

# David Garzón Ramos

RESEARCH ASSOCIATE · SWARM ROBOTICS

Bristol Robotics Lab, T-Block, UWE Frenchay Campus, Bristol BS16 1QY, United Kingdom

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## Highlights

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My research is at the intersection of artificial intelligence, collective intelligence, and robotics. I investigate how to use optimization and machine learning concepts to design large groups of intelligent and self-organized autonomous robots—the robot swarms.

My vision is that by applying machine learning concepts, we will be able to design, produce and deploy robot swarms in a completely integrated and automatic way. In addition to my scientific contribution to this vision, I am also active in the popularization of these ideas through science communication activities.

I have conducted most of my research as a PhD student at IRIDIA, the Artificial Intelligence Research Laboratory of the Université libre de Bruxelles, Belgium. Since February 2024, I joined the Bristol Robotics Laboratory as a Research Associate of the University of Bristol, United Kingdom. I am also a Visiting Lecturer for Robotics and Collective Intelligence at Universidad de Nariño, Colombia.

My research has been funded by the Colombian Ministry of Science, Technology and Innovation – Minciencias, Colombia. I have also received funding as a team member of two European projects: DEMIURGE, funded by the European Research Council, and EMERGE, funded by the European Innovation Council and UK Research and Innovation.

**Research interests :** Swarm robotics, optimization-based design, collective intelligence, Robot Operating System (ROS).

## Education

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### PhD in Engineering and Technology

Université libre de Bruxelles

- Thesis: Leveraging environmental and inter-robot signaling in the automatic modular design of robot swarms: communication, reaction to events, and sequential missions

Brussels, Belgium

Viva on 13 Jan. 2025

### Master in Engineering - Industrial Automation

Universidad Nacional de Colombia

- Thesis: Empirical comparison of methods for the design of robot swarms: a simulation-only study of swarms that coordinate other swarms (*in Spanish*)

Manizales, Colombia

finished 9 Jun. 2022

### Master in Automation and Robotics

Universidad Politécnica de Madrid

- Thesis: Multi-robot inspection of hazards in critical infrastructure (*in Spanish*)

Madrid, Spain

finished 26 Oct. 2016

### Electronics Engineering

Universidad Nacional de Colombia

- Thesis: Development of UV sensor films based on ZnO micro-structures (*in Spanish*)

Manizales, Colombia

finished 10 Apr. 2014

## Research Experience

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### Research Associate

Bristol Robotics Laboratory (BRL), University of Bristol

- Emergent state-awareness in robot swarms, member of the EMERGE project, funded by the European Innovation Council and UKRI

Bristol, United Kingdom

27.Feb. 2024 – present

### Researcher

IRIDIA, Université libre de Bruxelles

- Automatic design of collective behaviors for robot swarms, member of the DEMIURGE project, funded by the European Research Council

Brussels, Belgium

01.Sep. 2017 – 26.Feb. 2024

### Researcher

Robotics & Cybernetics group, Universidad Politécnica de Madrid

- Design of multi-robot coordination strategies for unmanned ground vehicles

Madrid, Spain

01.Jun. 2015 – 30.Aug. 2017

### Intern

Aerospace Systems & Control Section, SENER Engineering Group

- Guidance, navigation and control of unmanned ground vehicles with ROS

Madrid, Spain

01.Sep. 2014 – 30.Aug. 2017

### Undergraduate researcher

Grupo de Propiedades Ópticas de los Materiales, Universidad Nacional de Colombia

- Development and production of UV sensors

Manizales, Colombia

01.Jan. 2011 – 30.Jun. 2014

## Honors and Awards

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2022	<b>Science Communication Award,</b> 2022 IEEE International Conference on Robotics and Automation (ICRA)	Philadelphia, PA, USA
2021	<b>Best Oral Presentation,</b> 1er Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SoPhIC)	Bogotá, Colombia
2021	<b>First place in the DOTS swarm robotics competition,</b> awarded by Bristol Robotics Laboratory, University of Bristol, and Toshiba BRIL	Bristol, United Kingdom
2018	<b>Scholarship for PhD studies,</b> granted by the Colombian Adm. Dep. of Science, Technology and Innovation-Colciencias	Bogotá, Colombia
2014	<b>Scholarship for master's degree studies,</b> granted by SENER Foundation	Madrid, Spain
2014	<b>Best Thesis on Electronics Engineering,</b> awarded by Universidad Nacional de Colombia	Manizales, Colombia
2012	<b>Best Theoretical Work,</b> X National School of Condensed Matter Physics	Manizales, Colombia
2009	<b>Scholarship for undergraduate studies,</b> granted by Ecopetrol S.A. (program: Mario Galan Gomez - Bachilleres por Colombia)	Bogotá, Colombia
2007	<b>Academic tuition exemption,</b> granted by Universidad Nacional de Colombia	Manizales, Colombia

## Teaching

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### Visiting lecturer

Maestría en Ingeniería Electrónica, Universidad de Nariño

- Master's course: MaIE-CE1 - Robótica

Pasto, Colombia  
II-2020, II-2021, II-2022, II-2023

### Summer school lecturer

Intensive Selection Camp (ISC) 2024 - University of Bristol

- Short course: Biorobotics

Bristol, United Kingdom  
05.Aug. 2024 – 09.Aug. 2024

### Summer school lecturer

ACM SIGSOFT Summer School for Software Engineering in Robotics

- Practical session: Manual design of collective behaviors for robot swarms

Brussels, Belgium  
08.Jun. 2024

### Teaching assistant

IRIDIA, Université libre de Bruxelles (with Prof. Marco Dorigo and Prof. Mauro Birattari)

- Master's course: INFO-H-414 - Swarm Intelligence - Practical sessions on swarm robotics
- Master's course: PROJ-H-402 - Computing project

Brussels, Belgium  
01.Sep. 2017 – 26.Feb. 2024

### Teacher

Grupo Formarte - Pre-university courses

- Pre-university courses: Elementary Physics, Elementary Mathematics

Manizales, Colombia  
01.Mar. 2014 – 30.Jun. 2014

### Undergraduate teaching assistant

Departamento de Física y Química, Universidad Nacional de Colombia (with Prof. Carlos Vargas)

