CARLOS G. DIUK-WASSER

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CURRENT POSITION

2013-present FACEBOOK, INC. Data and Research Scientist in the Computational Social Science team, within Facebook's Core Data Science.

The Computational Social Science and Core Data Science teams are research and innovation teams that work across Facebook's family of apps. We work on long-term, higher-risk, open research problems, often under a consulting model.

EDUCATION

2010 PhD IN COMPUTER SCIENCE, Rutgers University-New Brunswick. Dissertation: "An Object-oriented Representation for Efficient Reinforcement Learning". Advisor: Michael Littman.

2003 LICENCIATURA IN COMPUTER SCIENCE (6-year degree), University of Buenos Aires. Thesis: "A Computational Tool for the Reconstruction of   Genealogies".

PROFESSIONAL AND RESEARCH EXPERIENCE

2009-2013 PRINCETON UNIVERSITY. Research Scientist (2013) and Postdoctoral Research Associate (2009-2012). Yael Niv and Matthew Botvinick laboratories.   Department of Psychology and Neuroscience Institute.

2007   GOOGLE (NY). Graduate Summer Intern in the Personalized Search group.

2006   INTEL RESEARCH. Graduate Research Intern in the Distributed Detection and Inference group.

2004   YALE UNIVERSITY. Developer of web infrastructure for research projects in the Dept. of Public Health.

1998-03   UNIVERSITY OF BUENOS AIRES. Research Assistant for Enrique Tándeter, developing algorithms for genealogy reconstruction from historical records.

2003   Project Manager at Tecnonexo (USA office).

2000-03   Independent consultant for more than 10 major companies in Argentina

1998-00   Project Leader at Lemma Informatics for Movicom/Bellsouth Argentina and   the Public Libraries of the City of Buenos Aires

PUBLICATIONS

Journals and Peer-reviewed Proceedings

Alec Solway, <u>Carlos Diuk</u>, Natalia Córdoba, Debbie Yee, Andrew G. Barto, Yael Niv and Matthew Botvinick
Optimal Behavioral Hierarchy. *PLOS Computational Biology, 2014*

Luciano Paz, Andrea Goldin, <u>Carlos Diuk</u> and Mariano Sigman
Parsing heuristic and forward search in first-graders game-play behavior. *Cognitive Science. 2014*

<u>Carlos Diuk</u>, Karin Tsai, Jonathan Wallis, Matthew Botvinick and Yael Niv (2013) **Hierarchical learning induces two simultaneous, but separable, prediction errors in human basal ganglia.** *The Journal of Neuroscience, 33 (13), 5797-5805.*

<u>Carlos Diuk</u>, Anna Schapiro, Natalia Córdova, Yael Niv and Matthew Botvinick (in press). **Divide and conquer: hierarchical reinforcement learning and task decomposition in humans.** *In "Computational and Robotic Models of the Hierarchical Organization of Behavior" book.* Baldassare G, Mirolli M (Eds.). Springer Verlag.

<u>Carlos Diuk</u>, Diego F. Slezak, Iván Raskovsky, Mariano Sigman and Guillermo Cecchi (2012). **A quantitative philology of introspection.** *Frontiers of Integrative Neuroscience, 6 (80), 1-12.*

José J.F. Ribas-Fernandes, Alec Solway, <u>Carlos Diuk</u>, Joseph T. McGuire, Andrew G. Barto, Yael Niv and Matthew M. Botvinick (2011). **A Neural Signature of Hierarchical Reinforcement Learning.** *Neuron*, 71 (2), 370-379.

Thomas J. Walsh, Kaushik Subramanian, Michael L. Littman and <u>Carlos Diuk</u> (2010). **Generalizing Apprenticeship Learning across Hypothesis Classes.** *Proceedings of the Twenty-Seventh International Conference on Machine Learning (ICML-10),* Haifa, Israel.

<u>Carlos Diuk</u>, Lihong Li and Bethany R. Leffler (2009). **The Adaptive k-Meteorologists Problem and Its Application to Structure Learning and Feature Selection in Reinforcement Learning.** *Proceedings of the Twenty-*

Sixth International Conference on Machine Learning (ICML-09), Montreal, Canada.

Thomas Walsh, Istvan Szita, <u>Carlos Diuk</u> and Michael Littman (2009). **Exploring compact reinforcement-learning representations with linear regression.** *Proceedings of the Twenty-Fifth Conference in Uncertainty in Artificial Intelligence (UAI-09),* Montreal, Canada.

<u>Carlos Diuk</u>, Andre Cohen and Michael Littman (2008). **An Object-Oriented Representation for Efficient Reinforcement Learning.** *Proceedings of the Twenty-Fifth International Conference on Machine Learning (ICML-08),* Helsinki, Finland.

