# Krista A. Ehinger

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# Education

2007-2013	Massachusetts Institute of Technology, Ph.D. in Cognitive Science Advisor: Dr. Ruth Rosenholtz Thesis: <i>Visual features for scene recognition and reorientation</i>
2004-2007	University of Edinburgh, B.Sc. (Hons) in Psychology Advisor: Dr. James Brockmole Thesis: <i>Role of low- and high-spatial-frequency information in real-world scene</i> <i>contextual cueing</i>

1999-2003 California Institute of Technology, B.S. in Engineering & Applied Science

# **Professional Appointments**

2019-	Senior Lecturer in Digital Health School of Computing and Information Systems University of Melbourne, Melbourne, Australia
2016-2019	Postdoctoral Fellow, Human and Computer Vision Laboratory PI: Dr. James Elder Centre for Vision Research, York University, Toronto, Canada
2016	Independent contractor, data analysis and statistics Digital Cognition Technologies, 210 Bear Hill Rd, Waltham, USA
2014-2015	Instructor, Department of Brain & Cognitive Sciences Massachusetts Institute of Technology, Cambridge, USA
2013-2016	Postdoctoral Fellow, Visual Attention Lab PI: Dr. Jeremy Wolfe Harvard Medical School and Brigham & Women's Hospital, Cambridge, USA

# Grants & Fellowships

2021-2024	DP210100433 "Heat transfer and fluid flow in geomaterials: Physics-inspired AI framework" (\$388,735 AUD)	
2021	MEL/BER Partnership Program "Artificial Intelligence to advance Cognitive Training Adherence and Compliance at Home (AI-COACH)" (\$81,725 AUD)	
2020	MSE Platform Interdisciplinary Grant "Reducing risk and improving safety on construction sites by computer vision and AI" (\$30,000 AUD)	
2017-2019	Vision: Science to Applications (VISTA) Postdoctoral Fellowship, York University	
2012-2013	P.E.O. Scholar Award, Philanthropic Educational Organization	
2009-2012	Graduate Research Fellowship, National Science Foundation	

# Awards & Honors

2019	Facebook Reality Labs award for best Human Vision poster, ICPV2019 (2 <sup>nd</sup> place)
2011	Walle Nauta Award for Continued Dedication to Teaching
2010	Angus MacDonald Award for Excellence in Undergraduate Teaching
2009	Elsevier/Vision Research Travel Award
2008	NSF Graduate Research Fellowship Honorable Mention
2007	NSF Graduate Research Fellowship Honorable Mention
2007	Drever Prize (top undergraduate in Psychology), University of Edinburgh

# Publications

Anderson, M., Graf, E. W., Elder, J. H., **Ehinger, K. A.**, & Adams, W. J. (2021). Category systems for real-world scenes. *Journal of Vision*.

Zhang, R., Madumal, P., Miller, T., **Ehinger, K. A.**, & Rubinstein, B. I. P. (2021). *Invertible* concept-based explanations for CNN models with non-negative concept activation vectors. AAAI Conference on Artificial Intelligence (AAAI).

Rashidi, S., **Ehinger, K. A.**, Turpin, A., & Kulik, L. (2020). Optimal visual search based on a model of target detectability in natural images. *Neural Information Processing Systems (NeurIPS)*.

Spratley, S., **Ehinger, K. A.**, & Miller, T. (2020). A closer look at generalisation in RAVEN. *European Conference on Computer Vision (ECCV)*.

Zhang, J., Fang, S., **Ehinger, K. A.**, Haikun, W., Yang, W., Zhang, K., & Yang, J. (2018). Hypergraph optimization for salient region detection based on foreground and background queries. *IEEE Access*, 6, 26729-26741.

**Ehinger, K. A.**, Adams, W. J., Graf, E. W., & Elder, J. H. (2017). Local depth edge detection in humans and deep neural networks. *International Conference on Computer Vision (ICCV) Workshop on Mutual Benefits of Cognitive and Computer Vision*, 2681-2689.

Aizenman, A. M., Drew, T., **Ehinger, K. A.**, Georgian-Smith, D., & Wolfe, J. M. (2017). Comparing search patterns in digital breast tomosynthesis and full-field digital mammography: an eye tracking study. *Journal of Medical Imaging*, 4(4):045501, doi: 10.1117/1.JMI.4.4.045501.

