

# Kevin A Smith

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Massachusetts Institute of Technology  
Department of Brain and Cognitive Sciences  
77 Massachusetts Avenue  
Cambridge, MA 02139  
Email: k2smith@mit.edu  
Website: [www.mit.edu/~k2smith/](http://www.mit.edu/~k2smith/)

## Employment and Education

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Massachusetts Institute of Technology	
▪ Research Scientist in Brain and Cognitive Sciences	2019-Present
▪ Postdoctoral Scholar in Brain and Cognitive Sciences	2016-2019
▪ Advisor: Joshua Tenenbaum	
University of California San Diego	2010-2015
▪ Ph.D. in Experimental Psychology	
▪ Advisor: Edward Vul	
Marine Biological Laboratory Summer Course	Summer 2014
▪ Brains, Minds & Machines program	
UCLA IPAM Summer School	Summer 2011
▪ Probabilistic Models of Cognition program	
Dartmouth College	2001-2005
▪ B.A. in Cognitive Science, Minor in Computer Science	
▪ Graduated Magna Cum Laude with High Honors in Cognitive Science	

## Grants, Fellowships, and Awards

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Robotics: Science and Systems Best Paper Award	2018
UCSD Interdisciplinary Collaboratory Fellowship	2014
Vision Sciences Society Student Travel Award	2013
Glushko & Samuelson Foundation Student Grant	2012
Oceanids Bertha Lebus Scholarship	2012-2013
Cognitive Science Society Computational Modeling Prize: Perception/Action category	2012
Norman Anderson Travel Grant	2010-2011, 2014
UCSD Dean's Fellowship	2010-2012

## Publications

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\* Indicates equal authorship

- KR Allen,\* **KA Smith**,\* JB Tenenbaum (2020). Rapid trial-and-error learning with simulation supports flexible tool use and physical reasoning. *Proceedings of the National Academy of Sciences*, 117 (47) 29302-29310
- KA Smith**, L Mei, S Yao, J Wu, E Spelke, JB Tenenbaum, TD Ullman (2020). *The fine structure of surprise in intuitive physics: When, why, and how much?* Proceedings of the 41<sup>st</sup> Annual Meeting of the Cognitive Science Society.
- KR Allen, **KA Smith**, U Piterbarg, R Chen, JB Tenenbaum (2020). *Abstract strategy learning underlies flexible transfer in physical problem solving*. Proceedings of the 41<sup>st</sup> Annual Meeting of the Cognitive Science Society.
- K Ota, DK Jah, D Romeres, J van Baar, **KA Smith**, T Semitsu, T Oiki, A Sullivan, D Nikovski, JB Tenenbaum (2020). Towards human-level learning of complex physical puzzles. *arXiv preprint, arXiv: 2011.07193*
- Y Du, **KA Smith**, TD Ullman, JB Tenenbaum, J Wu (2020). Unsupervised discovery of 3D physical objects from video. *arXiv preprint, arXiv:2007.12348*
- KA Smith**,\* L Mei,\* S Yao,\* J Wu, E Spelke, JB Tenenbaum, TD Ullman (2019). *Modeling expectation violation in intuitive physics with coarse probabilistic object representations*. Advances in Neural Information Processing Systems. Vancouver, Canada
- KA Smith**, PW Battaglia, E Vul (2018). Different physical intuitions exist between tasks, not domains. *Computational Brain & Behavior*, 1(2): 101-118
- FAB Peres, **KA Smith**, KR Allen, JB Tenenbaum, JZ Kolter (2018). *End-to-end differentiable physics for learning and control*. Advances in Neural Information Processing Systems. Montreal, Canada
- I Yildirim,\* **KA Smith**,\* M Belledonne,\* J Wu, JB Tenenbaum (2018). *Neurocomputational modeling of human physical scene understanding*. Proceedings of the 2018 Conference on Cognitive Computational Neuroscience, Philadelphia, PA
- I Dasgupta,\* **KA Smith**,\* E Schulz, JB Tenenbaum, SJ Gershman (2018). *Learning to act by integrating mental simulations and physical experiments*. Proceedings of the 40<sup>th</sup> Annual Meeting of the Cognitive Science Society, Madison, WI
- MA Gates, TL Veuthey, MH Tessler, **KA Smith**, T Gerstenberg, L Bayet, JB Tenenbaum (2018). *Tiptoeing around it: Inference from absence in potentially offensive speech*. Proceedings of the 40<sup>th</sup> Annual Meeting of the Cognitive Science Society, Madison, WI
- M Toussaint, KR Allen, **KA Smith**, JB Tenenbaum (2018). *Differentiable physics and stable modes for tool-use and manipulation planning*. Robotics: Science and Systems

