JOHANNES BURGE June 1, 2018

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Academic Positions

Assistant Professor of Psychology	University of Pennsylvania	2014-present
Post-doctoral Fellow	University of Texas at Austin	2009-2014
Post-doctoral Researcher	University of California, Berkeley	2008-2009

Education

Vision Science, PhD	University of California, Berkeley	2008
BA: Psychology; Minor: Mathematics	Stanford University	2000

Funding

NIH-R01, EY028571	"Estimating and Discriminating Motion and Depth in Natural Scenes"	2018-2023
PI: **Johannes Burge**	UPenn: Direct Costs: $1,250,000; Indirect Costs: $762,500	
Oculus Research Grant	"Optimal & human focus error estimation from individual images"	2017-2018
PI: **Johannes Burge**	UPenn: Direct Costs: $25,000; Indirect Costs: $0	
NIH-R01, EY011747	"Detection and Estimation of Local Properties in Natural Scenes"	2016-2020
PI: Wilson S. Geisler	UT Austin: Direct Costs: $760,000; Indirect Costs: $XXX,XXX	
Co-Investigator: **Johannes Burge**	UPenn: Direct Costs: $240,000; Indirect Costs: $146,400	

Awards

NSF CAREER Award	University of Pennsylvania (declined)	2018
NIH Institutional Training Grant	University of Texas at Austin	2012-2014
Best Paper Award	SPIE, Digital Photography VIII; Canon USA, Inc.	2012
Post-doctoral Travel Award	Computational and Systems Neuroscience	2012
William C. Ezell Fellowship	American Optometric Foundation (AOF)	2006
NIH Institutional Training Grant	University of California, Berkeley	2002-2004

Trainee Awards

Benjamin Chin	University of Pennsylvania: Dean's Scholar Award	2018

Patents

Burge J, Geisler WS. "Focus error estimation in images". Application No. 13/965,758. Reference No.: 5934 US. File No.: 93331-001910US-882167. Filing date: August 13, 2013.

Publications

Iyer AV, **Burge J** (submitted). "Model neuron response statistics to natural images".

Burge J (submitted). "Optimal image-based estimates of focus error in the human eye and in a smartphone camera".

Geisler WS, **Burge J** (under revision). "Local image matching to estimate global surface orientation and distance".

Iyer AV, **Burge J** (2018). "Depth variation and stereo processing tasks in natural scenes". *Journal of Vision*. 18(6): 4, 1-22. doi:10.1167/18.6.4.

Kim S, **Burge J** (2018). "The lawful imprecision of human surface tilt estimation in natural scenes". *eLife*. 7:31448. doi: 10.7554/eLife.31448

Jaini P, **Burge J** (2017). "Linking normative models of natural tasks and descriptive models of neural response". *Journal of Vision*. 17(12): 16, 1-26.

Burge J, Jaini P (2017). "Accuracy Maximization Analysis for sensory-perceptual tasks: Computational improvements, filter robustness, and coding advantages for scaled additive noise". *PLoS Computational Biology*. 13(2):e1005281. doi:10.1371/journal.pcbi.1005281

Burge J (2017). "Accurate image-based estimates of focus error in the human eye and in a smartphone camera". *Information Display*. 33(1), 18-23.

Burge J, McCann BC, Geisler WS (2016). "Estimating 3D tilt from local image cues in natural scenes". *Journal of Vision*. 16(13): 2, 1–25.

Green JD, **Burge J**, Stansberry JA, Meinke B (2016). "Cameras a Million Miles Apart: Stereoscopic Imaging Potential with Hubble and James Webb Space Telescopes". *arXiv*:1610.0748

Burge J, Geisler WS (2015). "Optimal speed estimation in natural image movies predicts human performance". *Nature Communications*. doi:10.1038/ncomms8900

Sebastian S*, **Burge J***, Geisler WS (2015). "Defocus blur discrimination in natural images with natural optics". *Journal of Vision*, 5(15):16, 1-17. ***Joint first-authorship**

Bonnen K, **Burge J**, Yates J, Pillow JW, Cormack LK (2015). "Continuous psychophysics: Target-tracking to measure visual sensitivity". *Journal of Vision*, 15:3(14), 1-16.

Burge J, Geisler WS (2014). "Optimal disparity estimation in natural stereo-images". *Journal of Vision*. 14:2(1), 1-18.

