ANDREW LOVETT

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Research Interests

I study **visual perception**, **visual comparison**, and **spatial problem-solving**. It is critical that we better understand these processes, and what separates individuals with high and low spatial ability, so that we can improve education in science and engineering. I build large-scale computational models of spatial problem-solving tasks, ranging from mental rotation to the Raven's Matrices intelligence test.

Education

Northwestern University, M.S., Ph.D. in Computer Science   2004 – 2012
    Advisor: Kenneth D. Forbus

Yale University, B.A. in Cognitive Science   2000 – 2004
    Advisor: Brian Scassellati
    Magna Cum Laude, with *Distinction in the Major*

Research Experience

Postdoctoral Trainee in Psychology   2014 – Present
Visual Cognition Lab, Northwestern University
    Advisor: Steve Franconeri

Postdoctoral Researcher   2013 – 2014
SFB/TR 8 Spatial Cognition, Universität Bremen

Postdoctoral Researcher   2012 – 2013
Qualitative Reasoning Group, Northwestern University

Graduate Research Assistant   2004 – 2012
Qualitative Reasoning Group, Northwestern University
    Advisor: Kenneth D. Forbus

Undergraduate Research Assistant   2002 – 2004
Social Robotics Lab, Yale University
    Advisor: Brian Scassellati

Summer Research Assistant   2001
Yale University
    Advisor: Drew McDermott

Summer Research Assistant   2000
Institute for Environmental Modeling, University of Tennessee
    Advisor: Lou Gross

Teaching Experience

Teaching Assistant   Spring 2007, Spring 2009
Northwestern University
    Computer Game Design

Teaching Assistant   Fall 2007
Northwestern University
    Introduction to Cognitive Modeling

Awards & Honors

Institutional Research Training Grant (T32), National Institute of Health, 2014.

Robert J. Glushko Dissertation Prize, Cognitive Science Society, 2013.

Junior Fellowship, Hanse-Wissenschaftskolleg Institute for Advanced Study, 2013.

Best Paper Award, International Conference on Development & Learning, 2004.

Cognitive Science Fellowship, Northwestern University, 2004.

Magna Cum Laude, Yale University, 2004.

National Merit Scholarship, 2000.

Societies & Service

Member, Cognitive Science Society, 2005 – 2016.

Member, Association for the Advancement of Artificial Intelligence, 2007 – 2010.

Reviewer, *Cognitive Science,* 2013, 2015.

Reviewer, *Cognition*, 2014.

Reviewer, *Journal of Experimental & Theoretical Artificial Intelligence,* 2012.

Reviewer, *Cognitive Systems Research*, 2011.

Reviewer, *Cognitive Processing*, 2010.

Reviewer, Annual Conference of the Cognitive Science Society, 2007 – 2009, 2013, 2015 – 2016.

Reviewer, Advances in Cognitive Systems, 2015 – 2016.

Reviewer, International Workshop on Qualitative Reasoning, 2015 – 2016.

Reviewer, Spatial Cognition Conference, 2012, 2016.

Reviewer, Workshop on Eye-Tracking and Visualization, 2015.

Reviewer, International Conference on Neural Information Processing, 2012.

Reviewer, International Workshop on Similarity and Analogy-based AI, 2012.

Reviewer, International Workshop on Spatio-Temporal Dynamics, 2012.

Reviewer, International Analogy Conference, 2009.

Reviewer, IEEE Transactions on Knowledge and Data Engineering, 2008.

Invited Talks

Conference Talks

"Modeling visual problem-solving and spatial reasoning." *Spatial Language Modules Workshop*. Delmenhorst, Germany. September 20, 2014.

"Spatial Routines: A framework for modeling visual problem-solving." *Third International Conference on Analogy*. Dijon, France. August 8, 2013.

"Spatial Routines: A framework for modeling visual problem-solving." Glushko Dissertation Prize Symposium. *35th Annual Conference of the Cognitive Science Society.* Berlin, Germany. August 3, 2013.

Campus Talks

"Categorical perception of spatial relations between objects." Cognitive Brown Bag. Northwestern University. January 15, 2016.

"Categorical perception of topological relations between objects." SALLY Meeting. Northwestern University. June 3, 2015.

"Categorical relations guide visual memory & comparison." Cognitive Brain Mapping Group. Northwestern University. January 28, 2015.