- Engineering courses: Waves and Oscillations Physics, Mechanical Physics

Manizales, Colombia  
16.Sep. 2013 – 10.Dec. 2013

## Research projects

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### Ongoing

- [D3] *SOLE-R: del aprendizaje social en insectos al aprendizaje social en enjambres de robots.* Funded by Corporación Ecuatoriana para el Desarrollo de la Investigación y Academia (CEDIA). Ecuador. Co-investigator. 2025.
- [D2] *QUPAS: robots modulares y económicos para la investigación en robótica colectiva.* funded by Escuela Superior Politécnica del Litoral (ESPOL). Ecuador. Co-principal investigator. 2024–2026.
- [D1] *Desarrollo de un laboratorio remoto y abierto en la línea de robótica de enjambres para la Universidad de Nariño.* Funded by Universidad de Nariño. Colombia. Co-investigator. 2023–2025.

## Editorial activities

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### Program Committee Member

ANTS 2024 – Fourteenth International Conference on Swarm Intelligence

Konstanz, Germany

9.Oct. 2024 – 11.Oct. 2024

### Publication Chair

SoPhIC 2023, II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia:  
ciencia para el futuro e integración de las regiones

Colombia

9.Aug. 2023 – 11.Aug. 2023

## Academic and Professional Societies

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### Institute of Electrical and Electronics Engineers (IEEE)

Student Member, IEEE Benelux Section

Dec. 2020 – present

### IEEE Robotics & Automation Society

Student Member

Dec. 2020 – present

### IEEE Computational Intelligence Society

Student Member

Sep. 2022 – present

### Sociedad de Doctores e Investigadores de Colombia (SoPhIC)

PhD Student Member

Aug. 2021 – present

## Robotics Competitions

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### Team leader, Swarmanauts

1st place DOTS competition: Powering emergency food distribution using robot swarms  
competition organized within the South Gloucestershire Council's UMBRELLA project.

Bristol, United Kingdom

24.May. 2021 – 18.Jun. 2021

### Team member, SARRUS (Search And Rescue Robot of UPM & Sener)

2nd and 3rd place in land trials, euRathlon 2015 robotics Grand Challenge  
competition organized within the European FP7 euRathlon project.

Piombino, Italy

17.Sep. 2015 – 25.Sep. 2015

## Articles in journals

- [J12] M. Kegeleirs, D. Garzón Ramos, and M. Birattari. “DeimOS: a ROS-ready operating system for the e-puck”. In: *Journal of Open Research Software* (2024), (in review).
- [J11] D. Garzón Ramos, F. Pagnozzi, T. Stützle, and M. Birattari. “Automatic design of robot swarms under concurrent design criteria: a study based on Iterated F-Race”. In: *Advanced Intelligent Systems* (2024), p. 2400332. doi: 10.1002/aisy.202400332.
- [J10] M. Salman, D. Garzón Ramos, and M. Birattari. “Automatic design of stigmergy-based behaviors for robot swarms”. In: *Communications Engineering* 3 (2024), p. 30. doi: 10.1038/s44172-024-00175-7.
- [J9] M. Kegeleirs, D. Garzón Ramos, K. Hasselmann, L. Garattoni, G. Francesca, and M. Birattari. “Transferability in the automatic off-line design of robot swarms: from sim-to-real to embodiment and design-method transfer across different platforms”. In: *IEEE Robotics and Automation Letters* 9.3 (2024), pp. 2758–2765. doi: 10.1109/LRA.2024.3360013.
- [J8] F. J. Mendiburu, D. Garzón Ramos, M. R. Morais, A. M. Lima, and M. Birattari. “AutoMoDe-Mate: automatic off-line design of spatially-organizing behaviors for robot swarms”. In: *Swarm and Evolutionary Computation* 74 (2022), p. 101118. doi: 10.1016/j.swevo.2022.101118.
- [J7] D. Garzón Ramos and M. Birattari. “Automatic design of collective behaviors for robots that can display and perceive colors”. In: *Applied Sciences* 10.13 (2020), p. 4654. doi: 10.3390/app10134654.
- [J6] M. Salman, D. Garzón Ramos, K. Hasselmann, and M. Birattari. “Phormica: photochromic pheromone release and detection system for stigmergic coordination in robot swarms”. In: *Frontiers in Robotics and AI* 7 (2020), p. 195. doi: 10.3389/frobt.2020.591402.
- [J5] M. Birattari, A. Ligot, D. Bozhinoski, M. Brambilla, G. Francesca, L. Garattoni, D. Garzón Ramos, K. Hasselmann, M. Kegeleirs, J. Kuckling, F. Pagnozzi, A. Roli, M. Salman, and T. Stützle. “Automatic off-line design of robot swarms: a manifesto”. In: *Frontiers in Robotics and AI* 6 (2019), p. 59. doi: 10.3389/frobt.2019.00059.
- [J4] D. Garzón Ramos, D. A. Guzmán-Embús, D. C. Barrera-Andrade, A. M. Florez-Villamil, and C. Vargas-Hernández. “Diseño e implementación del sistema de espectroscopia de fotoimpedancia eléctrica en el desarrollo de sensores ópticos basados en microvaras de ZnO”. In: *Revista de Investigaciones Universidad del Quindío* 25 (2014), pp. 141–146. doi: 10.33975/riug.vol25n1.165.
- [J3] D. Garzón Ramos, E. A. Belalcazar-Bolaños, J. R. Orozco-Arroyave, J. F. Vargas-Bonilla, and C. Vargas-Hernández. “Reconstrucción del espectro Raman mediante la sustracción de la línea base usando las funciones de Huber y cuadrática truncada”. In: *Revista Colombiana de Física* 46.1 (2014), pp. 1–4.
- [J2] D. Garzón Ramos, C. Vargas-Hernández, and E. Cano Plata. “Estudios por impedancia eléctrica de nanoestructuras de ZnO”. In: *Scientia Et Technica* 18.2 (2013), pp. 309–314.
- [J1] D. Garzón Ramos, A. Martínez, D. Rico, D. A. Guzmán-Embús, and C. Vargas-Hernández. “Sistema SILAR para el crecimiento de películas semiconductoras con diferentes aplicaciones”. In: *Revista de Investigaciones Universidad del Quindío* 23.1 (2012), pp. 16–22. doi: 10.33975/riug.vol23n1.414.

