

Jorge Peña

Institute for Advanced Study in Toulouse, 1 Esplanade de l'Université
31080 Toulouse Cedex 6 – France

☎ +33 561 12 86 93 • ✉ jorge.pena@iast.fr • 🌐 jorgeapenas.wordpress.com/

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Academic Positions

Assistant Professor/Tenure-Track Researcher

Institute for Advanced Study in Toulouse, University of Toulouse 1 Capitole

Toulouse, France

since September 2017

Postdoctoral Fellow

Geomar Helmholtz Centre for Ocean Research Kiel

Advisor: Prof. Oscar Puebla

Kiel, Germany

September 2016 – August 2017

Postdoctoral Fellow

Max Planck Institute for Evolutionary Biology

Advisor: Prof. Arne Traulsen

Plön, Germany

September 2013 – August 2016

Postdoctoral Fellow

Faculty of Business and Economics, University of Basel

Advisors: Prof. Georg Nöldeke and Prof. Laurent Lehmann

Basel, Switzerland

April 2012 – August 2013

Graduate Assistant

Faculty of Social and Political Sciences, University of Lausanne

Lausanne, Switzerland

September 2006 – August 2011

Fixed-term Part-time Lecturer

Faculty of Electronics Engineering, Universidad Pontificia Bolivariana

Medellín, Colombia

January 2004 – August 2005

Education

Ph.D. in Applied Mathematics for the Human and Social Sciences

Faculty of Social and Political Sciences, University of Lausanne, Lausanne, Switzerland

2012

Dissertation title: "Conformity, upstream reciprocity and social diversity: secondary mechanisms for the evolution of cooperation"

Supervisors: Prof. Henri Volken and Prof. Marco Tomassini

M.A.S. in Embedded Systems Design

University of Lugano, Lugano, Switzerland

2006

Electronics Engineering

Universidad Pontificia Bolivariana, Medellín, Colombia

2004

5-year degree

Research Interests

Theoretical biology, evolutionary ecology, game theory; special focus on social evolution theory (sociobiology) and collective action problems

Publications

Refereed Journals

Nöldeke, G., **Peña, J.** (2020). "Group size and collective action in a binary contribution game." *Journal of Mathematical Economics* 88, 42-51

Peña, J., Nöldeke, G., Puebla, O. (2020). "The evolution of egg trading in simultaneous hermaphrodites." *The*

American Naturalist 195(3), 524-533

Estrela, S., Libby, E., Van Cleve, J., Débarre, F., Deforet, M., Harcombe, W. R., **Peña, J.**, Brown, S. P., Hochberg, M. E. (2019). "Environmentally mediated social dilemmas." *Trends in Ecology & Evolution*, 34(1), 6-18

Peña, J., Nöldeke, G. (2018). "Group size effects in social evolution." *Journal of Theoretical Biology*, 457, 211-220

Pichugin, Y., **Peña, J.**, Rainey, P., Traulsen, A. (2017). "Fragmentation modes and the evolution of life cycles." *PLOS Computational Biology* 13(11): e1005860

dos Santos, M., **Peña, J.** (2017). "Antisocial rewarding in structured populations." *Scientific Reports* 7: 6212

Peña, J., Wu, B., Arranz, J., Traulsen, A. (2016). "Evolutionary games of multiplayer cooperation on graphs." *PLOS Computational Biology* 12(8): e1005059

Nöldeke, G., **Peña, J.** (2016). "The symmetric equilibria of symmetric voter participation games with complete information." *Games and Economic Behavior*, 99, 71-81

Peña, J., Wu, B., Traulsen, A. (2016). "Ordering structured populations in multiplayer cooperation games." *Journal of the Royal Society Interface*, 13: 20150881

Peña, J., Nöldeke, G. (2016). "Variability in group size and the evolution of collective action." *Journal of Theoretical Biology*, 389, 72-82

Peña, J., Nöldeke, G., Lehmann, L. (2015). "Evolutionary dynamics of collective action in spatially structured populations." *Journal of Theoretical Biology*, 382, 122-136