Geisler WS, **Burge J**, Michel MM, D'Antona AD (2014). Characterizing the effects of stimulus and neural variability on perceptual performance. In: Gazzinga & Mangun (Eds.). The Cognitive Neurosciences, 5th Edition, 363-374. Cambridge: MIT Press.

Scholl B, **Burge J**, Priebe NJ (2013). "Binocular integration and disparity selectivity in mouse primary visual cortex". *Journal of Neurophysiology*, 109, 3013-3024.

Burge J, Geisler WS (2013). Simulation of mouse vision appearing in a news feature by Monya Baker. "Through the eyes of a mouse", *Nature*, 502, 156-158.

Burge J, Geisler WS (2012). "Optimal defocus estimates from individual images for autofocusing a digital camera". Proceedings of the SPIE, January: Burlingame, CA. (Best Paper Award)

Burge J, Geisler WS (2011). "Optimal defocus estimation in individual natural images". *Proceedings of the National Academy of Sciences*, 108 (40): 16849-16854.

Cooper E, **Burge J**, Banks MS (2011). "The vertical horopter is not adaptable but it may be adaptive". *Journal of Vision*, 11(3) 20: 1-19.

Banks MS, **Burge J**, & Held R (2011). "The statistical relationship between depth, visual cues, and human perception". In: Sensory Cue Integration. Ed: Landy, M. Oxford University Press.

Burge J, Geisler WS (2011). "Optimal image-based defocus estimates from individual natural images". Proceedings of the Optical Society of America: Imaging Systems and Applications, July: Toronto, Canada.

Burge J, Fowlkes CC, Banks MS (2010). "Natural scene statistics predict how the figure-ground cue of convexity affects human depth perception". *Journal of Neuroscience*, 30(21): 7269-7280.

Burge J, Girshick AR, Banks MS (2010). "Visual-haptic adaptation is determined by relative reliability". *Journal of Neuroscience*, 30(22): 7714-7721.

Burge J, Ernst MO, Banks MS (2008). "The statistical determinants of adaptation rate in human reaching". *Journal of Vision*, 8(4) 20: 1-19.

Burge J, Peterson MA, & Palmer SE (2005). "Ordinal configural cues combine with metric disparity in depth perception." *Journal of Vision*, 5(6), 534-542.

Gepshtein S, **Burge J**, Ernst MO, & Banks MS (2005). "The combination of vision and touch depends on spatial proximity." *Journal of Vision*, 5(11), 1013-1023.

Professional & University Service

Official Advisor	Computational Neuroscience Minor at the University of Pennsylvania	2015-present
Editorial Board	Neurons, Behavior, Data analysis, and Theory (NBDT)	2018-present
Editor	Scientific Reports	2016-present
Organizer	Interdisciplinary Mind-Brain Colloquium Series (Chair)	2017-2018
	Interdisciplinary Mind-Brain Colloquium Series	2016-2017
	CoSyNe Workshop: "Joint Encoding/Decoding in Specific Sensory-Perceptual Tasks"	2017
	CoSyNe Program Committee Member	2016
	CoSyNe Program Committee Member	2015
	Department of Psychology Colloquium Series	2015-16
Reviewer	Advances in Neural and Information Processing Systems, Cognition, Current Biology, eLife, Frontiers in Perception Science, Frontiers in Psychology, IEEE-Transactions on Image Processing, IEEE-Pattern Analysis and Machine Intelligence, Investigative Ophthalmology and Visual Science, Journal of Neuroscience, Journal of Neurophysiology, Journal of Vision, Nature Neuroscience, Neural Computation, Neuron, PLoS Computational Biology, PLoS One, Proceedings of the National Academy of Sciences, Royal Society Open Science, Scientific Reports, Scientific Advances, Transactions on Haptics, Vision Research	