## Book chapters and articles in post-proceedings

- [C5] G. Spaey, M. Kegeleirs, D. Garzón Ramos, and M. Birattari. “Evaluation of alternative exploration schemes in the automatic modular design of robot swarms”. In: *Artificial Intelligence and Machine Learning: BNAIC 2019, BENELEARN 2019*. Ed. by B. Bogaerts, G. Bontempi, P. Geurts, N. Harley, B. Lebichot, T. Lenaerts, and G. Louppe. Vol. 1196. CCIS. Cham, Switzerland: Springer, 2020, pp. 18–33. doi: 10.1007/978-3-030-65154-1\_2.
- [C4] J. J. Roldán, E. Peña-Tapia, D. Garzón Ramos, J. de León, M. Garzón, J. del Cerro, and A. Barrientos. “Multi-robot systems, virtual reality and ROS: developing a new generation of operator interfaces”. In: *Robot Operating System (ROS): The Complete Reference*. Ed. by A. Koubaa. Vol. 778. SCI. Cham, Switzerland: Springer, 2018, pp. 29–64. doi: 10.1007/978-3-319-91590-6\_2.
- [C3] M. Garzón, J. Valente, J. J. Roldán, D. Garzón Ramos, J. de León, A. Barrientos, and J. del Cerro. “Using ROS in multi-robot systems: experiences and lessons learned from real-world field tests”. In: *Robot Operating System (ROS): The Complete Reference*. Ed. by A. Koubaa. Vol. 707. SCI. Cham, Switzerland: Springer, 2017, pp. 449–483. doi: 10.1007/978-3-319-54927-9\_14.
- [C2] J. J. Roldán, J. del Cerro, D. Garzón Ramos, P. Garcia-Aunon, M. Garzón, J. de León, and A. Barrientos. “Robots in agriculture: state of art and practical experiences”. In: *Service Robots*. Ed. by A. J. R. Neves. London, United Kingdom: IntechOpen, 2017. doi: 10.5772/intechopen.69874.
- [C1] D. Garzón Ramos, D. A. Guzmán-Embús, C. Serna-Plata, D. C. Galvez-Coy, and C. Vargas-Hernández. “Estudio de las propiedades estructurales, vibracionales y eléctricas de la matriz compleja PVA + microvaras de ZnO”. In: *Materiales Compuestos y Recubrimientos: Numero especial Artículos cortos, VII Congreso Internacional de Materiales*. Ed. by M. L. Álvarez Láinez, N. R. Rojas Reyes, P. Fernández Morales, and M. E. López Gómez. Medellín, Colombia: Revista Colombiana de Materiales, Universidad de Antioquia, 2014.

