Sebastian Musslick

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Current position

PhD Candidate, Princeton Neuroscience Institute

Education

2014-present PH.D., Princeton University, Neuroscience, Advisor: Jonathan D. Cohen
Quantitative and Computational Neuroscience Track
2014-2016 M.A., Princeton University, Neuroscience, Advisor: Jonathan D. Cohen
2008-2014 Diplom (M.S. equivalent), Technische Universität Dresden, Psychology (*Graduated with Distinction*), Advisor: Thomas Goschke
Diplom Thesis: "The Role of Task-Feature Bindings in Cued Task Switching."

Pre-Doctoral Research Experience

2013-2014 Visiting Student Research Scholar, Princeton University, PI: Jonathan D. Cohen
2012-2013 Short-Term Scholar, Colorado University at Boulder, PI: Randall C. O'Reilly
2011-2013 Student Research Assistant, Technische Universität Dresden, PI: Clemens Kirschbaum
2011-2012 Student Research Assistant, Technische Universität Dresden, PI: Thomas Goschke
2008-2012 Freelance Work, Software Development and Design

Honors & Awards

2018 ReMatch award for undergraduate mentoring, Princeton University
2017 Graduate Fellow in Cognitive Science, Princeton University
2015 Ehrenfried-Walter-von-Tschirnhaus-Award for best graduates of the School of Science, Technische Universität Dresden
2014-15 McDonnell Fellowship in Neuroscience, Princeton University
2014 Werner-Straup-Award for distinctive achievements in scientific qualification, Technische Universität Dresden
2014 Doctoral Scholarship of the Collaborative Research Center "Volition and Cognitive Control" at the Technische Universität Dresden
2012-14 National Scholarship (Deutschlandstipendium)

2012-13 DAAD PROMOS Global Scholarship

2012 "Karl-und-Charlotte-Bühler-Preis" for excellent teaching, Technische Universität Dresden

Publications & Presentations

Forthcoming

Petri, G., **Musslick, S.**, Öczimder K., Dey B., Ahmed N., Willke T., Cohen J. D. (in prep). Universal limits to parallel processing capability of network architectures.

Dey B., Özcimder K., **Musslick S.**, Petri G., Ahmed N. K., Willke T., Cohen J. D. (in prep). A Formal Approach to the Requirements for Cognitive Control in Network Architectures.

Musslick S., Cohen J. D., Shenhav, A. (in prep). Estimating the costs of cognitive control from task performance: theoretical validation and potential pitfalls.

Musslick S., Shenhav A., Botvinick M.M., Cohen J. D. (in prep). A computational model of control allocation based on the Expected Value of Control.

Musslick S., Öczimder K., Dey B., Saxe A., Petri G., Reichman D., Mennen A., Krieger P., Ahmed N., Willke T., Cohen J. D. (in prep). On the rational boundedness of cognitive control: Interactive versus independent parallelism.

Peer-Reviewed Journal Articles

Shenhav A., Straccia, M., **Musslick S.**, Cohen J. D., Botvinick M.M. (2018). Dissociable neural mechanisms track evidence accumulation for selection of attention versus action. Nature Communications, 9(1), 2485.

Lieder, F., Shenhav, A., **Musslick, S.**, Griffiths, T. L. (2018). Rational metareasoning and the plasticity of cognitive control. PLOS Computational Biology. 14(4), 1-27.

Shenhav A., **Musslick S.**, Lieder F., Kool W., Griffiths T. L., Cohen J. D., Botvinick M. M. (2017). Toward a rational and mechanistic account of mental effort. Annual Review of Neuroscience. 40, 99-124.

Peer-Reviewed Conference Articles

Bustamante L., Lieder F., **Musslick S.**, Shenhav A., Cohen J. D. (2018). Learning to (mis)allocate control: maltransfer can lead to self-control failure. Computational Cognitive Neuroscience Conference. [Poster]

Musslick S., Cohen J. D., Shenhav A. (2018). Estimating the costs of cognitive control: theoretical validation and potential pitfalls. Proceedings of the 40th Annual Meeting of the Cognitive Science Society. Wisconsin, pp. 800-805 [Contributed Talk]

Musslick S., Jang J. S., Shvartsman M., Shenhav A., Cohen J. D. (2018). Constraints associated with cognitive control and the stability-flexibility dilemma. Proceedings of the 40th Annual Meeting of the Cognitive Science Society. Wisconsin, pp. 806-811 [Contributed

Talk]

Sagiv Y., **Musslick S.**, Niv Y., Cohen J. D. (2018). Efficiency of learning vs. processing: Towards a normative theory of multitasking. Proceedings of the 40th Annual Meeting of the Cognitive Science Society. Wisconsin, pp. 1004-1009 [Contributed Talk; *Awarded for Best Modeling Work in Higher-Level Cognition*]