**Ehinger, K. A.** & Rosenholtz, R. (2017). A general account of peripheral encoding also predicts scene perception performance. *Journal of Vision*, 16:13, doi:10/1167/16.2.13.

Zhang, J., **Ehinger, K. A.**, Wei, H., Zhang, K., & Yang, J. (2017). A novel graph-based optimization framework for salient object detection. *Pattern Recognition*, 64(C), 39-50.

**Ehinger, K. A.** & Wolfe, J. M. (2016). When is it time to move to the next map? Optimal foraging in guided search. *Attention, Perception & Psychophysics*, 78(7), 2135-2151.

**Ehinger, K. A.**, Allen, K., & Wolfe, J. M. (2016). Change blindness for cast shadows in natural scenes: Even informative shadow changes are missed. *Attention, Perception & Psychophysics*, 78(4), 978-987.

Xiao, J., **Ehinger, K. A.**, Hays, J., Torralba, A., & Oliva, A. (2016). SUN Database: Exploring a large collection of scene categories. *International Journal of Computer Vision*, 119(1), 3-22.

Sareen, P., Ehinger, K. A., & Wolfe, J. M. (2016). A Change Detection Database for objects in natural indoor scenes. *Behavior Research Methods*, 48(4), 1343-1348.

Sareen, P., Ehinger, K. A., & Wolfe, J. M. (2015). Through the looking-glass: Objects in the mirror are less real. *Psychonomic Bulletin & Review*, 22(4), 980-986.

Zhang, J., Ehinger, K. A., Ding, J., & Yang, J. (2014). A prior-based graph for salient object detection. *Proc. 21st IEEE International Conference on Image Processing (ICIP)*.

Xiao, J., Hays, J., Russell, B. C, Patterson, G., **Ehinger, K. A.**, Torralba, A., & Oliva, A. (2013). Basic level scene understanding: Categories, attributes and structures. *Frontiers in Psychology*, 4. doi: 10.3389/fpsyg.2013.00506

Xiao, J., **Ehinger, K. A.**, Oliva, A., & Torralba, A. (2012). Recognizing scene viewpoint using panoramic place representation. *Proceedings of 25th IEEE Conference on Computer Vision and Pattern Recognition*.

Goujon, A., Brockmole, J. R., & Ehinger, K. A. (2012). How visual and semantic information influence learning in familiar contexts. *Journal of Experimental Psychology: Human Perception and Performance*, 38, 1315-1327.

Rosenholtz, R., Huang, J., & **Ehinger, K. A.** (2012). Rethinking the role of top-down attention in vision: Effects attributable to a lossy representation in peripheral vision. *Frontiers in Consciousness Research*, 3. doi: 10.3389/fpsyg.2012.00013

**Ehinger, K. A.** & Oliva, A. (2011). Canonical views of scenes depend on the shape of the space. In L. Carlson, C. Hölscher, & T. Shipley (Eds.), *Proceedings of the 33rd Annual Conference of the Cognitive Science Society* (pp. 2114-2119). Austin, TX: Cognitive Science Society.

**Ehinger, K. A.**, Xiao, J., Torralba, A., & Oliva, A. (2011). Estimating scene typicality from human ratings and image features. In L. Carlson, C. Hölscher, & T. Shipley (Eds.), *Proceedings of the 33rd Annual Conference of the Cognitive Science Society* (pp. 2562-2567). Austin, TX: Cognitive Science Society.

**Ehinger, K. A.** & Altschuler, E. L. (2011). What did the early American presidents really look like? Gilbert Stuart portraits as a "Rosetta Stone" to the pre-photography era. *Perception*, 40(1), 91-94.

Xiao, J., Hays, J., **Ehinger, K. A.**, Oliva, A., & Torralba, A. (2010). SUN Database: Large scale scene recognition from abbey to zoo. In *Proc. 23rd IEEE Conference on Computer Vision and Pattern Recognition*, 3485-3492.

Judd, T., **Ehinger, K.**, Durand, F., Torralba, A. (2009). Learning to predict where people look. In *12th IEEE International Conference on Computer Vision*, 2106-2113.