## Articles in refereed conference proceedings

- [P23] G. M. Madroñero Pachajoa, W. Achicanoy, and D. Garzón Ramos. “Automating the evaluation of the scalability, flexibility, and robustness of collective behaviors for robot swarms”. In: *2024 Brazilian Symposium on Robotics (SBR)*. 2024.
- [P22] D. Garzón Ramos and S. Hauert. “Designing robot swarms: a puzzle, a problem, and a mess”. In: *40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40)*. 2024, pp. 1600–1602.
- [P21] M. Kegeleirs, D. Garzón Ramos, G. Legarda Herranz, I. Gharbi, J. Szpirer, O. Debeir, L. Garattoni, G. Francesca, and M. Birattari. “Collective perception for tracking people with a robot swarm”. In: *40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA40)*. 2024, pp. 1292–1294.
- [P20] J. Szpirer, D. Garzón Ramos, and M. Birattari. “Automatic design of robot swarms that perform composite missions: an approach based on inverse reinforcement learning”. In: *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2024.
- [P19] D. Garzón Ramos and M. Birattari. “Automatically designing robot swarms in environments populated by other robots: an experiment in robot herding”. In: *2024 IEEE International Conference on Robotics and Automation (ICRA)*. Piscataway, NJ, USA: IEEE, 2024, pp. 12240–12247. doi: 10.1109/ICRA57147.2024.10611309.
- [P18] I. Gharbi, J. Kuckling, D. Garzón Ramos, and M. Birattari. “Show me what you want: inverse reinforcement learning to automatically design robot swarms by demonstration”. In: *2023 IEEE International Conference on Robotics and Automation (ICRA)*. Piscataway, NJ, USA: IEEE, 2023, pp. 5063–5070. doi: 10.1109/ICRA48891.2023.10160947.
- [P17] J. B. Medina, A. Pantoja, and D. Garzón Ramos. “Caracterización de comportamientos de enjambres de robots mediante el análisis de imágenes demostrativas”. In: *II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2023): ciencia para el futuro e integración de las regiones*. Ed. by J. Ari Noriega, B. Foliaco, D. Garzón Ramos, P. Paz, L. A. Pedraza Herrera, E. Ramírez Vargas, and E. Villota. Bogotá, Colombia: Editorial SoPhIC, 2023, pp. 271–275. doi: 10.5281/zenodo.10277237.
- [P16] J. A. Diaz, A. Pantoja, and D. Garzón Ramos. “Aplicación de la minería de procesos en el estudio de comportamientos colectivos para enjambres de robots”. In: *II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2023): ciencia para el futuro e integración de las regiones*. Ed. by J. Ari Noriega, B. Foliaco, D. Garzón Ramos, P. Paz, L. A. Pedraza Herrera, E. Ramírez Vargas, and E. Villota. Bogotá, Colombia: Editorial SoPhIC, 2023, pp. 297–301. doi: 10.5281/zenodo.10277237.
- [P15] G. M. Madroñero Pachajoa, W. Achicanoy, and D. Garzón Ramos. “Construcción de un repositorio de comportamientos colectivos para enjambres de robots en ARGoS3”. In: *II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2023): ciencia para el futuro e integración de las regiones*. Ed. by J. Ari Noriega, B. Foliaco, D. Garzón Ramos, P. Paz, L. A. Pedraza Herrera, E. Ramírez Vargas, and E. Villota. Bogotá, Colombia: Editorial SoPhIC, 2023, pp. 303–307. doi: 10.5281/zenodo.10277237.
- [P14] E. Solarte Paz, W. Achicanoy, and D. Garzón Ramos. “Desarrollo de un marco experimental para estudiar comportamientos de especialización en enjambres de robots”. In: *II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2023): ciencia para el futuro e integración de las regiones*. Ed. by J. Ari Noriega, B. Foliaco, D. Garzón Ramos, P. Paz, L. A. Pedraza Herrera, E. Ramírez Vargas, and E. Villota. Bogotá, Colombia: Editorial SoPhIC, 2023, pp. 321–325. doi: 10.5281/zenodo.10277237.
- [P13] D. Garzón Ramos, J. P. Bolaños, J. Diaz, G. Pachajoa, and M. Birattari. “Introduciendo la robótica de enjambres a entusiastas de la robótica: experiencias y resultados de una colaboración académica”. In: *I Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2021): la ciencia al servicio de la sociedad*. Ed. by E. Ramírez Vargas, L. A. Pedraza Herrera, V. Otero Jiménez, and S. L. Leiva Maldonado. Bogotá, Colombia: Editorial SoPhIC, 2021, pp. 46–48. doi: 10.5281/zenodo.6555506.
- [P12] G. Spaey, M. Kegeleirs, D. Garzón Ramos, and M. Birattari. “Comparison of different exploration schemes in the automatic modular design of robot swarms”. In: *Proceedings of the Reference AI & ML Conference for Belgium, Netherlands & Luxembourg, BNAIC/BENELEARN 2019*. Ed. by K. Beuls, B. Bogaerts, G. Bontempi, P. Geurts, N. Harley, B. Lebicot, T. Lenaerts, G. Louppe, and P. Van Eecke. Vol. 2491. CEUR Workshop Proceedings. Aachen, Germany: CEUR-WS.org, 2019.
- [P11] M. Kegeleirs, D. Garzón Ramos, and M. Birattari. “Random walk exploration for swarm mapping”. In: *Towards Autonomous Robotic Systems, TAROS*. Ed. by K. Althoefer, J. Konstantinova, and K. Zhang. Vol. 11650. LNCS. Cham, Switzerland: Springer, 2019, pp. 211–222. doi: 10.1007/978-3-030-25332-5\_19.
- [P10] D. Garzón Ramos, M. Garzón, J. de León, and A. Barrientos. “Enhancing RRT planning for interception with distance and probability maps based on FMM”. In: *ROBOT 2017: Third Iberian Robotics Conference*. Ed. by A. Ollero, A. Sanfeliu, L. Montano, N. Lau, and C. Cardeira. Vol. 693. AISC. Cham, Switzerland: Springer, 2018, pp. 867–878. doi: 10.1007/978-3-319-70833-1\_70.
- [P9] J. de León, M. Garzón, D. Garzón Ramos, and A. Barrientos. “Study of gait patterns for an hexapod robot in search and rescue tasks”. In: *ROBOT 2017: Third Iberian Robotics Conference*. Ed. by A. Ollero, A. Sanfeliu, L. Montano, N. Lau, and C. Cardeira. Vol. 694. AISC. Cham, Switzerland: Springer, 2018, pp. 731–742. doi: 10.1007/978-3-319-70836-2\_60.
- [P8] D. Garzón Ramos, M. Garzón, and A. Barrientos. “Planificación para interceptación de objetivos: integración del método Fast Marching y Risk-RRT”. In: *Actas de las XXXVIII Jornadas de Automática*. Ed. by H. López García. Oviedo, Spain: Servicio de Publicaciones de la Universidad de Oviedo, 2017, pp. 738–745. doi: 10.17979/spudc.9788497497749.0738.

- [P7] J. J. Roldán, M. Garzón, J. de León, D. Garzón Ramos, A. Martín-Barrio, S. Terrile, P. Garcia-Aunon, J. del Cerro, C. Rossi, and A. Barrientos. “Proyecto PRIC: Protección Robotizada de Infraestructuras Críticas”. In: *Libro de actas de las Jornadas Nacionales de Robótica 2017*. Ed. by M. Mellado Arteche, A. Sánchez Salmerón, and E. J. Bernabeu Soler. Barcelona, Spain: Comité Español de Automática (CEA-IFAC), 2017.
- [P6] M. Garzón, D. Garzón Ramos, A. Barrientos, and J. del Cerro. “Pedestrian trajectory prediction in large infrastructures - a long-term approach based on path planning”. In: *ICINCO 2016: 13th International Conference on Informatics in Control, Automation and Robotics*. Ed. by O. Gusikhin, D. Peaucelle, and K. Madani. Setúbal, Portugal: SciTePress, 2016, pp. 381–389. doi: 10.5220/0005983303810389.
- [P5] D. Garzón Ramos, M. Garzón, and A. Barrientos. “Protección multi-robot de infraestructuras: un enfoque cooperativo para entornos con información limitada”. In: *Libro de Actas de las XXXVII Jornadas de Automática*. Ed. by H. López García. Barcelona, Spain: Comité Español de Automática (CEA-IFAC), 2016, pp. 1132–1139. doi: 10.17979/spudc.9788497497749.0738.
- [P4] J. de León, M. Garzón Oviedo, D. Garzón Ramos, J. del Cerro, and A. Barrientos. “Towards complex human robot cooperation based on gesture-controlled autonomous navigation”. In: *RoboCity16: Open Conference on Future Trends in Robotics*. Ed. by R. E. Fernández and H. Montes. Madrid, Spain: Consejo Superior de Investigaciones Científicas, 2016, pp. 1–9.
- [P3] D. Garzón Ramos, M. Garzón, and A. Barrientos. “Pedestrian motion prediction: a graph based approach”. In: *RoboCity16: Open Conference on Future Trends in Robotics*. Ed. by R. E. Fernández and H. Montes. Madrid, Spain: Consejo Superior de Investigaciones Científicas, 2016, pp. 309–316.
- [P2] J. de León, M. Garzón, D. Garzón Ramos, E. Narváez, J. del Cerro, and A. Barrientos. “From video games multiple cameras to multi-robot teleoperation in disaster scenarios”. In: *ICARSC 2016: IEEE International Conference on Autonomous Robot Systems and Competitions*. Ed. by B. Cunha, J. Lima, M. Silva, and P. Leitão. Los Alamitos, CA, USA: IEEE Computer Society, 2016, pp. 323–328. doi: 10.1109/ICARSC.2016.41.
- [P1] D. Garzón Ramos, J. A. Martínez Macuna, D. A. Rico Ayala, and C. Vargas-Hernández. “Sistema SILAR de producción para películas semiconductoras aplicadas en sensores de humedad”. In: *16 Convención Científica de Ingeniería y Arquitectura*. La Habana, Cuba: Instituto Superior Politécnico José Antonio Echeverría (CUJAE), 2012, pp. 330–339.