Peña, J., Lehmann, L., Nöldeke, G. (2014). "Gains from switching and evolutionary stability in multi-player matrix games." *Journal of Theoretical Biology*, 346, 23-33

Peña, J., Rochat, Y. (2012). "Bipartite graphs as models of population structures in evolutionary multiplayer games." *PLOS ONE*, 7(9): e44514

Peña, J. (2012). "Group-size diversity in public goods games." *Evolution*, 66, 623-636

Buesser, P., **Peña, J.**, Pestelacci, E., Tomassini, M. (2011). "The influence of tie strength on evolutionary games on networks: an empirical investigation." *Physica A*, 390, 4502-4513

Peña, J., Pestelacci, E., Berchtold, A., Tomassini, M. (2011). "Participation costs can suppress the evolution of upstream reciprocity." *Journal of Theoretical Biology*, 273, 197-206

Peña, J., Volken, H., Pestelacci, E., Tomassini, M. (2009). "Conformity hinders the evolution of cooperation on scale-free networks." *Physical Review E*, 80, 016110

Refereed Proceedings in Computer Science

Peña, J., Pestelacci, E., Tomassini, M., Volken, H. (2009). "Conformity and network effects in the prisoner's dilemma." In *Proceedings of the IEEE Congress on Evolutionary Computation, 2009*, pp. 506-513

Montes De Oca, M. A., **Peña, J.**, Stützle, T., Pinciroli, C., Dorigo, M. (2009). "Heterogeneous particle swarm optimizers." In *Proceedings of the IEEE Congress on Evolutionary Computation, 2009*, pp. 698-705

Peña, J. (2008). "Conformist transmission and the evolution of cooperation." In *Artificial Life XI: Proceedings of the Eleventh International on the Simulation and Synthesis of Living Systems*, pp. 458-465. MIT Press, Cambridge, MA

Peña, J. C., **Peña, J.**, Upegui, A. (2008). "Evolutionary graph models with dynamic topologies on the ubiclip." In *Evolvable Systems: From Biology to Hardware. Proceedings of the 8th International Conference, ICES 2008. Lecture Notes in Computer Science* 5216, pp. 59-70

Peña, J. (2008). "Simple dynamic particle swarms without velocity." In *Ant Colony Optimization and Swarm Intelligence. Proceedings of the 6th International Conference, ANTS 2008. Lecture Notes in Computer Science* 5217, pp. 144-154

- Peña, J.** (2008). "Theoretical and empirical study of particle swarms with additive stochasticity and different recombination operators." In *Proceedings of the 10th Annual Conference on Genetic and Evolutionary Computation, GECCO '08*, pp. 95-102. ACM, New York, NY
- Peña, J.**, Upegui, A. (2007). "A population-oriented architecture for particle swarms." In *Proceedings of the Second NASA/ESA Conference on Adaptive Hardware and Systems, 2007*, pp. 563-570
- Peña, J.**, Upegui, A., Sanchez, E. (2006). "Particle swarm optimization with discrete recombination: an online optimizer for evolvable hardware." In *Proceedings of the First NASA/ESA Conference on Adaptive Hardware and Systems, 2006*, pp. 163-170
- Peña, J.**, Vanegas, M., Valencia, A. (2006). "Digital hardware architectures for Kohonen's self-organizing feature maps with exponential neighboring function." In *Proceedings of the IEEE International Conference on Reconfigurable Computing and FPGAs, 2006*, pp. 1-8

Preprints

- González-Forero, M., **Peña, J.** "Eusociality through conflict dissolution" *bioRxiv* 2020.09.29.316877
- Cooper, G. A., **Peña, J.**, Liu, M., West S. A. "Mechanisms to divide labour in social microorganisms" *bioRxiv* 2020.02.25.964643