*Winner of annual Best Paper Award at R:SS 2018*

- KA Smith**, FAB Peres, E Vul, JB Tenenbaum (2017). *Thinking inside the box: Motion prediction in contained spaces uses simulation*. Proceedings of the 39<sup>th</sup> Annual Meeting of the Cognitive Science Society, London, UK
- T Gerstenberg, L Zhou, **KA Smith**, JB Tenenbaum (2017). *Faulty Towers: A counterfactual simulation model of physical support*. Proceedings of the 39<sup>th</sup> Annual Meeting of the Cognitive Science Society, London, UK
- KA Smith**, E Vul (2015). The role of sequential dependence in creative semantic search. *Topics in Cognitive Science*, 7(3): 543-546
- KA Smith**, E Vul (2015). *Prospective uncertainty: The range of possible futures in physical prediction*. Proceedings of the 37<sup>th</sup> Annual Meeting of the Cognitive Science Society, Pasadena, CA
- JB Hamrick, **KA Smith**, TL Griffiths, E Vul (2015). *Think again? The amount of mental simulation tracks uncertainty in the outcome*. Proceedings of the 37<sup>th</sup> Annual Meeting of the Cognitive Science Society, Pasadena, CA
- DE Walker, **KA Smith**, E Vul (2015). *The “Fundamental Attribution Error” is rational in an uncertain world*. Proceedings of the 37<sup>th</sup> Annual Meeting of the Cognitive Science Society, Pasadena, CA
- KA Smith**, E Vul (2014). Reductionism and practicality. *Cosmos and History: The Journal of Natural and Social Philosophy*, 10(1): 78-85
- KA Smith**, E Vul (2014). *Looking forwards and backwards: Similarities and differences in prediction and retrodiction*. Proceedings of the 36<sup>th</sup> Annual Meeting of the Cognitive Science Society, Quebec City, Canada
- DD Bourgin, JT Abbott, TL Griffiths, **KA Smith**, E Vul (2014). *Empirical evidence for Markov Chain Monte Carlo in memory search*. Proceedings of the 36<sup>th</sup> Annual Meeting of the Cognitive Science Society, Quebec City, Canada
- KA Smith**, DE Huber, E Vul (2013). Multiply-constrained semantic search in the Remote Associates Test. *Cognition*, 128(1): 64-75
- KA Smith**, E Vul (2013). Sources of uncertainty in intuitive physics. *Topics in Cognitive Science*, 5(1): 185-199
- CA Rieth, **KA Smith**, S Piantadosi, E Vul (2013). Put your money where your mouth is: Incentivizing the truth by making nonreplicability costly. *European Journal of Personality*, 27: 131-132
- KA Smith**, E Dechter, JB Tenenbaum, E Vul (2013). *Physical predictions over time*. Proceedings of the 35<sup>th</sup> Annual Meeting of the Cognitive Science Society, Berlin, Germany

**KA Smith**, P Battaglia, E Vul (2013). *Consistent physics underlying ballistic motion prediction*. Proceedings of the 35<sup>th</sup> Annual Meeting of the Cognitive Science Society, Berlin, Germany

**KA Smith**, E Vul (2012). *Sources of uncertainty in models of intuitive physics*. Proceedings of the 34<sup>th</sup> Annual Meeting of the Cognitive Science Society, Sapporo, Japan  
*Awarded the Computational Modeling Prize in the Perception/Action category*

## **Manuscripts submitted or in preparation**

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\* *Indicates equal authorship*

**KA Smith**, JB Hamrick, AN Sanborn, PW Battaglia, T Gerstenberg, TD Ullman, JB Tenenbaum (*forthcoming*). Probabilistic Models of Physical Reasoning. Chapter to appear in *Probabilistic Models of Cognition*.

DE Walker, **KA Smith**, E Vul (*submitted*). The Fundamental Attribution Error is reasonable in an uncertain world.

DD Bourgin, JT Abbott, TL Griffiths, **KA Smith**, E Vul (*submitted*). The roles of blind variation and selective retention in creative search.

JB Hamrick, **KA Smith**, E Vul, TL Griffiths (*submitted*). The adaptive allocation of mental simulation.

**KA Smith**,\* I Dasgupta,\* E Schulz, JB Tenenbaum, S Gershman (*in prep*). Learning to act by integrating mental simulations and physical experiments.

**KA Smith**, PW Battaglia, JB Tenenbaum (*in prep*). Strategy selection for physical reasoning.

## **Talks and Poster Presentations**

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“Building models of infants’ physical understanding” Jul 2020  
*Origins of Common Sense workshop*  
42<sup>nd</sup> Annual Meeting of the Cognitive Science Society

“The resource rational architecture of intuitive physics” Mar 2020  
Harvard Psychology Cognition, Brain, and Behavior seminar

“Perception and action from generative models of physics” Dec 2019  
*Perception as Generative Reasoning workshop*  
Neural Information Processing Systems