### Articles presented at workshops/conferences (no formal proceedings)

- [W4] D. Garzón Ramos, J. B. Medina, S. Hauert, and M. Birattari. “Selection of communication mechanisms in the automatic modular design of robot swarms”. In: *Late breaking abstracts - ANTS 2024, Fourteenth International Conference on Swarm Intelligence*. Konstanz, Germany: Universität Konstanz, 2024.
- [W3] M. Kegeleirs, D. Garzón Ramos, G. Legarda Herranz, I. Gharbi, J. Szpirer, K. Hasselmann, L. Garattoni, G. Francesca, and M. Birattari. “Leveraging swarm capabilities to assist other systems”. In: *ICRA 2024 Breaking Swarm Stereotypes Workshop*. Yokohama, Japan: EU EIC project EMERGE, 2024. doi: 10.48550/arXiv.2405.04079.
- [W2] M. Kegeleirs, D. Garzón Ramos, L. Garattoni, G. Francesca, and M. Birattari. “Automatic off-line design of robot swarms: exploring the transferability of control software and design methods across different platforms”. In: *ICRA 2023 Transferability in Robotics Workshop*. London, UK: EU Horizon project euRobin, 2023. doi: 10.48550/arXiv.2305.16126.
- [W1] D. Garzón Ramos, D. Bozhinoski, G. Francesca, L. Garattoni, K. Hasselmann, M. Kegeleirs, J. Kuckling, A. Ligot, F. J. Mendiburu, F. Pagnozzi, M. Salman, T. Stützle, and M. Birattari. “The automatic off-line design of robot swarms: recent advances and perspectives”. In: *R2T2: Robotics Research for Tomorrow’s Technology*. Ed. by G. De Masi, E. Ferrante, and P. Dario. Abu Dhabi, United Arab Emirates: Technology Innovation Institute, 2021.

### Theses

- [T4] D. Garzón Ramos. “Leveraging environmental and inter-robot signaling in the automatic modular design of robot swarms: communication, reaction to events, and sequential missions”. PhD Thesis (to appear). Brussels, Belgium: Université libre de Bruxelles, 2024.
- [T3] D. Garzón Ramos. “Comparación empírica de métodos de diseño de enjambres de robots: un estudio en simulación sobre enjambres que coordinan a otros enjambres”. Master’s Thesis (in Spanish). Available online: <https://repositorio.unal.edu.co/handle/unal/81376>. Manizales, Colombia: Universidad Nacional de Colombia, 2022.
- [T2] D. Garzón Ramos. “Inspección multi-robot de amenazas en infraestructuras críticas”. Master’s Thesis (in Spanish). Madrid, Spain: Universidad Politécnica de Madrid, 2016.
- [T1] D. Garzón Ramos. “Desarrollo y evaluación de películas sensores de UV basadas en microestructuras de ZnO”. Electronics Engineering Thesis (in Spanish). Available online: <https://repositorio.unal.edu.co/handle/unal/81625>. Manizales, Colombia: Universidad Nacional de Colombia, 2014.

### Edited conference proceedings

- [E1] J. Ari Noriega, B. Foliaco, D. Garzón Ramos, P. Paz, L. A. Pedraza Herrera, E. Ramírez Vargas, and E. Villota, eds. *II Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2023): ciencia para el futuro e integración de las regiones*. Bogotá, Colombia: Editorial SoPhIC, 2023. doi: 10.5281/zenodo.10277237.

## Technical reports

- [R4] D. Garzón Ramos, M. Salman, K. Ubeda Arriaza, K. Hasselmann, and M. Birattari. *MoCA: a modular RGB color arena for swarm robotics experiments*. Tech. rep. TR/IRIDIA/2022-014. Brussels, Belgium: IRIDIA, Université libre de Bruxelles, 2022.
- [R3] M. Kegeleirs, R. Todesco, D. Garzón Ramos, G. Legarda Herranz, and M. Birattari. *Mercator: hardware and software architecture for experiments in swarm SLAM*. Tech. rep. TR/IRIDIA/2022-012. Brussels, Belgium: IRIDIA, Université libre de Bruxelles, 2022.
- [R2] G. Legarda Herranz, D. Garzón Ramos, J. Kuckling, M. Kegeleirs, and M. Birattari. *Tycho: a robust, ROS-based tracking system for robot swarms*. Tech. rep. TR/IRIDIA/2022-009. Brussels, Belgium: IRIDIA, Université libre de Bruxelles, 2022.
- [R1] K. Hasselmann, A. Ligot, G. Francesca, D. Garzón Ramos, M. Salman, J. Kuckling, F. J. Mendiburu, and M. Birattari. *Reference models for AutoMoDe*. Tech. rep. TR/IRIDIA/2018-002. Brussels, Belgium: IRIDIA, Université libre de Bruxelles, 2018.