Invited Talks

2018, April	Kings Court English House, University of Pennsylvania	Philadelphia, PA
2018, March	University of Ülm	Ülm, Germany
2017, May	University of Nevada at Reno	Reno, NV
2017, April	Rochester Institute of Technology	Rochester, NY
2017, March	SUNY: Optometry	New York, NY
2017, February	Cosyne Workshop "Joint Encoding and Decoding in Specific Sensory-Perceptual Tasks"	Salt Lake City, UT
2017, January	Annual Interdisciplinary Conference	Breckenridge, CO
2016, October	PRISM 6 "Perceptual representation of illumination, shape, and materials"	Geissen, Germany
2016, September	Rank Prize Lectures "Seeing the World from More than One Perspective"	Grasmere, England
2016, May	Vision Sciences Society: Symposium "Artifice versus realism as an experimental methodology"	St. Petersburg, FL
2016, April	Princeton University	Princeton, NJ
2015, August	Stanford University Workshop	Stanford, CA
2015, June	Systems & Integrative Vision Training Grants Retreat (UPenn)	Philadelphia, PA
2015, May	Vision Sciences Society	St. Petersburg, FL
2014, November	Rutgers University	New Brunswick, NJ
2014, May	Vision Sciences Society	St. Petersburg, FL
2014, February	Annual Interdisciplinary Conference	Jackson Hole, WY
2013, May	Vision Sciences Society	Naples, FL
2013, January	University of Pennsylvania	Philadelphia, PA
2012, June	"Perception, Representation, & Objectivity: Themes from Tyler Burge"	St. Petersburg, Russia
2012, February	Computational and Systems Neurosciences	Salt Lake City, UT
2012, January	IS&T/SPIE Conference on Electronic Imaging	Burlingame, CA
2012, January	Stanford University	Stanford, CA
2011, July	Optical Society of America, Imaging Systems	Toronto, Canada
2011, May	Vision Sciences Society	Naples, Florida
2011, February	Ohio State University	Columbus, Ohio
2010, September	Redwood Center for Theoretical Neuroscience	Berkeley, CA

2010, May	Vision Sciences Society	Naples, Florida
2010, March	Italian Institute of Technology	Genoa, Italy
2010, March	Computational and Systems Neurosciences	Salt Lake City, Utah
2008, May	Vision Sciences Society	Naples, Florida
2007, August	European Conference on Visual Perception	Arezzo, Italy
2005, August	European Conference on Visual Perception	La Coruna, Spain
2005, July	MPI for Biological Cybernetics	Tubingen, Germany
2004, May	Vision Sciences Society	Sarasota, Florida

Teaching

2017, Fall	Psych 111: Introduction to Perception	University of Pennsylvania
2016, Fall	Psych 111: Introduction to Perception	University of Pennsylvania
2016, Fall	Psych 600: Pro-seminar in Perception	University of Pennsylvania
2016, Spring	Psych 511: Fundamentals of Vision	University of Pennsylvania
2015, Fall	Psych 111: Introduction to Perception	University of Pennsylvania
2015, Spring	Psych 111: Introduction to Perception	University of Pennsylvania
2011, July	Summer Workshop: Natural scene statistics	Ludwig Maximilian Universität
2003	Perception & Psychophysics	UC, Berkeley
2003	Perception & Psychophysics	UC, Berkeley

Mentoring

Post-doctoral Fellows:	Takahiro Doi, Ph.D.	(2017-present)
	Vijay Singh, Ph.D.	(2016-present; jointly advised with David Brainard)
	Seha Kim, Ph.D.	(2015-present)
	Arvind Iyer, Ph.D.	(2015-2018)
Ph.D. students:	David White,	Neuroscience (2016-present)
	Benjamin Chin,	Psychology (2015-present)
Rotation students:	Lingqi Zhang,	Psychology (2018)
	David White,	Neuroscience (2016)
	Benjamin Chin,	Psychology (2015)
Visiting students:	Victor Rodriguez,	Spanish National Research Council-CSIC, Optics M.S. student, Primary Advisor: Carlos Dorronsoro (2018).
	Priyank Jaini,	University of Waterloo, Computer Science Ph.D. student, Primary Advisor: Pascal Poupart (2015-2017).
Exam Committees:	Michael Barnett,	Psychology, 2018, Qualifying Committee Advisors: David Brainard & Geoff Aguire
	Jennifer Stiso,	Neuroscience, 2018, Qualifying Committee Advisors: Danielle Bassett & Timothy Lucas
	Yunshu Fan,	Neuroscience, 2015-present, Qualifying & Thesis Committees Advisors: Long Ding & Josh Gold
	Andrew Jaegle,	Neuroscience, 2015-2018, Qualifying & Thesis Committees Advisors: Diego Contreras & Kostas Daniilidis
	Alex Burka,	Bioengineering, 2015-2018, Qualifying & Thesis Committees Advisor: Katherine Kuchenbecker

Undergrad researchers: Emily Zanker (2017), Joseph Tharakhan (2015)

Conference Abstracts

Burge J (2018). "Inferring the shape of the decision variable distributions from psychometric functions". Vision Sciences Society, St. Petersburg, FL.

