

# Andrew Kyle Lampinen

## Email

andrewlampinen@gmail.com

## Website

<https://lampinen.github.io>

## Education

**Stanford University**, Ph.D. Psychology (Cognitive), 2015-2020

- Dissertation: A computational framework for learning and transforming task representations
- Advisor: James L. McClelland.
- Center for Mind, Brain, Computation, and Technology Trainee (Co-Mentor: Surya Ganguli).
- Minor in Computer Science.

**UC Berkeley**, B.A. Mathematics, Physics, 2010-2014

- Highest honors in mathematics, high distinction in general scholarship.

## Honors

Ric Weiland Graduate Fellowship in the Humanities and Sciences, 2018-2020

National Science Foundation Graduate Research Fellowship, 2015-2018

Percy Lionel Davis Award for Excellence in Scholarship in Mathematics, 2014

Berkeley Physics Olsen Scholar 2013-2014

Berkeley Letters & Science Dean's List 2012-2014

Berkeley Physics Undergraduate Research Scholar, Spring & Fall 2012

## Research Experience

**Research Scientist**, DeepMind, October 2020 - Present

- Research on generalization, language & grounding.

**PhD Candidate**, Stanford University Department of Psychology, August 2015 - Present

- Empirical and theoretical investigations of generalization, transfer, and abstraction in deep learning models.
- Research on reducing the quantity of data required to train a deep learning system, including transfer, memory, and curriculum learning.
- Research on zero-shot performance of new tasks by transforming task representations.
- Experiments to investigate the effects of presentations of concepts on learning of related concepts in mathematical cognition.

**PhD Intern**, DeepMind, May 2019 - September 2019

- Explored automated curriculum generation for goal-conditioned reinforcement learning.
- Explored generalization in reinforcement learning.

**PhD Software Engineering Intern**, Google Brain, June 2017 - September 2017

- Designed and developed a system for using low-quality data from human interactions to improve an adversarially trained image generative model.
- Contributed gradients to TensorFlow image resizing ops.

**Associate Professional Staff I**, Johns Hopkins University Applied Physics Laboratory, June 2014 - July 2015

- Worked on image classification using convolutional neural networks.
- Developed models and simulations of sensor systems, shipping and transportation, and autoimmune diseases.
- Devised metrics for assessing sensors.
- Worked on methods for identifying malicious software based on its behavior.

**Student Research Associate**, Lawrence Berkeley National Laboratories, January - May 2012 & August - December 2012

- Developed simulations of processes in nuclear physics.
- Engineered software and hardware for efficiently collecting & analyzing data.

**Summer Research Intern**, A\*STAR Institute of High Performance Computing, Singapore, June - August 2012

- Wrote and adapted simulations of crystallization processes in super-cooled metals.
- Developed software for analyzing and visualizing the structure of crystals.

**Research Assistant**, UC Davis Plant Sciences, June - August 2011

- Developed procedures and software for testing the physical attributes of fruit.

## Publications and Proceedings

**Andrew K. Lampinen** and James L. McClelland, (2020), “Transforming task representations to allow deep learning models to perform novel tasks,” *Proceedings of the National Academy of Sciences*

Katherine L. Hermann\* and **Andrew K. Lampinen\***, (2020), “What shapes feature representations? Exploring datasets, architectures, and training,” *Advances in Neural Information Processing Systems*, (\*equal contribution)

James L. McClelland, Bruce L. McNaughton, and **Andrew K. Lampinen** (2020), “Integration of new information in memory: new insights from a complementary learning systems perspective”, *Proceedings of the Royal Society B*

Sébastien Racanière\*, **Andrew K. Lampinen\***, Adam Santoro, David P. Reichert, Vlad Firoiu, and Timothy P. Lillicrap, (2020), “Automated curricula through setter-solver interactions,” *Proceedings of the 8th International Conference on Learning Representations*, (\*equal contribution)

Felix Hill, **Andrew K. Lampinen**, Rosalia Schneider, Stephen Clark, Matthew Botvinick, James L. McClelland, and Adam Santoro (2020), “Environmental drivers of systematicity and generalisation in a situated agent,” *Proceedings of the 8th International Conference on Learning Representations*

**Andrew K. Lampinen** and James L. McClelland, (2019), “Zero-shot task adaptation by homoiconic meta-mapping,” *Learning Transferable Skills Workshop, NeurIPS*

**Andrew K. Lampinen** and Surya Ganguli, (2019), “An analytic theory of generalization dynamics and transfer learning in deep linear networks,” *Proceedings of the 7th International Conference on Learning Representations*

**Andrew K. Lampinen** and James L. McClelland, (2018), “Different presentations of a mathematical concept can support learning in complementary ways,” *Journal of Educational Psychology*

Robert X. D. Hawkins, Eric N. Smith, Carolyn Au, Juan Miguel Arias, Rhia Catapano, Eric Hermann, Martin Keil, **Andrew Lampinen**, Sarah Raposo, Jesse Reynolds, Shima Salehi, Justin Salloum, Jed Tan, and Michael C. Frank, (2018), “Improving the replicability of Psychological Science through pedagogy,” *Advances in Methods and Practices in Psychological Science*

Steven S. Hansen, **Andrew K. Lampinen**, Gaurav Suri, and James L. McClelland, (2017), “Building on prior knowledge without building it in,” *Commentary in Behavioral & Brain Sciences*