## Presentations in poster sessions

- [S7] I. Gharbi, J. Kuckling, D. Garzón Ramos, M. Kegeleirs, G. Legarda Herranz, and M. Birattari. *Robotique en essaim : Orchestra*. Poster presented at: Printemps des Sciences 2022. Fédération Wallonie-Bruxelles. Brussels, Belgium. 2022.
- [S6] J. J. Alzate, J. Araujo, D. Garzón Ramos, F. Londoño Zapata, J. A. Ortiz Torres, and A. Torres Burgos. *Fabricación de un robot móvil terrestre con capacidad de navegación autónoma para la medición de variables ambientales sensibles para la automatización del sector agroindustrial de Caldas*. Poster presented at: XIII Encuentro Virtual Departamental de Semilleros de Investigación. RREDSI Red Regional de Semilleros de Investigación Nodo Caldas. Manizales, Colombia. 2021.
- [S5] M. Garzón, J. de León, and D. Garzón Ramos. *Surveillance, search and rescue*. Poster presented at: Industriales Research Meeting 2016. ETSII, Universidad Politécnica de Madrid. Madrid, Spain. 2016.
- [S4] D. Garzón Ramos, E. Cano-Plata, D. A. Guzmán-Embús, and C. Vargas-Hernández. *Development and evaluation of UV sensor films based on ZnO microrods*. Poster presented at: International Materials Research Congress. Sociedad Mexicana de Materiales. Cancún, Mexico. 2014.
- [S3] D. Garzón Ramos, E. A. Belalcazar-Bolaños, J. R. Orozco-Arroyave, J. F. Vargas-Bonilla, and C. Vargas-Hernández. *Automatic background removal from ZnO and GaAs Raman spectra using Huber and quadratic truncated functions*. Poster presented at: NanoAntioquia 2013, II Taller Internacional de Materiales Nanoestructurados. Universidad de Antioquia. Medellín, Colombia. 2013.
- [S2] D. C. Galvez-Coy, D. Garzón Ramos, and C. Vargas-Hernández. *Caracterización estructural, vibracional y mecánica de hueso tipo fémur vacuno*. Poster presented at: 3er Congreso de Ingeniería Física. Universidad EAFIT. Medellín, Colombia. 2012.
- [S1] D. Garzón Ramos, A. Martínez, D. Rico, and C. Vargas-Hernández. *Implementación de la DAQ NI-USB6009 en el sistema SILAR para el crecimiento de películas semiconductoras*. Poster presented at: 3er Congreso de Ingeniería Física. Universidad EAFIT. Medellín, Colombia. 2012.

## Student supervision

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### Master's thesis

- [G11] E. Solarte Paz. *Building robot societies: an experiment on the automatic design of robot swarms*. Universidad de Nariño, Colombia. Co-supervised with Prof. Wilson Achicanoy. Feb. 2023 – Ongoing.
- [G10] Q. Roels. *Estimating the global state of a robot swarm via local communication between robots*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2023 – Jun. 2024.
- [G9] J. Szpirer. *Automatic design of robot swarms by demonstration: addressing sequences of missions via multi-criteria design*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2022 – Aug. 2023.
- [G8] L. Colpaert. *Automatic modular design of robot swarms with Map-Elites*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2022 – Jun. 2023.
- [G7] A. Hasan. *Building an integrated framework for the automatic modular design of robot swarms*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2021 – Aug. 2022.
- [G6] I. Gharbi. *Intuitive mission specification for robot swarm by learning from demonstration*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2021 – Aug. 2022.
- [G5] R. Todesco. *RVR: a new robot platform for swarm robotics research*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2021 – Aug. 2022.
- [G4] F. Trouillez. *Robot recognition using a 360-degree vision module for swarm robots: a new view on swarm robotics*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2021 – May. 2022.
- [G3] G. Spaey. *The influence of random walks on automatic design of robot swarms: an experiment with AutoMoDe*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2018 – Aug. 2019.
- [G2] A. AlFaham. *A family of methods based on NEAT for the automatic design of behaviors of single robots and robot swarms*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2018 – Aug. 2019.

- [G1] M. Kegeleirs. *Developing ROS-based software for the e-puck: an experiment in exploration and mapping*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari. Sep. 2017 – Aug. 2018.

## Bachelor's thesis

- [B5] C. E. Galabay Gomez and D. A. Romero Yanez. *Optimización del robot QUPAS e implementación de su sistema de seguimiento*. Escuela Superior Politécnica del Litoral, Ecuador. Co-supervised with Prof. Christian Tutivén Gálvez. Ongoing.
- [B4] M. S. Aguilar Zambrano and O. A. Yturalde Villegas. *CoopBot: un robot para el estudio de comportamiento colectivo*. Escuela Superior Politécnica del Litoral, Ecuador. Co-supervised with Prof. Christian Tutivén Gálvez. Jun. 2024 – Aug. 2024.
- [B3] G. Madroñero Pachajoa. *Flexibilidad, escalabilidad y robustez de comportamientos colectivos típicos para enjambres de robots*. Universidad de Nariño, Colombia. Co-supervised with Prof. Wilson Achicanoy. Sep. 2023 – Ongoing.
- [B2] J. P. B. Medina. *Diseño automático de enjambres de robots basado en demostraciones visuales*. Universidad de Nariño, Colombia. Co-supervised with Prof. Andrés Pantoja. Sep. 2023 – Dec. 2023.
- [B1] J. Diaz Martinez. *Análisis de comportamientos colectivos de enjambres de robots mediante minería de procesos*. Universidad de Nariño, Colombia. Co-supervised with Prof. Andrés Pantoja. Sep. 2023 – Dec. 2023.

## Interns

- [N6] C. A. Lara Vera. *Extension modules for Mercator: a robot platform for swarm robotics experiments*. Escuela Superior Politécnica del Litoral (ESPOL), Ecuador. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Feb. 2023 – May. 2023.
- [N5] J. Diaz Martinez. *Estudio de la aplicabilidad de la minería de procesos para analizar el comportamiento de sistemas de movilidad*. Universidad de Nariño, Colombia. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Aug. 2022 -- Sep. 2022.
- [N4] J. P. B. Medina. *Estudio de la portabilidad de métricas de enjambres de robots al análisis de sistemas de movilidad*. Universidad de Nariño, Colombia. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Aug. 2022 -- Sep. 2022.
- [N3] G. Madroñero Pachajoa. *Estudio de la portabilidad de las herramientas de simulación de enjambres de robots para simular sistemas de movilidad*. Universidad de Nariño, Colombia. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Aug. 2022 -- Sep. 2022.
- [N2] E. Loems. *Development of a testbed for the characterization of photochromic materials used in swarm robotics*. Université libre de Bruxelles, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Oct. 2021 -- May. 2022.
- [N1] J.-C. Doine. *Realization of a tracking system for monitoring experiments with robot swarms*. IEPSCF-Uccle, Belgium. Co-supervised as teaching assistant with Prof. Mauro Birattari at Université libre de Bruxelles, Belgium. Dec. 2020 -- Mar. 2021.