"Modeling visual problem-solving and spatial reasoning." SFB/TR8 Colloquium. Universität Bremen. April 4, 2014.

Publications

Journal Papers & Book Chapters

1. Lovett, A., & Forbus, K. (submitted). Modeling visual problem-solving as analogical reasoning.

2. Lovett, A., & Schultheis, H. (submitted). Spatial abstraction: Modeling a key spatial ability.

3. Forbus, K., Ferguson, R. W., Lovett, A., & Gentner, D. (in press). Extending SME to handle large-scale cognitive modeling. *Cognitive Science.*

4. Sagi, E., Gentner, D., & Lovett, A. (2012). What difference reveals about similarity. *Cognitive Science, 36*(6), 1019-1050.

5. Lovett, A., & Forbus, K. (2011). Cultural commonalities and differences in spatial problem-solving: A computational analysis. *Cognition, 121*(2), 281-287.

6. Forbus, K., Usher, J., Lovett, A., Lockwood, K., & Wetzel, J. (2011). CogSketch: Sketch understanding for cognitive science research and for education. *Topics in Cognitive Science, 3*(4), 648-666.

7. Lovett, A., Tomai, E., Forbus, K., & Usher, J. (2009). Solving geometric analogy problems through two-stage analogical mapping. *Cognitive Science, 33*(7), 1192-1231.

8. Lovett, A., Gentner, D., Forbus, K., & Sagi, E. (2009). Using analogical mapping to simulate time-course phenomena in perceptual similarity. *Cognitive Systems Research, 10*(3): Special Issue on Analogies - Integrating Cognitive Abilities, 216-228.

9. Striegnitz, K., Tepper, P., Lovett, A., & Cassell, J. (2009). Knowledge representation for generating locating gestures in route directions. In K. R. Coventry, T. Tenbrink, & J. Bateman (Eds.), *Spatial Language and Dialogue (Explorations in Language and Space).* Oxford: Oxford University Press.

Peer-Reviewed Conference Publications

1. Lovett, A., & Schultheis, H. (2014). Modeling spatial abstraction during mental rotation. *Proceedings of the 36th Annual Conference of the Cognitive Science Society*. Quebec City, Canada, 886-891.

2. Lovett, A., & Forbus, K. (2013). Modeling spatial ability in mental rotation and paper-folding. *Proceedings of the 35th Annual Conference of the Cognitive Science Society*. Berlin, Germany, 930-935.

3. Lovett, A., & Forbus, K. (2012). Modeling multiple strategies for solving geometric analogy problems. *Proceedings of the 34th Annual Conference of the Cognitive Science Society.* Sapporo, Japan, 701-707.

4. Lovett, A., Forbus, K., & Usher, J. (2010). A structure-mapping model of Raven's Progressive Matrices. *Proceedings of the 32nd Annual Conference of the Cognitive Science Society*. Portland, OR, 2761-2766.

5. Lovett, A., Sagi, E., Gentner, D., & Forbus, K. (2009). Modeling perceptual similarity as analogy resolves the paradox of difference detection. *Proceedings of the 2nd International Analogy Conference.* Sofia, Bulgaria, 320-329.

6. Lovett, A., & Forbus, K. (2009). Using a visual routine to model the computation of positional relations. *Proceedings of the 31st Annual Conference of the Cognitive Science Society.* Amsterdam, The Netherlands, 1882-1887.

7. Lovett, A., Lockwood, K., & Forbus, K. (2008). A computational model of the visual oddity task. *Proceedings of the 30th Annual Conference of the Cognitive Science Society.* Washington, D.C., 631-636.

8. Lovett, A., Lockwood, K., & Forbus, K. (2008). Modeling cross-cultural performance on the visual oddity task. *Proceedings of Spatial Cognition 2008.* Freiburg, Germany, 378-393.

9. Lockwood, K., Lovett, A., & Forbus, K. (2008). Automatic classification of containment and support spatial relations in English and Dutch. *Proceedings of Spatial Cognition 2008*. Freiburg, Germany, 283-294.

10. Lovett, A., Dehghani, M., & Forbus, K. (2007). Incremental learning of perceptual categories for open-domain sketch recognition. *Proceedings of the International Joint Conference on Artificial Intelligence.* Hyderabad, India, 447-452.