Alon, N., Reichman, D., Shinkar, I., Wagner, T., **Musslick, S.**, Cohen J. D., Griffiths, T., Dey, B., Özcimder, K. (2017). A Graph-Theoretic Approach to Multitasking. Advances in Neural Information Processing Systems. Long Beach, pp. 2097-2106. [Contributed Talk]

Musslick S., Saxe A., Özcimder K., Dey B., Henselman G., Cohen J. D. (2017). Multitasking capability versus learning efficiency in neural network architectures. Proceedings of the 39th Annual Meeting of the Cognitive Science Society. London, pp. 829-34 [Contributed Talk]

Özcimder K., Dey B., **Musslick S.**, Petri G., Ahmed N. K., Willke T., Cohen J. D. (2017). A formal approach to modeling the cost of cognitive control. Proceedings of the 39th Annual Meeting of the Cognitive Science Society. London, pp. 895-900 [Contributed Talk]

Bustamante L., Lieder F., **Musslick S.**, Shenhav A., Cohen J. D. (2017). Learning to (mis)allocate control: maltransfer can lead to self-control failure. Reinforcement Learning and Decision Making Conference 2017. [Poster]

Musslick S., Dey B., Özcimder K., Patwary M., Willke T. L., Cohen J. D. (2016). Controlled vs. Automatic Processing: A graph-theoretic approach to the analysis of serial vs. parallel processing in neural network architectures. Proceedings of the 38th Annual Meeting of the Cognitive Science Society. Philadelphia, pp. 1547-52 [Contributed Talk]

Musslick S., Shenhav A., Botvinick M. M., Cohen J. D. (2015). A computational model of control allocation based on the Expected Value of Control. Reinforcement Learning and Decision Making Conference 2015. [Poster, *selected for spotlight presentation*]

Peer-Reviewed Workshop Contributions

Cherkaev, A., **Musslick S.**, Cohen J. D., Srikumar, V., Flatt, M. (2017). SweetPea: A Language for Designing Experiments. The 45th Symposium on Principles of Programming Languages (POPL). [Contributed Talk]

Musslick S., Dey B., Özcimder K., Patwary M., Willke T. L., Cohen J. D. (2016). Parallel processing capability versus efficiency of representation in neural networks. 15th Neural Computation and Psychology Workshop. [Contributed Talk]

Musslick S., Cohen J.D. (2015). The computational tradeoff between multiuse and multitasking in neural networks. NIPS Workshop on Bounded Optimality and Rational Metareasoning. [Poster]

Conference Abstracts

Musslick S., Jang J. S., Shvartsman M., Shenhav A., Cohen J. D. (2018). The cost of cognitive control as a solution to the stability-flexibility dilemma. Society for Neuroeconomics Annual Meeting. Philadelphia. [Poster, *selected for spotlight presentation*]

Novick A., **Musslick S.**, Iordan C., Cohen J. D., Shenhav A. (2018). Why we struggle to multitask: Converging evidence from computational modeling, human behavior, and neuroimaging. Society for Neuroscience (SfN) Annual Meeting. San Diego. [Poster]

Musslick S., Cohen J. D., Shenhav A. (2018). Estimating the costs of cognitive control: theoretical validation and potential pitfalls. Society for Neuroscience (SfN) Annual Meeting. San Diego. [Poster]

Musslick S., Öczimder K., Dey B., Saxe A., Petri G., Reichman D., Mennen A., Willke T., Cohen J. D. (2018). On the rational boundedness of cognitive control. Association for Psychological Science. [Poster]

Musslick S., Cohen J. D., Shenhav A. (2017). Estimating the costs of cognitive control: theoretical validation and potential pitfalls. Society for Neuroeconomics Annual Meeting. Toronto. [Poster]

Musslick S., Jang J. S., Panichello M., Bustamante L., Shenhav A., Cohen J. D. (2017). Constraints associated with cognitive control and the stability-flexibility dilemma. Society for Neuroscience (SfN) Annual Meeting. [Contributed Talk]

Bustamante L., Lieder F., **Musslick S.**, Shenhav A., Cohen J. D. (2017). Learning to (mis)allocate control: maltransfer can lead to self-control failure. Society for Neuroscience (SfN) Annual Meeting. [Contributed Talk]

Petri G., **Musslick S.**, Özcimder K., Dey B., Ahmed, N., Willke, T. L., Cohen J. D. (2017). Universal limits to parallel processing capability of neural systems. Conference on Complex Systems 2017. [Contributed Talk]

Petri G., **Musslick S.**, Özcimder K., Dey B., Ahmed, N., Willke, T. L., Cohen J. D. (2017). Diminishing returns with size for parallel computation capacity of neural architectures. NetSci 2017. [Contributed Talk]

Momennejad I., Reverberi C., **Musslick S.**, Cohen J. D., Haynes J.-D. (2016). The role of task similarity in encoding and executing planned task sequences. Society for Neuroscience (SfN) Annual Meeting. [Poster]