# Dissemination

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## Exhibitions

- [X1] D. Garzón Ramos, F. Noussa Yao, and M. Birattari. *A swarm of robots: demonstrating collective behaviors with a group of Sphero BOLT robots*. Exposition at FARI Test & Experience Center. Brussels, Belgium. Mar. 2023.

## Invited talks

- [K9] D. Garzón Ramos. *Diseño automático de comportamientos colectivos para enjambres de robots: contexto y experimentos*. Seminario Grupo de Investigación en Sistemas con Retardo (GISRe). San Luís Potosí, Mexico. Apr. 2024.
- [K8] D. Garzón Ramos. *Robótica y enjambres, y algunas lecciones aprendidas en el camino*. Presentation at Ciencia y tecnología. Seminario para los programas de Ingeniería civil en ciencias de datos e Ingeniería civil en informática. Pontificia Universidad Católica de Valparaíso. Valparaíso, Chile. Sept. 2023.
- [K7] D. Garzón Ramos. *Ingeniería de enjambres: de la inspiración al diseño de automático de comportamientos colectivos para robots*. Presentation at Introducción a la Inteligencia de Enjambre: Algoritmos, Robots y Música. 1er Workshop con Egresados UNAL. Universidad Nacional de Colombia. Manizales, Colombia. Mar. 2023.
- [K6] D. Garzón Ramos. *Automatic design of robot swarms: context and experiments*. Presentation at Thursday morning talk, Cluster of Excellence "Science of Intelligence" (SCIOI). Berlin, Germany. Jan. 2023.
- [K5] D. Garzón Ramos. *Robótica de enjambres de la A a la Z: una introducción al diseño de inteligencia colectiva para enjambres de robots*. Presentation at RAS UNMSM Robotic Update, Universidad Nacional Mayor de San Marcos. Lima, Peru. Dec. 2022.
- [K4] D. Garzón Ramos. *Automatic design of robot swarms: a case study on shepherding*. Presentation at NEST Lab, Worcester Polytechnic Institute. Worcester, MA, USA. June 2022.
- [K3] D. Garzón Ramos. *Cuando muchos no son tantos: robots móviles, sistemas multi-robot y enjambres*. Keynote at XIX Feria Tecnológica del Centro de Automatización Industrial, SENA Regional Caldas. Manizales, Colombia. Nov. 2021.
- [K2] D. Garzón Ramos. *Robótica de enjambres: diseñando robots que se comportan como animales sociales*. Presentation at Bioinspiración para el desarrollo de tecnología, Universidad Mariana. Pasto, Colombia. Aug. 2021.
- [K1] D. Garzón Ramos. *Enjambres de robots, qué son y cómo diseñarlos*. Keynote at CEASoft 2020: I Congreso Nacional Virtual de Electrónica, Automatización y Software, SENA. Barranquilla, Colombia. Nov. 2020.

## Publications in media outlets

- [M5] D. Garzón Ramos. *Robotics people – #ICRA2022 Day 5 big wrap-up*. Robohub. <https://robohub.org/robotics-people-icra2022-day-5-big-wrap-up/>. 2022.
- [M4] D. Garzón Ramos. *Robots that act collectively: when, and how? – #ICRA2022 Day 4 interview with K. Petersen, M. A. Olivares Mendez, and T. Kaiser (+ video digest)*. Robohub. <https://robohub.org/robots-that-act-collectively-when-and-how-icra2022-day-4-interview-with-kirstine-hagelskjaer-petersen-miguel-angel-olivares-mendez-and-tanja-katharina-kaiser-video-digest/>. 2022.
- [M3] D. Garzón Ramos. *Connecting robots and people – #ICRA2022 Day 3 interview with Kate Ladenheim (+ video digest)*. Robohub. <https://robohub.org/connecting-robots-and-people-icra2022-day-3-interview-with-kate-ladenheim-video-digest/>. 2022.
- [M2] D. Garzón Ramos. *The art of making robots – #ICRA2022 Day 2 interviews and video digest*. Robohub. <https://robohub.org/the-art-of-making-robots-icra2022-day-2-interviews-and-video-digest/>. 2022.
- [M1] D. Garzón Ramos. *#ICRA2022, the great robotics scicommer – Day 1 video digest*. Robohub. <https://robohub.org/icra2022-the-great-robotics-scicommer-day-1-video-digest/>. 2022.

## Presentations available online

- [O7] D. Garzón Ramos. *Diseño automático de comportamientos colectivos para enjambres de robots: contexto y experimentos*. Presented at: Seminario del Grupo de Investigación en Sistemas con Retardo (GISRe). <https://www.youtube.com/live/f7cYqMhZEe8>. 2024.
- [O6] D. Garzón Ramos. *Diseño de enjambres de robots: un estudio sobre enjambres que coordinan a otros enjambres*. Presented at: Universidad Nacional de Colombia. <https://youtu.be/gnjDAKbIW4U>. 2022.
- [O5] D. Garzón Ramos. *The automatic off-line design of robot swarms: recent advances and perspectives*. Presented at: R2T2: Robotics Research for Tomorrow's Technology. [https://youtu.be/8xU30A\\_GToA](https://youtu.be/8xU30A_GToA). 2021.
- [O4] D. Garzón Ramos. *Introduciendo la robótica de enjambres a entusiastas de la robótica: experiencias y resultados de una colaboración académica*. Presented at: I Congreso Internacional de la Sociedad de Doctores e Investigadores de Colombia (SOPHIC 2021): la ciencia al servicio de la sociedad. <https://youtu.be/ZRC4Dfe2UmA>. 2021.
- [O3] D. Garzón Ramos. *Cuando muchos no son tantos: robots móviles, sistemas multi-robot y enjambres*. Presented at: XIX Feria Tecnológica Centro de Automatización Industrial, SENA. (starts at: 00:05:41) <https://youtu.be/l5TrSsPpkWQ>. 2021.