Kim S, **Burge J** (2018). "Spatial pooling of local Bayes-optimal estimates predicts human 3D tilt estimation in natural

scenes". Vision Sciences Society, St. Petersburg, FL.

Chin B, **Burge J** (2018). "A model grounded in natural scene statistics predicts human performance with both natural and artificial stimuli". Vision Sciences Society, St. Petersburg, FL.

Iyer A, **Burge J** (2018). "Optimal binocular disparity estimation in the presence of natural depth variation". Vision Sciences Society, St. Petersburg, FL.

Doi T, **Burge J** (2018). "Adaptive spatial re-weighting in stereoscopic depth perception revealed by disparity reverse correlation". Vision Sciences Society, St. Petersburg, FL.

White D, **Burge J** (2018). "Human binocular disparity estimation with natural stereo-images". Vision Sciences Society, St. Petersburg, FL.

Oluk C, Bonnen K, **Burge J**, Cormack LK, Geisler WS (2018). "Stereo slant estimation of planar surfaces: Standard cross-correlation vs. planar-correlation". Vision Sciences Society, St. Petersburg, FL.

Meinke B, Green J, **Burge J**, Stansbury JA, May B (2018). "Solar System Stereoscopy with Hubble and James Webb Space Telescopes". XXXth General Assembly of the International Astronomical Union. Vienna, Austria.

Singh V, Heasly B, Cottaris N, Brainard DH, **Burge J** (2017). "A supervised approach to understanding color constancy". Society for Neuroscience, Washington D.C.

Singh V, Heasly B, Cottaris N, Brainard DH, **Burge J** (2017). "A supervised approach to understanding color constancy". Cognitive Computational Neuroscience, New York, NY

Green JD, Stansberry JA, **Burge J**, Meinke B (2017). "Potential and Challenges for Stereo 3D Imaging with the Hubble and James Webb Space Telescopes". 49th Annual Division for Planetary Sciences Meeting, Provo, UT

Chin B, **Burge J** (2017). ""Predicting human performance in a natural task with strongly constrained models of noise". Vision Sciences Society, St. Petersburg, FL (TALK)

Kim S, **Burge J** (2017). "Human surface tilt estimation in natural and artificial 3D scenes". Vision Sciences Society, St. Petersburg, FL (TALK)

Iyer AV, **Burge J** (2017). "Predicting natural depth variation and its effect on binocular disparity estimation". Vision Sciences Society, St. Petersburg, FL

Burge J, Jaini P (2017). "Linking Normative Models of Natural Tasks and Descriptive Models of Neural Response". Vision Sciences Society, St. Petersburg, FL

Burge J, Jaini P (2017). "Linking Normative Models and Methods for Neural Systems Identification". Cosyne, Salt Lake City, UT

Burge J (2017). "Depth variation, binocular contrast differences, and disparity estimation in natural scenes". Annual Interdisciplinary Conference, Breckenridge, CO (INVITED TALK).

Burge J (2016). "Predicting human performance in fundamental visual tasks with natural stimuli". Vision Sciences Society Symposium: "Artifice versus realism as an experimental methodology". St. Petersburg, FL (INVITED TALK)

Burge J (2016). "Local cues for half-occlusion detection in stereo-images of natural scenes". Vision Sciences Society, St. Petersburg, FL

Kim S, **Burge J** (2016). "Human tilt estimation in local patches of natural stereo images". Vision Sciences Society, St. Petersburg, FL

Chin B, **Burge J** (2016). "External vs. internal determinants of human speed discrimination with natural image movies". Vision Sciences Society, St. Petersburg, FL

Burge J, Jaini P (2016). "Accuracy Maximization Analysis for Sensory-Perceptual Tasks: Computational Improvements, Priors, and Coding Advantages for Multiplicative Noise". NETI Workshop, Austin, TX

Burge J (2016). "Optimal motion-in-depth estimation from natural stereo image movies". COSYNE, Salt Lake City, UT