Talks and Posters

Invited Seminars

- Queen Mary University of London, Complex Systems Seminar, December 2020
- Sorbonne Université, Laboratoire Jean Perrin, February 2019
- University Claude Bernard Lyon, Laboratoire de Biométrie et Biologie Évolutive, October 2018
- Aarhus University, Department of Bioscience, April 2018
- Toulouse School of Economics, MAD-Stat seminar series, March 2018
- University of St Andrews, School of Biology, July 2017
- Monash University, Faculty of Information Technology, November 2016
- Santa Fe Institute, June 2016
- Institute for Advanced Study in Toulouse, May 2015
- University of Lausanne, Department of Ecology and Evolution, June 2013
- Max Planck Institute for Evolutionary Biology, Research Group for Evolutionary Theory, May 2013
- Universidad Carlos III de Madrid, Department of Mathematics, May 2012
- Université Pierre & Marie Curie, Séminaires Ecologie et Evolution, May 2012
- Universidad Pontificia Bolivariana, Escuela de Ingenierías, February 2012
- Max Planck Institute for Evolutionary Biology, Research Group for Evolutionary Theory, November 2011
- Universidad Pontificia Bolivariana, Escuela de Ingenierías, March 2011
- Universidad EAFIT, Departamento de Ciencias Matemáticas, March 2011
- Universidad de Antioquia, Departamento de Matemáticas, March 2011

Workshops and Conferences

- ESEB 2019 (Turku), Congress of the European Society for Evolutionary Biology, talk
- MMEE 2019 (Lyon), Mathematical Models in Ecology and Evolution Conference, talk
- Edinburgh Napier University, Workshop on Evolution and Dynamics of Institutions, May 2019, talk
- EHBEA 2019 (Toulouse), 14th Annual Conference for the European Human Behaviour and Evolution Association,

poster

Evolution 2018 (Montpellier), II Joint Congress on Evolutionary Biology, talk

SHOW 2018 (Paris), Simultaneously Hermaphroditic Organisms Workshop, talk

MMEE 2017 (London), Mathematical Models in Ecology and Evolution Conference, talk and poster

Max Planck Institute for Evolutionary Biology (Plön), Workshop on Conflict, Competition, Cooperation & Complexity Workshop, January 2016, talk

MMEE 2015 (Paris), Mathematical Models in Ecology and Evolution Conference, talk

Institute for Advanced Study in Toulouse, Toulouse Economics and Biology Workshop, June 2015, poster

ECMTB 2014 (Gothenburg), 9th European Conference on Mathematical and Theoretical Biology, talk

Max Planck Institute for Evolutionary Biology (Plön), Spatial Human Cooperation Meeting, May 2014, talk

Institute for Advanced Study in Toulouse, Toulouse Economics and Biology Workshop, May 2014, poster

Max Planck Institute for Evolutionary Biology (Plön), 6th Workshop on Theoretical Biology, talk

Inclusive Fitness and Game Theory Workshop (Arolla), May 2013, talk

University of Basel, 4th Bernoulli Workshop in Economics and Psychology, June 2012, talk

MMEE 2011 (Groningen), Mathematical Models in Ecology and Evolution Conference, poster

Social Decision Making: Bridging Economics and Biology Workshop (Monte Verità), March 2011, poster

ECCS 2010 (Lisbon), European Conference on Complex Systems, poster

SUNBELT XXX (Riva del Garda), SUNBELT Conference of the International Network for Social Network Analysis, talk

Evolution of Cooperation – Models and Theories Conference (Laxenburg), September 2009, poster

CEC 2009 (Trondheim), IEEE Congress on Evolutionary Computation, talk

ANTS 2008 (Brussels), 6th International Conference on Ant Colony Optimization and Swarm Intelligence, talk and poster

ALIFE 2008 (Winchester), 11th International Conference on Artificial Life, talk

GECCO 2008 (Atlanta), 10th Annual Conference on Genetic and Evolutionary Computation, talk

AHS 2007 (Edinburgh), 2nd NASA/ESA Conference on Adaptive Hardware and Systems, talk

AHS 2006 (Istanbul), 1st NASA/ESA Conference on Adaptive Hardware and Systems, talk

Grants and Awards

Swiss National Science Foundation – Early Mobility Postdoc Fellowship. PBLAP3-145860: “Multiplayer game theory and the evolution of collective action.” 42,500 CHF. 2013–2014

Swiss Government Excellence Scholarship for Foreign Scholars and Artists. 21,840 CHF. 2005–2006