11. Lovett, A. Forbus, K., & Usher, J. (2007). Analogy with qualitative spatial representations can simulate solving Raven's Progressive Matrices. *Proceedings of the 29th Annual Conference of the Cognitive Science Society*. Nashville, TN, 449-454.

12. Dehghani, M., & Lovett, A. (2006). Efficient genre classification using qualitative representations. *Proceedings of the 7th International Conference on Music Information Retrieval.* Vancouver, Canada.

13. Lovett, A., Gentner, D., & Forbus, K. (2006). Simulating time-course phenomena in perceptual similarity via incremental encoding. *Proceedings of the 28th Annual Conference of the Cognitive Science Society.* Vancouver, Canada, 1723-1728.

14. Tomai, E., Lovett, A., Forbus, K., & Usher, J. (2005). A structure mapping model for solving geometric analogy problems. *Proceedings of the 27th Annual Conference of the Cognitive Science Society.* Stressa, Italy, 2190-2195.

15. Lovett, A., & Scassellati, B. (2004). Using a robot to reexamine looking time experiments. *Proceedings of the 4th International Conference on Development and Learning (ICDL).* San Diego, CA. **[Best Paper Award]**

Peer-Reviewed Workshop & Symposium Papers

1. Lovett, A., & Franconeri, S. (2015). Humans encode qualitative topological relations. *Proceedings of the 29th International Workshop on Qualitative Reasoning.* Minneapolis, MN.

2. Lovett, A., Kandaswamy, S., McLure, M., & Forbus, K. (2012). Evaluating qualitative models of shape representation. *Proceedings of the 26th International Workshop on Qualitative Reasoning*. Los Angeles, CA.

3. Lovett, A. & Forbus, K. (2011). Organizing and representing space for visual problem-solving. *Proceedings of the 25th International Workshop on Qualitative Reasoning*. Barcelona, Spain, 92-99.

4. Lovett, A. & Forbus, K. (2010). Shape is like space: Modeling shape representation as a set of qualitative spatial relations. *Proceedings of the AAAI Spring Symposium on Cognitive Shape Processing*. Palo Alto, CA.

5. Lovett, A., & Forbus, K. (2009). Computing human-like qualitative topological relations via visual routines. *Proceedings of the 23rd International Qualitative Reasoning Workshop.* Ljubljana, Slovenia, 76-83.

6. Lovett, A., Dehghani, M., & Forbus, K. (2008). Building and comparing qualitative descriptions of three-dimensional design sketches. *Proceedings of the 22nd International Qualitative Reasoning Workshop.* Boulder, CO, 95-101.

7. Forbus, K., Usher, J., Lovett, A., Lockwood, K., & Wetzel, J. (2008). CogSketch: Open-domain sketch understanding for cognitive science research and for education. *Proceedings of the Fifth Eurographics Workshop on Sketch-Based Interfaces and Modeling.* Annecy, France, 159-166.

8. Lovett, A., Lockwood, K., Dehghani, M., & Forbus, K. (2007). Modeling human-like rates of learning via analogical generalization. *Proceedings of Analogies: Integrating Multiple Cognitive Abilities.* Nashville, TN.

9. Lovett, A., Sagi, E., & Gentner, D. (2007). Analogy as a mechanism for comparison. *Proceedings of Analogies: Integrating Multiple Cognitive Abilities.* Nashville, TN.

10. Lovett, A., Dehghani, M., & Forbus, K. (2007). Constructing spatial representations of variable detail for sketch recognition. *AAAI Spring Symposium on Control Mechanisms for Spatial Knowledge Processing in Cognitive / Intelligent Systems.* Stanford University, CA.

11. Lovett, A., Forbus, K., & Usher, J. (2007). Using qualitative representations and analogical mapping to solve problems from a spatial intelligence test. *Proceedings of the 21st International Qualitative Reasoning Workshop.*Aberystwyth, U.K., 79-86.

12. Dehghani, M., Unsworth, S., Lovett, A., & Forbus, K. (2007). Capturing and categorizing mental models of food webs using QCM. *Proceedings of the 21st International Qualitative Reasoning Workshop.* Aberystwyth, U.K., 25-30.

13. Lovett, A., Dehghani, M., & Forbus, K. (2006). Efficient learning of qualitative descriptions for sketch recognition. *Proceedings of the 20th International Qualitative Reasoning Workshop.* Hanover, New Hampshire.