Iyer AV, **Burge J** (2016). "Weber's Law in disparity discrimination is predicted by the statistics of natural stereo-images." COSYNE, Salt Lake City, UT

Burge J, Geisler WS (2015). "Optimal speed estimation in natural image movies predicts human performance". Vision Sciences Society, St. Petersburg, FL (TALK)

Burge J, Geisler WS (2014). "3D surface tilt estimation in natural scenes from image cue gradients". Vision Sciences Society, St. Petersburg, FL (TALK)

Bonnen K, **Burge J**, Yates JL, Pillow JW, Cormack LK (2014). "A general behavioral tracking paradigm for estimating visual sensitivity using dynamic internal models". COSYNE, Salt Lake City, UT

Burge J, Geisler WS (2014). "3D surface tilt estimation in natural scenes from image cue gradients". COSYNE, Salt Lake City, UT

Burge J, Geisler WS (2014). "Using natural image movies to determine optimal processing for speed estimation". Annual Interdisciplinary Conference, Jackson Hole, WY

Burge J, Geisler WS (2013). "Optimal retinal speed estimation in natural image movies". Vision Sciences Society, Naples, FL

Burge J, Geisler WS (2013). "Optimal speed estimation in natural image movies". COSYNE, Salt Lake City, UT

Burge J, Geisler WS (2012). "Linear and non-linear receptive fields for optimal disparity estimation in natural stereo-images". COSYNE, Salt Lake City, UT (TALK)

Burge J, Geisler WS (2012). "Optimal defocus estimates from individual images for autofocusing a digital camera". IS&T/SPIE Conference on Electronic Imaging: Digital Photography, Burlingame, CA (TALK)

Sebastian S, **Burge J**, Geisler WS (2011). "Human discrimination of defocus blur in natural images". Society for Neuroscience, Washington, D.C.

Burge J, Geisler WS (2011). "Optimal receptive fields for disparity estimation in natural images". Society for Neuroscience, Washington, D.C.

Burge J, Geisler WS (2011) "Optimal image-based defocus estimates from individual natural images". Optical Society of America: Imaging Systems and Applications. Toronto, Canada. (TALK)

Burge J, Geisler WS (2011) "Optimal disparity estimation in natural stereo-images". Vision Sciences Society, Naples, Florida. (TALK)

Burge J, Geisler WS (2010) "Optimal defocus detection and estimation in natural images". Vision Sciences Society, Naples, Florida. (TALK)

Burge J, Geisler WS (2010) "Detection and estimation of defocus in natural images". COSYNE, Salt Lake City, Utah (TALK)

Burge J, Held R, Banks MS (2008) "Blur and accommodation are metric depth cues." Vision Sciences Society,

Sarasota, Florida (TALK)

Girshick AR, **Burge J**, Banks MS (2008). "Prior expectations in slant perception: has the visual system internalized natural scene geometry". Vision Sciences Society, Sarasota, Florida (TALK)

Burge J, Fowlkes, CC, Banks, MS (2007) "Configural cues, disparity, and depth perception: the internalization of natural scene statistics". European Conference on Visual Perception, A Coruna, Spain (TALK)

Burge J, Girshick AR, Banks MS (2007) "Visuo-haptic adaptation: the role of relative reliability" Vision Science Society, Sarasota, Florida

Burge J, Ernst MO, Banks MS (2006) "Modeling visuo-motor adaptation behavior with a Kalman Filter" Computational workshop: bridging the gap between sensation and perception, Karlsruhe, Germany

Burge J, Peterson MA, Palmer SE, & Banks MS (2005) "Configural cues combine with disparity in depth perception", European Conference on Visual Perception (TALK)

Ernst MO, **Burge J**, Banks MS (2005). "Using a Kalman Filter to predict visuomotor adaptation behavior". European Conference on Visual Perception

Banks MS, **Burge J**, & Schlerf, JE (2005). "Disparity and texture gradients are combined in a weighted sum and a subtraction" European Conference on Visual Perception

Ernst MO, **Burge J**, Banks MS (2005). "Resolving visual-tactual incongruity depends on sensory reliability". International Multisensory Research Forum, Dublin, Ireland

Burge J, Hillis JM., Landy MS, & Banks MS (2003) "Disparity and texture gradients are combined in two ways." Vision Sciences Society