**Andrew K. Lampinen**, Shaw Hsu, and James L. McClelland, (2017), “Analogies emerge from learning dynamics in neural networks,” *Proceedings of the 39th Annual Meeting of the Cognitive Science Society*

## Preprints

**Andrew K. Lampinen** and James L. McClelland, (2017), “One-shot and few-shot learning of word embeddings,” *arXiv*

**Andrew K. Lampinen**, David So, Douglas Eck, and Fred Bertsch, (2017), “Improving image generative models with human interactions,” *arXiv*

<b>Invited Talks</b>	<hr/> <p>“Multi-task learning, transfer, and abstraction,” <i>Parallel Distributed Processing and the Emergence of an Understanding of Mind</i>, Princeton University, September 29th, 2018</p> <p>“The Jabberwocky: One-shot and few-shot learning of word embeddings,” <i>Meaning in Context Workshop</i>, Center for the Study of Language and Information, Stanford University, September 12th, 2017</p> <hr/>
<b>Presentations</b>	<hr/> <p>“Automated curricula through setter-solver interactions,” <i>8th International Conference on Learning Representations</i>, 2020</p> <p>“Environmental drivers of systematicity and generalisation in a situated agent,” <i>8th International Conference on Learning Representations</i>, 2020</p> <p>“Zero-shot task adaptation by homoiconic meta-mapping,” <i>Learning Transferable Skills Workshop, NeurIPS</i>, 2019</p> <p>“An analytic theory of generalization dynamics and transfer learning in deep linear networks,” Natural / Artificial Intelligence, Stanford Neurosciences Institute, 2018</p> <p>“An analytic theory of generalization dynamics and transfer learning in deep linear networks,” <i>Parallel Distributed Processing and the Emergence of an Understanding of Mind</i>, Princeton University, 2018</p> <p>“Analogies emerge from learning dynamics in neural networks,” 39th Annual Meeting of the Cognitive Science Society, 2017</p> <p>“Fast and sparse learning with compositional concept training,” 15th Neural Computation and Psychology Workshop, 2016</p> <hr/>
<b>Teaching Experience</b>	<p><b>Teaching Assistant</b>, Stanford University Department of Psychology, 6 courses between Fall 2016 and Winter 2019</p> <ul style="list-style-type: none"> <li>• Planned and taught discussion sections for undergraduate statistics &amp; memory courses and graduate statistics &amp; research methods courses.</li> <li>• Gave lectures on reinforcement learning and wrote and graded homeworks for graduate course on Neural Network Models of Cognition.</li> <li>• Held office hours.</li> </ul> <p><b>Undergraduate Student Instructor</b>, UC Berkeley Mathematics, Spring, Fall 2013, &amp; Spring 2014</p> <ul style="list-style-type: none"> <li>• Planned and taught discussion sections.</li> <li>• Held office hours.</li> <li>• Wrote and graded quizzes and midterms.</li> </ul> <p><b>Teaching Assistant</b>, UC Berkeley Early Academic Outreach Program, June-July 2013</p> <ul style="list-style-type: none"> <li>• Held office hours.</li> <li>• Substitute taught classes.</li> </ul> <hr/>
<b>Other Work Experience</b>	<p><b>Statistics Consultant</b>, Stanford University Department of Psychology, 2016-2017, 2019-2020</p> <ul style="list-style-type: none"> <li>• Advised graduate students on technical aspects of data collection, analysis, and modeling.</li> </ul> <hr/>
<b>Service</b>	<p><b>Reviewer:</b></p> <ul style="list-style-type: none"> <li>• Journal of Educational Psychology.</li> <li>• Artificial Intelligence.</li> <li>• Neural Information Processing Systems, 2020.</li> <li>• Cognitive Science Society, 2019 &amp; 2020.</li> <li>• Conference on the Mathematical Theory of Deep Neural Networks (DeepMath), 2019</li> </ul>

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**Technical Skills**

**Computer science:** Experienced with both theory and practice.

- Graduate coursework in machine learning, neural networks, and probabilistic models & algorithms.
- Experienced user of Python, R, C++, C, JavaScript, Matlab, some knowledge of Mathematica, Macaulay2, Haskell.
- Used many common libraries for these languages, e.g. numpy, scipy, tidyrr, dplyr, jquery, matplotlib, Matlab Computer Vision Toolbox, FFTW.
- Used many machine learning libraries, including TensorFlow, Torch, scikit-learn, and Caffe.
- Experienced with \*NIX operating systems.

**Mathematics:** Knowledge across many domains, with applications.

- Algebraic geometry, group theory, category theory, topology, etc.
- Practical applications to machine learning, computer vision, neural coding, etc.

**Statistics:** Significant experience with standard data analysis techniques.

- Linear modeling, hierarchical modeling, etc.
- Fitting algorithms & goodness-of-fit tests.

**Physics:** Experienced in a wide variety of applied and experimental contexts.

- Statistical mechanics, biophysics, analytic mechanics, etc.
- Experimentation ranging from NMR to quantum entanglement.

**Modeling & Simulation:** Developed models and simulations of various phenomena.

- Developed both from published methods and directly from physical principles.
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**Other Activities**

**Carillon:** Carillonneur member of the Guild of Carillonneurs in North America ([www.gcna.org](http://www.gcna.org)).

**Rock climbing:** Bouldering, sport, and trad. Routesetter at Stanford Climbing Wall, set problems for Collegiate Climbing Series events.