Beca Municipio de Medellín a los Mejores Bachilleres. 1999–2003

Teaching Experience

“Population Demography and Evolutionary Ecology” (Fall 2019, 24 CM hours; Fall 2018, 18 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Matrix population models)

“Introduction to Ecology for Economists (M2EIGF2)” (Fall 2019, 15 CM hours; Fall 2018, 15 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Introduction to population ecology)

“Mathématiques TD 15h (L1EPDD1)” (Fall 2019, 15 TD hours), Toulouse School of Economics, undergraduate course (Licence 1)

“Probabilités de gestion (LMAT04) - TD (L2GC062)” (Fall 2019, 7.5 TD hours, 3 groups), Toulouse School of Management, undergraduate course (Licence 2)

“Probabilités TD (LEE2AED)” (Fall 2018, 15 TD hours, 2 groups), Toulouse School of Economics

“Advanced Behavioral and experimental Economics II (DUEB0309)” (Spring 2018, 6 CM hours), Toulouse School of Economics, Doctoral program DEEQA. (Segment: Social evolution theory)

“Economics and the environment for Economists (M2EIGA2)” (Fall 2017, 15 CM hours), Toulouse School of Economics, Master 2 Environmental and Natural Resource Economics (ERNA), Ecology and Economics path (EEC). (Segment: Introduction to population ecology)

“Economics and Evolution (DUEB0274)” (Spring 2017, 7.5 CM hours), Toulouse School of Economics, Doctoral program DEEQA. (Segment: Population and evolutionary dynamics)

“Evolutionary Dynamics: Game Theory (MA4454)” (Fall 2014, 8 hours), University of Lübeck, Mathematics in Medicine and the Life Sciences. (Invited lectures)

“Mathematics II (Graphs and networks)”, “Mathematics IV (Complexity)” (2006–2011), University of Lausanne, Faculty of Social and Political Sciences. (Teaching assistant for Henri Volken)

“Statistics I” (2006–2011), University of Lausanne, Faculty of Social and Political Sciences. (Teaching assistant for Jean-Philippe Antonietti)

“Electronic Circuits II Lab”, “Automatic Control Systems Lab”, “Artificial Intelligence” (2004–2005), Universidad Pontificia Bolivariana, Faculty of Electronics Engineering. Fixed-term part-time lecturer (Profesor de Cátedra)

Professional Service

Journal referee for *The American Naturalist*, *Artificial Life*, *Behavioral Ecology and Sociobiology*, *Biology & Philosophy*, *BioSystems*, *Communications Biology*, *Cognition*, *Current Opinion in Insect Science*, *Dynamic Games and Applications*, *Ecology Letters*, *Europhysics Letters*, *Evolution*, *Games*, *IEEE Access*, *IEEE Transactions on Automatic Control*, *IEEE Transactions on Evolutionary Computation*, *IEEE Transactions on Systems, Man and Cybernetics*, *Journal of Mathematical Biology*, *Journal of the Royal Society Interface*, *Journal of Theoretical Biology*, *Management Science*, *Mathematical Biosciences*, *Mathematical Social Sciences*, *Nature Communications*, *Neural Computing & Applications*, *Oikos*, *PeerJ*, *Philosophical Transactions of the Royal Society B*, *PLOS Computational Biology*, *PLOS ONE*, *Proceedings of the Royal Society B*, *Royal Society Open Science*, *Science Advances*, *Scientific Reports*, *Swarm Intelligence*, *Theoretical Population Biology*

Book proposal referee for *Oxford University Press*, *Springer Nature*

Grant proposal referee for *Research Foundation – Flanders (FWO)*, *European Research Council (ERC)*

Workshop co-organizer: “The Biology and Economics of Mutualisms Workshop” at the Max Planck Institute for Evolutionary Biology (November 2017); Mni-symposium “Social Evolution in Subdivided Populations: Beyond the Usual Assumptions” at MMEE 2017

Member of the program committee at computer science conferences: ANTS (2016, 2012), ICANGA 2013, GECCO (2008–2013), CEC (2009–2011)