**Ehinger, K. A.**, Hidalgo-Sotelo, B., Torralba, A., & Oliva, A. (2009). Modeling search for people in 900 Scenes: A combined source model of eye guidance. *Visual Cognition*, 17, 945-978.

**Ehinger, K. A.** & Brockmole, J. R. (2008). The role of color in visual search in real-world scenes: Evidence from contextual cueing. *Perception & Psychophysics*, 70(7), 1366-1378.

# Manuscripts

Xu, P., **Ehinger, K. A**., Zhang, Y., Finkelstein, A., Kulkarni, S. R., & Xiao, J. (2015). TurkerGaze: Crowdsourcing saliency with webcam based eye tracking. arXiv:1504.06755.

Xiao, J., Russell, B. C., Hays, J., **Ehinger, K. A.**, Oliva, A., & Torralba, A. (2012). Basic level scene understanding: From labels to structure and beyond. In *SIGGRAPH Asia 2012 Technical Briefs (SA '12)*, Article 36. ACM: New York, NY.

# **Conference Presentations**

## 2020

Rashidi, S., **Ehinger, K. A.**, Turpin, A., & Kulik, L. (2020). Optimal visual search based on a model of target detectability in natural images. Poster presented at Neural Information Processing Systems (NeurIPS).

Spratley, S., **Ehinger, K. A.**, & Miller, T. (2020). A closer look at generalisation in RAVEN. Poster presented at European Conference on Computer Vision (ECCV).

#### 2019

**Ehinger, K. A.**, Qian, Y., Wilcox, L. M., & Elder, J. M. (2019). Influence of 2D shape on contour depth perception. Poster presented at the International Conference on Predictive Vision, June 13, 2019.

Vilankar, K., Xiang, H., **Ehinger, K. A.**, Adams, W. J., Graf, E. W., & Elder, J. H. (2019). Monocular depth discrimination in natural scenes: Humans vs. deep networks. Poster presented at Vision Sciences Society annual meeting, May 20, 2019.

**Ehinger, K. A.**, Qian, Y., Wilcox, L. M., & Elder, J. M. (2019). Influence of 2D shape on contour depth perception. Talk presented Vision Sciences Society annual meeting, May 18, 2019.

#### 2018

**Ehinger, K. A.** (2018). Motion Processing. Talk presented at CVPR 2018 Tutorial: A Crash Course in Computer Vision, June 18, 2018.

**Ehinger, K. A.** (2018). Perceiving Depth and Size. Talk presented at CVPR 2018 Tutorial: A Crash Course in Computer Vision, June 18, 2018.

**Ehinger, K. A.**, Adams, W. J., Graf, E. W., & Elder, J. H. (2018). Use of local image information in depth edge classification by humans and neural networks. Poster presented at Vision Sciences Society annual meeting, May 19, 2018.

**Ehinger, K. A.**, Adams, W. J., Graf, E. W., & Elder, J. H. (2018). Use of local image information in depth edge classification by humans and neural networks. Talk presented at MODVIS (Computational and Mathematical Models in Vision), May 17, 2018.

#### 2017

**Ehinger, K. A.**, Adams, W. J., Graf, E. W., & Elder, J. H. (2017). Detecting depth edges in spherical imagery with LiDAR ground truth. Talk presented at 2017 GIS in Education and Research Conference, Oct. 11, 2017.

**Ehinger, K. A.**, Joseph, K. T., Adams, W. J., Graf, E. W., & Elder, J. H. (2017). Detecting depth edges in real-world scenes with 3D ground truth. Poster presented at 2017 CVR International Conference on Vision in the Real World, June 15, 2017.

**Ehinger, K. A.**, Joseph, K. T., Adams, W. J., Graf, E. W., & Elder, J. H. (2017). Learning to identify depth edges in real-world images with 3D ground truth. Poster presented at Vision Sciences Society annual meeting, May 20, 2017.

**Ehinger, K. A.**, Joseph, K. T., Adams, W. J., Graf, E. W., & Elder, J. H. (2017). Learning to identify depth edges in real-world images with 3D ground truth. Talk presented at MODVIS (Computational and Mathematical Models in Vision), May 19, 2017.

## 2016

**Ehinger, K. A.** & Wolfe, J. M. (2016). How is visual search guided by shape? Using features from deep learning to understand preattentive "shape space". Poster presented at Vision Sciences Society annual meeting, May 15, 2016.