Musslick S., Dey B., Özcimder K., Patwary M., Krieger P. Willke T. L., Cohen J. D. (2016). Multitasking capacity versus efficiency of representation in neural network architectures. Computational models of decision making nanosymposium, Society for Neuroscience (SfN) Annual Meeting. [Contributed Talk]

Shenhav A., **Musslick S.**, Botvinick M.M., Cohen J. D. (2015). Anterior cingulate and the expected value of control. Society for Psychophysiological Research. [Contributed Talk]

Musslick S., Shenhav A., Botvinick M.M., Cohen J. D. (2015). A computational model of con-

trol allocation based on the Expected Value of Control. Society for Neuroscience (SfN) Annual Meeting. [Poster]

Zimmermann U., **Musslick S.**, Ruge H., Goschke T. (2013). The multidimensional nature of flexible task-control. Spring School CRC 940 Volition and Cognitive Control. [Poster]

Invited Talks

05/2019 Symposium at the Control Processes Meeting 2019, Brown University. Providence, RI
03/2019 Symposium on the "Neural Mechanisms of Effort Mobilization and Cognitive Control" at the International Convention of Psychological Science. Paris, France
07/2018 Lunch Talk at the Center for Magnetic Resonance Research, University of Minnesoata. Minneapolis, MN
03/2018 Joint Symposium on "The Mathematical Theory of Deep Neural Networks", Institute for Advanced Study - Princeton University. Princeton, NJ
07/2017 Psychiatry and Psychotherapy Symposium, University Hospital Ulm. Hiddensee, Germany.
05/2017 Princeton Neuroscience Institute Retreat, Avalon, NJ
03/2017 Shenhav Lab Meeting, Brown University. Providence, RI
03/2017 Laboratory for Neural Computation and Cognition Meeting, Brown University. Providence, RI
12/2016 Computational Cognitive Science Lab Meeting, Berkeley University. Berkeley, CA
11/2016 Redwood Center for Theoretical Neuroscience, Berkeley University. Berkeley, CA
04/2014 General Psychology Colloquium, Technische Universität Dresden. Dresden, Germany

Teaching

From Molecules to Systems to Behavior (lab). Assistant Instructor. Princeton University, Spring 2016.

Animal Learning and Decision Making: Psychological, Computational and Neural Perspectives (precept). Assistant Instructor. Princeton University, Fall 2015.

Biological Psychology (tutorial seminar). Lecturer. Technische Universität Dresden, Summer 2011, Fall 2011, Fall 2012, Summer 2013. *Received "Karl-und-Charlotte-Bühler-Preis" for excellent teaching.*

Student Mentoring

2018-present Sumedh Sontakke, Electrical Engineering Major, College of Engineering in Pune, India
2018-present Thea Zalabak, Sophomore, Princeton University
2018-present Susan Liu, Neuroscience Major, Princeton University
2018 Katie Tam, Freshman, Princeton University
2018-present Baran Cimen, Physics Major, Princeton University
2018-present Shamay Agaron, Neuroscience Major, Princeton University

2017-present Maia Hamin, Computer Science Major, Princeton University
2017-present Tolupe Adetayo, Psychology Major, Princeton University
2017-2018 Oliver Whang, Physics Major, Princeton University
2016-2018 Seong Jun Jang, Neuroscience Major, Princeton University
Senior Thesis: "Explaining Cognitive Control Constraints from the Perspective of the Flexibility-Stability Dilemma"
2016-2018 Markus Spitzer, Psychology (Graduate), University of Innsbruck
Master Thesis: "Exploring feature overlap in a task switching paradigm"
2016-2018 Yotam Sagiv, Computer Science Major, Princeton University
Senior Thesis: "Learn Fast or Multitask Well: First Steps Towards a Normative Theory of Multitasking"
2016-2017 Penina Krieger, Neuroscience Major, Princeton University
Senior Thesis: "Why We Can't Text and Drive: An Experimental Study of the Tradeoff of Learning and Multitasking Capacity in Human Cognition"
2016-2017 Mariam Pogosyan, Computer Science Major, Rutgers University
Summer 2016 Keith Perkins, Biology Major, Southern University at New Orleans
2014-2016 Aileloreuan Ohiwerei, Princeton University
2014 Franziska Kessler, Psychology Major, Technische Universität Dresden

Professional Activites

since 2018 *Co-Organizer*: Conference on the Mathematical Theory of Deep Neural Networks (scheduled for October 2019).

11/2016 *Conference Symposium Chair*: Computational models of decision making and confidence. Society for Neuroscience. Nanosymposium.

Ad Hoc Reviewer (alphabetical order):

Brain and Cognition,
Cognitive Science Society Conference,
Cortex,
Journal of Cognitive Neuroscience,
Journal of Neuroscience,
Nature Communications,
Neuropsychologia,
Psychonomic Bulletin & Review

Professional Affiliations

2014-present Society for Neuroscience
2016-present Cognitive Science Society
2017-present Society for Neuroeconomics
2018-present Association for Psychological Science