Linux-Ubuntu*, *Macintosh*, *Windows-Microsoft* and *LaTeX*.
- Digital communication systems, signal representations, modulations, and control systems.
- Extracurricular courses in the Business Administration and Organisational Leadership areas.
- Evaluate and assess situations effectively through research and compilation of information.
- Being dependable, hard-working, innovative, active participation, teamwork and leadership skills, self-motivated and committed to the job.
- Ability to create bonds towards the working group to reach personal and collective progress.

## ADDITIONAL EXPERIENCE

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- **Added Value Platforms Engineer** at Tigo Honduras-Operation and Maintenance. Sep 2013-Aug 2015
- **Resident Assistant at John Brown University** at the Student Development Department. School Year 2011-2012-2013

## VOLUNTEERING AND OUTREACH WORK

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- Volunteer at UK Cancer Research. Apr-Nov 2019
- Volunteer UK First Aid Africa. Aug 2017 - Jan 2018
- Parent-teacher translator; Nursing home volunteer and high school tutor in USA Arkansas. Jan 2009 - May 2013

## SELECTED PUBLICATIONS

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Please see my [Google Scholar Profile](#) for a full list of papers and their multimedia material.

### Journal Articles

- **Ardón, P.**, M. E. Cabrera, È. Pairet, R. PA Petrick, S. Ramamoorthy, K. Lohan, and M. Cakmak. “Affordance-Aware Handovers with Human Arm Mobility Constraints”. In: Accepted to RA-L to be presented in ICRA. Pre-print arXiv arXiv:2010.15436. (2021)
- **Ardón, P.**, È. Pairet, KS Lohan, S. Ramamoorthy, and R. Petrick. “Affordances in Robotic Tasks—A Survey”. In: *Preprint arXiv arXiv:2004.07400. To be submitted* (2021)
- **Ardón, P.**, È. Pairet, R. PA Petrick, S. Ramamoorthy, and K.S Lohan. “Learning Grasp Affordance Reasoning through Semantic Relations”. In: *IEEE Robotics and Automation Letters, presented in IROS 4.4* (2019), pp. 4571–4578
- È. Pairet, **Ardón, P.**, M. Mistry, and Y. Petillot. “Learning Generalisable Coupling Terms for Obstacle Avoidance via Low-dimensional Geometric Descriptors”. In: *IEEE Robotics and Automation Letters, presented in IROS* (2019)

### Conference Proceedings

- **Ardón, P.**, È. Pairet, Y. Petillot, R. PA Petrick, S. Ramamoorthy, and K.S Lohan. “Self-Assessment of Grasp Affordance Transfer”. In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2020
- D.A Robb, M. I Ahmad, C. Tiseo, A. C Aracri S.and McConnell, V. Page, C. Dondrup, F. J Chiyah Garcia, HN. Nguyen, È. Pairet, **Ardón, P.**, et al. “Robots in the Danger Zone: Exploring Public Perception through Engagement”. In: *Proceedings of the ACM/IEEE International Conference on Human-Robot Interaction*. 2020, pp. 93–102
- Y. Carreno, E. Pairet, **Ardón, P.**, Y. Petillot, and R.PA Petrick. “Task Allocation and Planning for Offshore Mission Automation”. In: *System demonstration at International Conference on Automated Planning and Scheduling (ICAPS)*. 2020
- È. Pairet, **Ardón, P.**, X. Liu, H. Lopes J.and Hastie, and K.S Lohan. “A digital twin for human-robot interaction”. In: *14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*. IEEE. 2019, pp. 372–372
- **Ardón, P.**, È. Pairet, R. Petrick, S. Ramamoorthy, and K.S Lohan. “Reasoning on Grasp-Action Affordances”. In: *Conference Towards Autonomous Robotic Systems*. Springer. 2019. **Finalist for best paper award**.
- È. Pairet, **Ardón, P.**, M. Mistry, and Y. Petillot. “Learning and composing primitive skills for dual-arm manipulation”. In: *Annual Conference Towards Autonomous Robotic Systems*. Springer. 2019. **Advanced Robotics at Queen Mary (ARQ) best paper award**, pp. 65–77
- **Ramírez, Paola Ardón**, Subramanian Ramamoorthy, and Katrin Solveig Lohan. “Object Affordances by Inferring on the Surroundings”. In: *2018 IEEE Workshop on Advanced Robotics and its Social Impacts (ARSO)*. IEEE. 2018, pp. 69–70
- **Ardón, P.**, È. Pairet, S. Ramamoorthy, and K.S Lohan. “Towards Robust Grasps: Using the Environment Semantics for Robotic Object Affordances”. In: *AAAI Fall Symposium. Reasoning and Learning in Real-World Systems for Long-Term Autonomy*. AAAI Press. 2018
- Eric Pairet, **Ramírez, Paola Ardón**, Frank Broz, Michael Mistry, and Yvan Petillot. “Learning and Composing Primitive Skills for Generalisable Dual-arm Manipulation”. In: *AAAI 2018 Fall Symposium: Reasoning and Learning in Real World Systems for Long-term Autonomy*. 2018

### Book Chapters

- K. Lohan, M. I. Ahmad, C. Dondrup, **Ardón, P.**, È. Pairet, and A. Vinciarelli. “Adapting Movements and Behaviour to Favour Communication in Human-Robot Interaction”. In: *Modelling Human Motion*. Springer, 2020, pp. 271–297
- **Ardón, P.**, M. Dragone, and M. S. Erden. “Reaching and grasping of objects by humanoid robots through visual servoing”. In: *International Conference on Human Haptic Sensing and Touch Enabled Computer Applications*. Springer. 2018, pp. 353–365

## REFERENCES

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- *Professor Subramanian Ramamoorthy:*  
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