Micheletto, R., **Ehinger, K. A.**, & Wolfe, J. M. (2016). Role of simple primitive shapes in complex distractors: Do shared features affect search times? Poster presented at Vision Sciences Society annual meeting, May 15, 2016.

Wolfe, J. M., Aizenman, A., Park, J., & **Ehinger, K. A.** (2016). How did you hide my bunny? Using a genetic algorithm to investigate preattentive processing of shape in visual search. Talk presented at Vision Sciences Society annual meeting, May 15, 2016.

# 2015

Mullins, R. S., **Ehinger, K. A.**, Aizenmann, A. M., Weiss, C. A., Wolfe, J. M., Fouse, A., & Pfautz, S. (2015). Geographic analysis in context: A visual search task comparing zooming metaphors. Paper session at North American Cartographic Information Society (NACIS) annual meeting, Oct. 15, 2015.

Aizenman, A. M., Thompson, M. B., **Ehinger, K. A.**, & Wolfe, J. M. (2014). Visual search through a 3D volume: Studying novices in order to help radiologists. Talk presented at Vision Sciences Society annual meeting, May 19, 2015.

**Ehinger, K. A.** & Wolfe, J. M. (2015). Foraging in satellite imagery: When is it time to move to the next map? Talk presented at Vision Sciences Society annual meeting, May 18, 2015.

Josephs, E., Cain, M. S., Hidalgo-Sotelo, B., Cook, G., Chang, N., **Ehinger, K. A.**, Oliva, A., Wolfe, J. M. (2015). When is stereopsis useful in visual search? Poster presented at Vision Sciences Society annual meeting, May 20, 2015.

Wolfe, J. M., Cain, M. S., **Ehinger, K. A.**, & Drew, T. (2014). Guided Search 5.0: Meeting the challenge of hybrid search and multiple-target foraging. Talk presented at Vision Sciences Society annual meeting, May 19, 2015.

Xiao, J., Xu, P., Zhang, Y., **Ehinger, K. A.**, Finkelstein, A., & Kulkarni, S. (2015). What can we learn from eye tracking data on 20,000 images? Poster presented at Vision Sciences Society annual meeting, May 18, 2015.

# 2014

**Ehinger, K. A.** & Wolfe, J. M. (2014). Foraging and navigating in a virtual orchard: Which tree do you visit next? Talk presented at Vision Sciences Society annual meeting, May 19, 2014.

Sareen, P., **Ehinger, K. A.**, & Wolfe, J. M. (2014). Through the looking glass: Are objects in mirrors really objects? Poster presented at Vision Sciences Society annual meeting, May 17, 2014.

# 2013

**Ehinger, K. A.** & Rosenholtz, R. (2013). Texture statistics predict human performance on a range of scene-perception tasks. Poster presented at the Vision Sciences Society annual meeting, May 14, 2013.

# 2012

**Ehinger, K. A.** & Rosenholtz, R. (2012). Quantifying boundary extension in scenes. Poster presented at Vision Sciences Society annual meeting, May 15, 2012.

# 2011

**Ehinger, K. A.** & Oliva, A. (2011). What determines the canonical view of a scene? Talk presented at Vision Sciences Society annual meeting, May 8, 2011.

**Ehinger, K. A.** & Oliva, A. (2011). Canonical views of scenes. Poster presented at the MIT Scene Understanding Symposium, Jan 28, 2011.

# 2010

**Ehinger, K. A.**, Haggerty, K. M., & Oliva, A. (2010). Canonical views of scenes depend on the shape of the space. Poster presented at Object Perception, Attention, & Memory, Nov, 18, 2010.

**Ehinger, K. A.**, Torralba, A., & Oliva, A. (2010). Building a taxonomy of visual scenes: Typicality ratings and hierarchical classification. Poster presented at Vision Sciences Society annual meeting, May 9, 2010.

Hays, J., Xiao, J., **Ehinger, K. A.**, Oliva, A., & Torralba, A. (2010). Scene categorization and detection: the power of global features. Talk presented at Vision Sciences Society annual meeting, May 8, 2010.

