Curriculum Vitae

Nathaniel R. Twarog

67 Madison Ave., Apt. 808, Memphis, TN, 38103
Phone (Cell): (617)997-8419
E-mail: nathanieltwarog@gmail.com
Website: http://www.nathanieltwarog.com/

Education:

2007-2012: Massachusetts Institute of Technology (GPA: 4.8)
Ph.D., Cognitive Science, Department of Brain and Cognitive Sciences
Thesis defended August 10, 2012: "Higher-Dimensional Computational Models of Perceptual grouping and Silhouette Analysis and Representation"
Thesis Advisor: Edward H. Adelson
Committee Members: Wilson Geisler, Edward Gibson, & Ruth Rosenholtz

2003-2007: Massachusetts Institute of Technology (GPA: 4.5)
B.S., Cognitive Science, Department of Brain and Cognitive Sciences
B.S., Theoretical Mathematics, Department of Mathematics

Research Experience:

2008-2012: Analysis, representation and synthesis of 2-D and 3-D shape in the language of image processing – Advisor: Edward Adelson

- Developed Puffball, a novel, intuitive approach to silhouette inflation using only image-processing techniques
- Implemented Puffball in MATLAB using image-processing techniques, including convolution and custom morphological operators
- Applied Puffball inflation to the problem of image-based material transfer, creating a fast, intuitive approach to surface texture and material image synthesis
- Demonstrated power of canonical three-dimensional interpretation in parts analysis of 2D silhouettes, using Puffball as source of canonical 3D shapes
- Evaluated Puffball part-segmentation using existing benchmark datasets and novel psychophysics experiments
- Utilized local patch-matching and belief-propagation as a robust, image-based approach to shape from shading, sheen and texture

2005-2008, 2011-2012: Perceptual grouping and image segmentation using filtering and higher-than-two-dimensional spaces – Advisor: Ruth Rosenholtz

- Developed intuitive and versatile computational framework to model human perceptual organization and Gestalt grouping principles
- Implemented grouping algorithm in MATLAB and C; applied to several grouping features, including luminance, oriented energy, good continuation and hue
- Utilized graphical segmentation hypotheses as a tool to convert output of grouping model framework to measurable, analyzable data

- Developed novel psychophysical methodology for testing strength of grouping by proximity and similarity, with emphasis on inter-image variation and image-based modeling

Additional Education:
Cold Spring Harbor Laboratory course in Computational Neuroscience: Vision (June 2010)

Workshop on science communication. Instructor: Chris Mooney (Author, *The Republican War on Science* and *Unscientific America*). (May 2010)

Workshop on communicating science to a general audience. Instructors: Thomas Levenson and Seth Mnookin, MIT Science Writing Program (Jan. 2012)

Teaching Experience:
2009-2011: Teaching Assistant, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology
Course: Sensation & Perception – Professor: Edward H. Adelson
Writing and grading assignments, writing and grading exams, preparing weekly 1-hour recitations and a 90-minute lecture
Course: Cognitive Processes – Professor: Mary Potter
Grading assignments, exams and 1 lecture

2004-2005: Teaching Assistant, Duke University TIP Residential Program, Kansas University campus
Course: Algebra I

Awards:
2013: $10,000 Grand Prize winner, FASEB Stand Up For Science! competition
Wrote, filmed and edited "Stand With Science: What's Next?" video

2013: Finalist, AAAS Science and Technology Congressional Fellowship

2012: Best Presentation Award, ACM Symposium on Applied Perception

2011: Angus T. MacDonald Award – Outstanding performance in undergraduate education
Teaching Assistant, 9.35: Sensation and Perception

2007-2008: MIT Presidential Fellow

MIT Battlecode/Robocraft Programming Competition
2007: Top 16 team, Special Award for Combat Effectiveness, total prize $500
2006: 5th Place team overall, $1000 prize

Additional Experience:

Lead Organizer, Creative Director: Stand With Science, a national campaign to petition the United States Congress to maintain research funding as a budget priority (www.standwithscience.org) (Oct. 2011 – Present)

Organizer: Science, Technology and Policy Crossroads, an inter-institution effort to build and connect the Boston-area science policy and technology policy community (Feb. 2010 – May 2012)

Member, MIT Science Policy Initiative (web.mit.edu/spi/) (Jan. 2010 – Aug. 2012)

Skills:
High level of experience with MATLAB, C/C++, Java, Python, LaTeX, HTML
Moderate experience with PHP, Javascript, web design
Familiar with techniques and principles of statistics, regression, machine learning and image processing
Design and implementation of psychophysical studies in Gestalt grouping and shape perception
Trained and cleared for work with human subjects
Designed and written materials for linguistic sentence judgment study
Production and editing of original video content

Conferences:
2012 ACM Symposium on Applied Perception, attendee, author and talk presenter

2012 Vision Sciences Society Annual Meeting, attendee and poster presenter

2011 Vision Sciences Society Annual Meeting, attendee and talk presenter

2009 SIGGRAPH International Conference and Exhibition on Computer Graphics and Interactive Technologies, attendee and demonstrator, Emerging Technologies

2009 ACM Conference on Human Factors in Computing Systems, attendee & author

Publications:
(2013) Twarog, N.R. and Rosenholtz, R., "Higher-dimensional Gestalt grouping: Pyschophysical evaluation." *In preparation.*

(2013) Twarog, N.R. and Adelson, E.H. "Inflation-based material transfer: A novel graphics technique for exemplar-based material synthesis." *In preparation.*

(2012) Twarog, N.R. "Higher-Dimensional Computational Models of Perceptual Grouping and Silhouette Analysis and Representation." (Doctoral Dissertation)

(2012) Twarog, N.R., Adelson, E.H., and Tappen, M.F., "Playing with Puffball: Simple Scale-Invariant Inflation for Use in Vision and Graphics." *Proc. of the ACM Symposium on Applied Perception*. Pp 47-54.

(2012) Twarog, N.R., Rosenholtz, R., "An Intuitive Model Framework for Gestalt Grouping Principles. (Abstract)" *Journal of Vision.* **12(9)**, article 1313.

(2011) Twarog, N.R., Adelson, E.H., & Tappen, M.F., "Segmenting 2D Shapes using 3D Inflation. (Abstract)" *Journal of Vision*. **11(11)**, article 851.

(2009) Rosenholtz, R., Twarog, N., Schinkel-Bielefeld, N., & Wattenberg, M. "An Intuitive Model of Perceptual Grouping for HCI Design." *Proc. of the 27th Int. Conf. on Human Factors in Computing Systems*, **27**, pp. 1331-1340.