<u>Carlos Diuk</u> and Michael Littman (2009). **Hierarchical Reinforcement Learning.** *Encyclopedia of Artificial Intelligence, IGI Global.* Juan R. Rabuñal, Julian Dorado, Alejandro Pazos (Eds.)

Alexander L. Strehl, <u>Carlos Diuk</u> and Michael L. Littman (2007). **Efficient Structure Learning in Factored-state MDPs.** *Proceedings of the Twenty-Second AAAI Conference on Artificial Intelligence,* Vancouver, Canada.

<u>Carlos Diuk</u>, Alexander Strehl and Michael Littman (2006). **A Hierarchical Approach to Efficient Reinforcement Learning in Deterministic Domains.** *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multiagent Systems.* Hakodate, Japan.

<u>Carlos Diuk</u> and Enrique Tándeter (2002). **Computer tools for reconstructing a genealogy.** *International Journal of History and Computing,* 12 (3), 329-346.

Peer-reviewed full-paper Workshops and Technical Reports

David Wingate, <u>Carlos Diuk</u>, Timothy O'Donnell, Joshua Tenenbaum and Samuel Gershman (2013). **Compositional policy priors.** *MIT CSAIL Technical Report 2013-007.*

Ivan Raskovsky, Diego Fernández Slezak, <u>Carlos Diuk</u> and Guillermo Cecchi (2010). **The emergence of the modern concept of introspection: a quantitative linguistic analysis.** *North American Association for Computational Linguistics Young Researchers Workshop.* Los Angeles, CA, USA.

John Mark Agosta, <u>Carlos Diuk</u>, Jaideep Chandrashekar and Carl Livadas (2007). **An adaptive anomaly detector for worm detection.** *Second Workshop on Systems and Machine Learning.* Cambridge, MA, USA.

<u>Carlos Diuk</u>, Michael L. Littman, Alexander L. Strehl (2006). **Efficient exploration and learning of structure in factored-state MDPs.** *Towards a New Reinforcement Learning Workshop (NIPS-06).* Vancouver, Canada.

<u>Carlos Diuk</u>, Michael L. Littman, and Alexander L. Strehl (2005). **A Hierarchical Approach to Efficient Reinforcement Learning in Factored State Spaces.** *Rich Representations for Reinforcement Learning Workshop (ICML-05).* Bonn, Germany.

Abstracts, Workshop Presentations and Posters

<u>Carlos Diuk</u>, Debbie Yee, José Ribas-Fernandes, Natalia Cordova, Anna Schapiro, Yael Niv, Matthew Botvinick (2012). **Divide and Conquer: Task Decomposition in Humans**. *Society of Neuroscience Meeting 2012 (38) 592.20.* New Orleans, LA, USA.

<u>Carlos Diuk</u>, Matthew Botvinick and Yael Niv (2011). **Two coincident but separable reward prediction errors in human ventral striatum**. *Society of Neuroscience Meeting 2011 (37) 827.14.* Washington, DC, USA.

<u>Carlos Diuk</u>, José Ribas-Fernandes, Natalia Córdova, Matthew Botvinick and Yael Niv (2011). **Hierarchical behavior and the brain: a reinforcement learning perspective.** *Computational and Systems Neuroscience (Cosyne-2011).* Salt Lake City, Utah.

<u>Carlos Diuk</u>, Matthew Botvinick, Andrew Barto and Yael Niv (2010). **Hierarchical Reinforcement Learning: An fMRI Study of learning in a two-level gambling task.** *Society of Neuroscience Meeting 2010 (36) 907.14.* San Diego, CA, USA.

<u>Carlos Diuk</u> (2009). **Tools for learning reinforcement learning representations**. *Fourth Barbados Workshop on Reinforcement Learning.* Holetown, Barbados.

<u>Carlos Diuk</u> (2008). **Object-oriented MDPs**. *Third Barbados Workshop on Reinforcement Learning.* Holetown, Barbados.

Thomas J. Walsh, <u>Carlos Diuk</u> and Michael Littman (2006). **Using Classifiers to Transfer Knowledge**. *New York Academy of Sciences Machine Learning Symposium*. New York, NY, USA.