- “Strategies for physical reasoning” Jul 2019  
*Heuristics, Hacks, and Habits workshop*  
 41<sup>st</sup> Annual Meeting of the Cognitive Science Society
- “Real-time inference of physical properties in dynamics scenes” Jul 2019  
 Poster presented at the 41<sup>st</sup> Annual Meeting of the Cognitive Science Society
- “Simulation and rule use in physical prediction” Jul 2019  
 45<sup>th</sup> Annual Meeting of the Society for Philosophy and Psychology
- “Efficient and robust physical reasoning” Apr 2019  
 Perceptive Automata invited talk
- “Thinking about thinking about physics” Nov 2018  
 Stanford Department of Psychology
- “Integrating rules and simulation” Jul 2018  
*Strategies and representations in physical inference symposium,*  
 40<sup>th</sup> Annual Meeting of the Cognitive Science Society
- “Simulation and other strategies for physical reasoning” Apr 2018  
*Concepts and Categories Symposium,*  
 NYU Department of Psychology
- “Approximate simulation and sampling in intuitive physics”, Jul 2017  
*Bridging levels of analysis with rational process models symposium,*  
 MathPsych / ICCM 2017
- “Simulation and heuristics in flexible tool use” Jul 2017  
 Poster presented at the 39<sup>th</sup> Annual Meeting of the Cognitive Science Society
- “Similarities and differences in forward and reverse motion May 2015  
 extrapolation”  
 Poster presented at the 15<sup>th</sup> Annual Meeting of the Vision Sciences Society
- “Physical simulation and ground truth” Feb 2015  
 Poster presented at presented at 2015 Society for Personality and  
 Social Psychology - Mental Simulation Preconference
- “Knowledge of uncertainty in physical prediction” Nov 2014  
 Poster presented at 2014 Psychonomic Society Annual Meeting
- “Looking forwards and backwards: Similarities and differences in Jul 2014  
 prediction and retrodiction”  
 36<sup>th</sup> Annual Meeting of the Cognitive Science Society
- “Tracking hidden objects with efficient physical prediction” May 2014  
 Poster presented at the 14<sup>th</sup> Annual Meeting of the Vision  
 Sciences Society

- “Physical predictions over time” Aug 2013  
35<sup>th</sup> Annual Meeting of the Cognitive Science Society
- “Physical prediction biases are faithful physics plus visual uncertainty” May 2013  
13<sup>th</sup> Annual Meeting of the Vision Sciences Society
- “Beyond priming: Causes of sequential dependence in semantic production tasks” Nov 2012  
Poster presented at 2012 Psychonomic Society Annual Meeting
- “Sources of uncertainty in models of intuitive physics” Aug 2012  
34<sup>th</sup> Annual Meeting of the Cognitive Science Society
- “Semantic search strategies in the Remote Associates Test”, Nov 2011  
Poster presented at 2011 Psychonomic Society Annual Meeting

## Teaching Experience

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- Course Consultant, Brains Minds and Machines summer school Summer 2016-19
- Lead advisor for *Development of Intelligence*, *Core Knowledge* projects
  - Taught tutorials on Optimization, Probabilistic Programming, Developing Online Experiments
- Invited Lecturer, Dept. of Brain and Cognitive Sciences, MIT
- Computational Cognitive Science: *Mental Models as Probabilistic Programs* Fall 2020
  - Computational Cognitive Science: *Metareasoning and Intuitive Physics* Fall 2018
- Teaching Assistant, Psychology Dept., UCSD
- Quantitative Methods in Psychology (graduate level) Fall/Winter 2011-15
  - Childhood Disorders Fall 2015
  - Principles of Behavior Spring, Summer 2015
  - Biological Psychology Fall 2010
- Invited Lecturer, UCSD
- Big Data Analytics: *Introduction to R* (Dept. of International Relations / Pacific Studies) Spring 2014
  - Analytical Methods in Computational Neuroscience: *Bayesian Inference* (Dept. of Neurosciences) Spring 2013, 2014

## Service

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Lead organizer of workshop “The Origins of Common Sense in Humans and Machines” at the Annual Meeting of the Cognitive Science Society	Jul 2020
Program committee member of “Bridging AI and Cognitive Science” workshop at International Conference on Learning Representations	Apr 2020
Co-organizer of workshop “Modeling the physical world: Perception, learning, and control” at Neural Information Processing Systems	Dec 2018
Organizer of symposium “Strategies and representations in physical inference” at the Annual Meeting of the Cognitive Science Society	Jul 2018
Postdoctoral Executive Committee, Center for Brains, Minds, and Machines	2016-17
Graduate Statistics Assistant, Psychology Dept., UCSD	2011-15
Statistical analyst for undergraduate enrollment analysis, Psychology Dept., UCSD	2015
Co-founder of <i>Graduate Talk Series</i> Psychology Dept., UCSD	2011

Ad-hoc reviewer: American Journal of Psychology, Behavior Research Methods, Cereberal Cortex, Cognition, Cognitive Science, Cognitive Science Society Annual Meeting, Collabra:Psychology, IEEE Transactions on Pattern Analysis and Machine Intelligence, Journal of Creativity, Nature Human Behavior, Neural Information Processing Systems, PLOS One, PLOS Computational Biology, Scientific Reports

Grant reviewer: NSF Perception, Action, and Cognition program