#### 2009

**Ehinger, K. A.**, Hidalgo-Sotelo, B., Torralba, A., & Oliva, A. (2009). Modeling search for people in 900 Scenes: The roles of saliency, target features, and scene context. Talk presented at Vision Sciences Society annual meeting, May 10, 2009.

**Ehinger, K. A.**, Hidalgo-Sotelo, B., Torralba, A., & Oliva, A. (2009). Modeling search for people in 900 Scenes: A combined source model of eye guidance. Poster presented at the MIT Scene Understanding Symposium, Jan 30, 2009.

Oliva, A., **Ehinger, K. A.**, Hidalgo-Sotelo, B., & Torralba, A. (2009). Context rules supreme in visual search through real-world scenes. Talk presented at the MIT Scene Understanding Symposium, Jan 30, 2009.

## 2008

**Ehinger, K. A.** (2008). Modeling sources of visual attention guidance in real-world search. Talk presented at MIT Cognitive Lunch, Oct 21, 2008.

**Ehinger, K. A.** & Oliva, A. (2008). Characterizing the shape and texture of natural objects using Active Appearance Models. Poster presented at the Vision Sciences Society annual meeting, May 11, 2008.

**Ehinger, K. A.** & Brockmole, J. R. (2008). The role of color in real-world scene contextual cueing. Poster presented at the MIT Scene Understanding Symposium, Feb 1, 2008.

# Invited Talks

# 2019

Panel presentation at Losing Lena at the University of Melbourne, December 19, 2019.

"Learning from large image datasets," Talk and panel participant at the Finding Ways to Make Unstructured Data Usable symposium presented by Data, Systems and Society Research Network (DSSRN) at the University of Melbourne, November 28, 2019.

# Teaching

# **Courses Taught**

2020-21	Machine Learning (COMP30027) (coordinator, co-instructor Ling Luo)
	Melbourne School of Engineering, The University of Melbourne
2019-20	Data Structures and Algorithms (COMP20003) (with co-instructor Nir Lipovetzky)
	Melbourne School of Engineering, The University of Melbourne

# **Courses Developed & Taught**

Spring 2015 Computational Perception (9.77) (with co-instructor Edward Adelson)

Department of Brain & Cognitive Sciences, MIT

Spring 2014 Computational Perception (9.77) (with co-instructor Edward Adelson) Department of Brain & Cognitive Sciences, MIT

## Tutorials / Short courses

2018	A Crash Course in Human Vision Full-day tutorial at CVPR 2018 (sites.google.com/view/cvpr2018cchv)
2014	Introduction to Computer Vision 5-lecture course for Frank S. Levy, Dept. of Urban Studies & Planning, MIT
2011	Programming Experiments in MATLAB PsychToolbox

Tutorial for MIT 9.63 (kehinger.com/PTBexamples.html)

## **Guest Lectures**

Spring 2016	Principles of Neural Coding (GS/PSYC 6256), York University "Signal detection theory and Bayesian decision theory" "Deep learning"	
	Statistical Modelling of Perception and Cognition (PSYC 6229), York University "Models of visual search"	
Fall 2016	Applications in Vision Science (BIOL 5149/KAHS 5149/PSYC 6228), York University "Deep belief nets and object recognition"	
Fall 2012	Special Topics in Vision Science (9.357), MIT "'Stuff' approaches to scene perception"	
Spring 2012	Computational Perception (9.77/9.777), MIT "Gradients, edges, SIFT, and HOG" "Texture analysis and synthesis"	
Fall 2010	Computational Visual Cognition Lab tutorial series, MIT "Mechanical Turk: Advanced experiment programming"	
Fall 2009	Computational Perception (9.77), MIT "Image analysis: Principles of saliency" "Computational models: Visual search" "Active Appearance Models"	
Fall 2008	Laboratory in Visual Cognition (9.63), MIT "Applying the Active Appearance Model to animal objects"	

#### Teaching Assistantships

Spring 2012	Computational Perception (9.77/9.777), MIT
Fall 2011	Laboratory in Visual Cognition (9.63), MIT
Fall 2010	Laboratory in Visual Cognition (9.63), MIT
Fall 2009	Computational Perception (9.77), MIT
Fall 2009	Laboratory in Visual Cognition (9.63), MIT
Spring 2009	Introduction to Psychology (9.00), MIT