TEACHING

2013	PSY/NEU 259 ASSISTANT INSTRUCTOR Introduction to Cognitive Neuroscience. *Princeton University*
2012	VISITING PROFESSOR UNIVERSITY OF BUENOS AIRES
2012	INSTRUCTOR AND CO-ORGANIZER. *Princeton-Champalimaud Reinforcement Learning course. Lisbon, Portugal.*
2010	COMPUTER SCIENCE WINTER SCHOOL (ECI 2010) - UNIVERSITY OF BUENOS AIRES. *Invited to teach the course "Reinforcement Learning: Theory and Applications in Robotics, Games and Neuroscience."*
2008	RUTGERS UNIVERSITY NEW BRUNSWICK. *Co-organizer of "Bayesian Reinforcement Learning" seminar.*
2003-04	RUTGERS UNIVERSITY NEW BRUNSWICK. *Teaching Assistant for senior undergraduate class "Design & Analysis of Algorithms". Worked with Professors Martin Farach-Colton, S. Muthukrishnan and Leonid Kachiyan.*
1999-02	UNIVERSITY OF BUENOS AIRES. *Teaching Assistant and Instructor for first-year course "Algortihms and Data Structures 1". Position obtained in annual contests.*

STUDENT MENTORING

Advisor for Anthony Lenton's MSc in Data Mining at U. of Buenos Aires (ongoing)

Co-advisor (with Yael Niv) for Dominic Kao's MSc in Computer Science at Princeton University (2011).

Advisor for Pablo Rodriguez Zivic's Licenciatura in Computer Science at the University of Buenos Aires (2010).

Mentor of a group of high-school students of New Jersey Governor's School Program of Engineering and Technology (Summer 2009).

(DATA) SCIENCE POPULARIZATION

[TEDx](#) Talk on social networks.

[Three and a half degrees of separation](#): How connected is the Facebook graph?

[World Cup Fan Migration](#): How fan support migrates from team to team during World Cup 2014.

The Formation of Love: How couples interact before and after the relationship is formed. (also here)

Cupid in your Network: The network properties of Facebook matchmakers.

Video of my Ignite San Francisco 2014 talk: *A quantitative philology of introspection.*

SELECTED TALKS

2014	SOCIAL INFORMATICS 2014. *Invited speaker at DYAD Workshop.*
2011	RUTGERS UNIVERSITY - NEW BRUNSWICK. *Reinforcement Learning in the Brain.*
2011	PRINCETON UNIVERSITY. *Neuroscience of Social Decision Making invited speaker.*
2008	UNIVERSITY OF MASSACHUSSETTS - AMHERST. *Invited speaker.*
2008	UNIVERSITAT POMPEU FABRA (Barcelona, Spain).
2006	AAMAS HIERARCHICAL AGENTS WORKSHOP. *Invited speaker.*
2005	UNIVERSIDAD DE BUENOS AIRES (Argentina).

SERVICE AND PROFESSIONAL ACTIVITIES

Ad-hoc Journal Reviewer:
> *Journal of Neuroscience, Cognition, Neurocomputing, Trends in Cognitive Sciences (TICS), Journal of Artificial Intelligence Research (JAIR), Adaptive Behavior, Artificial Intelligence, Journal of Autonomous Agents and Multiagent Systems (JAAMAS), Frontiers in Decision Neuroscience*

Conference Reviewer / Program Committee member:
> *Neural Information Processing Systems (NIPS, multiple)*
> *International Conference on Machine Learning (ICML 2010-2015)*
> *Knowledge Discovery and Datamining (KDD 2015, 2016)*
> *European Conference in Machine Learning (ECML, multiple)*
> *European Workshop on Reinforcement Learning (EWRL 2011, 2012)*
> *Association for the Advancement of Artificial Intelligence (AAAI, multiple)*
> *International Joint Conference in Artificial Intelligence (IJCAI 2011, 2016)*
> *Artificial Intelligence and Statistics (AI-Stats 2011)*
> *Intn'l Conf. on Pattern Recognition Apps and Methods (ICPRAM 2012, 2013)*
> *International Conference on Robotics and Automation (ICRA 2011)*

    AAAI-11 Workshop on Lifelong Learning from Sensorimotor Experience
    ICML/UAI/COLT-09 Workshop on Abstraction in Reinforcement Learning
    AAAI Video Competition (2008, 2009, 2010)
    ECAI-08 Workshop on Machine Learning and Planning
    AGRANDA 2015 (1ˢᵗ Argentinian Conference on Big Data)

Grant evaluator for Netherlands Organization for Scientific Research (NWO) 2012.

Grant evaluator for PICT 2010 (Argentina's Agency for Science and Technology Promotion) and UBACyT 2012 (University of Buenos Aires) grant programs.

Evaluator of candidate Researchers for Argentina's Research Council.

Chair Technical Committee of the Reinforcement Learning Competition (2009).

Judge in Princeton Undergraduate Research Symposium (2011).

President of the Graduate Student Association of Rutgers University (2006-2008).

President of the Computer Science Graduate Student Society of Rutgers University (2004-05).

Student member of the Computer Science Governing Council at University of Buenos Aires (elected for three consecutive periods, 1998-2001).