- [O2] D. Garzón Ramos. *Robótica de enjambres: diseñando robots que se comportan como animales sociales*. Presented at: Bioinspiración para el desarrollo de tecnología, Universidad Mariana. (starts at: 1:10:25) [https://youtu.be/Gtey\\_Mo2L5o](https://youtu.be/Gtey_Mo2L5o). 2021.
- [O1] D. Garzón Ramos. *Enjambres de robots: qué son y cómo diseñarlos*. Presented at: CEASoft 2020: I Congreso Nacional Virtual de Electrónica, Automatización y Software, SENA. <https://youtu.be/lbNQL4JG1AU>. 2020.

## Scientific videos and multimedia

- [V20] M. Kegeleirs, D. Garzón Ramos, G. Legarda Herranz, I. Gharbi, J. Szpirer, K. Hasselmann, L. Garattoni, G. Francesca, and M. Birattari. *Leveraging swarm capabilities to assist other systems*. Presented at: 40th Anniversary of the IEEE Conference on Robotics and Automation (ICRA@40). <https://youtu.be/s-zTDPYx5do>. 2024.
- [V19] D. Garzón Ramos, M. Salman, and M. Birattari. *Stigmergy, robots, and automatic design*. Communication video. <https://youtu.be/vlxAlVXtqpg>. 2024.
- [V18] I. Gharbi, J. Kuckling, D. Garzón Ramos, and M. Birattari. *ICRA 2023 | Inverse reinforcement learning to automatically design robot swarms by demonstration*. Accompanying video. <https://youtu.be/QfzuAdS34J0>. 2023.
- [V17] I. Gharbi, D. Garzón Ramos, M. Kegeleirs, J. Kuckling, G. Legarda Herranz, and M. Birattari. *Jingle swarms, jingle all the way! | A swarm robotics Christmas clip*. Communication video. <https://youtu.be/TV9trgigqNg>. 2022.
- [V16] D. Garzón Ramos, I. Gharbi, M. Kegeleirs, J. Kuckling, G. Legarda Herranz, and M. Birattari. *Paranormal swarmactivity: a ghostly robot swarm that learns from demonstrations!* Communication video. <https://youtu.be/a2q9H78ZCVM>. 2022.
- [V15] D. Garzón Ramos. *ICRA 2022 - Pincuyno gears*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/MfIKoSBZ2Zk>. 2022.
- [V14] D. Garzón Ramos. *ICRA 2022 - R5 Robot Ready*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/YW53aF3Faql>. 2022.
- [V13] D. Garzón Ramos. *ICRA 2022 - Machine lingo*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/um6aVPLKUZM>. 2022.
- [V12] D. Garzón Ramos. *ICRA 2022 - Da Robot Funk*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/6iDo0vfpK7I>. 2022.
- [V11] D. Garzón Ramos. *ICRA 2022 - Kicking off*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/XhTMsPIHfO4>. 2022.
- [V10] D. Garzón Ramos. *ICRA 2022 - Road to Philly! | Video teaser*. Communication video: IEEE International Conference on Robotics and Automation (ICRA 2022). <https://youtu.be/gSRvsK6M8BA>. 2022.
- [V9] I. Gharbi, G. Legarda Herranz, J. Kuckling, M. Kegeleirs, D. Garzón Ramos, and M. Birattari. *Orchestra: Mener les robots à la baguette !* Video presented at: Printemps des Sciences, Fédération Wallonie-Bruxelles. <https://youtu.be/YiPmafVrfdc>. 2022.
- [V8] D. Garzón Ramos, K. Hasselmann, and M. Birattari. *Neuro-evolutionary methods for the automatic design of robot swarms*. Communication video. <https://youtu.be/Sr8zWasO3Vc>. 2021.
- [V7] I. Gharbi, D. Garzón Ramos, J. Kuckling, M. Kegeleirs, G. Legarda Herranz, and M. Birattari. *Swarming lights on winter nights - AutoMoDe edition: a robot swarm ballet*. Communication video. <https://youtu.be/DBhYodX2NcU>. 2021.
- [V6] D. Garzón Ramos, M. Salman, and M. Birattari. *The DEMIURGE project: teaser video*. Communication video. <https://youtu.be/0oJkgxxh3Ms>. 2021.
- [V5] M. Kegeleirs, D. Garzón Ramos, J. Kuckling, I. Gharbi, and M. Birattari. *Automatic design of collective (collecting) behaviors for robot (rabbit) swarms - Easter egg hunt*. Communication video. <https://youtu.be/n9-KdeaNFXc>. 2021.
- [V4] J. Kuckling, M. Kegeleirs, D. Garzón Ramos, and M. Birattari. *La robotique en essaim : L'union fait la force !* Video presented at: Printemps des Sciences, Fédération Wallonie-Bruxelles. <https://youtu.be/WCstqUyEkZw>. 2021.
- [V3] D. Garzón Ramos, M. Salman, K. Hasselmann, and M. Birattari. *Christmas clip - Phormica: photochromic pheromone release and detection system for robot swarms*. Communication video. <https://youtu.be/GM3F04xLQo4>. 2020.
- [V2] D. Garzón Ramos, J. Kuckling, M. Kegeleirs, I. Gharbi, and M. Birattari. *Christmas clip - Automatic design of swarms of Santa's little helpers (a.k.a. robot swarms)*. Communication video. <https://youtu.be/AYYm5o3JubU>. 2020.
- [V1] D. Garzón Ramos, M. Kegeleirs, J. Kuckling, and M. Birattari. *ROS for robot swarms*. Video presented at: ROS World 2020, Open Robotics. <https://youtu.be/vAzHajseoc0>. 2020.