# **Students Mentored**

# PhD2019-Shima Rashidi"A cognitive model of Visual search in natural<br/>images, from neural circuits to search strategies"<br/>(co-supervisors: Andrew Turpin, Lars Kulik)2019-Steven R. Spratley"Abstraction and analogy in vision systems" (co-<br/>supervisor: Tim Miller)2019-Ruihan Zhang"Explainability based on human understandable<br/>features for CNN models" (co-supervisors: Tim<br/>Miller, Ben Rubinstein)

#### MA / MSc / MPhil

2019	Dmitry Grebenyuk	"Learning to generalise through features"
2018-20	Maryam Taheri-Shirazi	"Deep networks for assisted target detection in
		airborne search and rescue"
2018	Khushbu Patel	"Perception of lighting and reflectance in real and
		stimuli" (supervised thesis writing)

#### **Masters Projects**

2020	Yu Bai	"Depth estimation from image normal" (M-CS)
2020	Hai Ho Dac	"Understanding how object detectors search for
		targets in scenes" (M-IT)
2020	Hangyu Pan	"Facial expression classification" (M-CS)
2020	Yuhan Zhang	"Retinopathy detection based on ensembled multi-
		type convolutional neural network" (M-CS)
2019	David Watson	"Do CNNs search like humans?" (M-IT)

VISTA Travel Award recipient

#### Visiting Scholar

2019-2020	Khushbu Patel
2010 2020	

# Undergraduate

2018	David Kennedy	Lassonde Undergraduate Summer Research
2015	Kala Allen	CELEST Summer Program, Boston University
2014	Pascale Chataigne	CELEST Summer Program, Boston University
2014	Trevor Stubbs-Stroud	CELEST Summer Program, Boston University

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2021-	AI co-lead, School of Computing and Information Systems, The University of Melbourne
2020-	Program coordinator, Master of Information Technology (AI stream)
2020-	Human Research Ethics Committee member, The University of Melbourne
2019	Organizer, Mutual Benefits of Computational and Computer Vision workshop at CVPR 2019 (sites.google.com/view/mbccv19)
2018	Organizer, Mutual Benefits of Computational and Computer Vision workshop at CVPR 2018 (sites.google.com/site/mbcc2018w)
2018	Organizer, A Crash Course in Human Vision tutorial at CVPR 2018 (sites.google.com/view/cvpr2018cchv)
2017	Program committee member, Mutual Benefits of Computational and Computer Vision workshop at ICCV 2017 (sites.google.com/site/mbcc2017w)
2015	Program committee member, Conference on Sensorimotor, Perceptual Learning and Training
2008-2009	Graduate student representative, Department of Brain & Cognitive Sciences, MIT

# Additional Training

2016-2017	CREATE Postdoctoral Training program in Vision Science & Applications, York
	University
2012	Computational Vision Summer School, Bernstein Center Tübingen

# Science Outreach

2021	Mentor for Techgirls national competition
2017-2018	Cooperative Education mentor for Northville Heights Secondary School, Toronto
2017	Volunteer tutor for Ladies Learning Code, Toronto
2015	Mentor for Harvard Medical School's Project SUCCESS, summer program for high
	school science students from underrepresented / disadvantaged groups
2014-2016	Scholar Award search committee, Philanthropic Educational Organization

# Editorships

2020- Associate Editor, *Visual Cognition* (Taylor & Francis, UK)

# Ad-Hoc Reviewer

ACM SIGCHI

ACM Transactions on Applied Perception

Attention, Perception, & Psychophysics **Cognitive Research: Principles and Implications** Evolutionary Psychology Frontiers in Psychology **IEEE** Access **IEEE Transactions on Applied Perception** IEEE Transactions on Image Processing IEEE Transactions on Pattern Analysis and Machine Intelligence Journal of Artificial Intelligence Research Journal of Experimental Psychology: Human Perception and Performance Journal of Vision Pattern Recognition Perception PLOS One **Psychonomic Bulletin & Review** Quarterly Journal of Experimental Psychology Vision Research Visual Cognition

# **Professional Memberships**

- 2018- Association for Computing Machinery (ACM)
- 2017- Institute for Electrical and Electronic Engineers (IEEE)
- 2008- Vision Sciences Society