

# Jeffrey Brooke Mulligan

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## Education

1986	PhD in Psychology, University of California at San Diego
1982	MA in Psychology, University of California at San Diego
1980	AB in Physics ( <i>cum laude</i> general studies), Harvard University
1975	US Math Olympiad Summer Program, Rutgers University

## Employment

2021-present	Magnit (formerly PRO Unlimited), onsite contractor at Apple Inc.
2018-2022	Independent contractor to UCB (supporting NSF-funded TELLab project)
1987-2021	Computer engineer, NASA Ames Research Center
1986-1987	National Research Council post-doctoral associate, NASA Ames Research Center
1980-1986	Research and teaching assistant, Department of Psychology, UC San Diego
1982-1983	Research assistant, AT&T Bell Laboratories, Murray Hill NJ
1980	Research assistant, Division of Applied Sciences, Harvard University

## Teaching

1991	Introduction to Computer Science, UC Santa Cruz
1991	Data Structures, UC Santa Cruz
1990	Sensation & Perception, Cal. State Hayward (Contra Costa campus)
1980-1986	Teaching assistant, Department of Psychology, UC San Diego courses taught: sensory laboratory, neuropsychology

## Professional societies

2020-present	Association for Computing Machinery (ACM)
2001-present	Vision Sciences Society (VSS)
1984-present	Optica (formerly Optical Society of America, OSA)
2005-present	Society for Information Display (SID)
1982-2001	Association for Research in Vision and Ophthalmology (ARVO)

## Professional service

### CONFERENCE ORGANIZATION

2015	Chair, local organizing committee, OSA Fall Vision Meeting
2013-2016	Chair/Vice-chair, Vision technical committee, Vision and Color division, OSA
2012-present	Co-organizer, VSS satellite workshop on Computational and Mathematical Models in Vision (MODVIS)
2011-2014	Program co-chair, ACM Symposium on Eye Tracking Research and Applications
2009-2010	Area chair, ACM Symposium on Eye Tracking Research and Applications
2004-present	Program committee, SPIE/IS&T Conference on Human Vision and Electronic Imaging
2005-present	Program committee (Applied Vision subcommittee) Society for Information Display
2006-2012	Program committee, International Symposium on Visual Computing

### STANDARDS COMMITTEES

2013-2016	COGAIN technical committee for eye tracker data quality standardization
2016-present	ICDM - International Committee for Display Metrology

### AD HOC REVIEWING

Journal of Vision (“exceptional reviewer”)  
Vision Research  
Journal of the Optical Society of America, A  
Displays  
Biomedical Optics Express  
IEEE Transactions on Biomedical Engineering  
Physiological Measurement  
Optics Letters

## Honors & awards

2009	NASA group achievement award, Constellation Training Facility team
1983-1985	IBM graduate fellowship
1984	NIH travel scholarship to attend International School of Biophysics (Italy)
1983	ARVO travel fellowship

## Software

2009,2016	QuIP - An interactive environment for QUick Image Processing. The QuIP interpreter provides a convenient interface to libraries for image processing, graphics, image acquisition, and control of other pieces of laboratory hardware. The system runs on unix-like systems (linux, Mac OSX), and Apple iOS. GPU acceleration is provided with either CUDA or OpenCL. <a href="https://github.com/nasa/QuIP">https://github.com/nasa/QuIP</a>
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## Publications

### JOURNAL ARTICLES & PROCEEDINGS PAPERS

2020	Mulligan, J. B. (2020). "Evaluation of tablet-based methods for assessment of contrast sensitivity." in Rogowitz, B. E. Pappas, T. N., and de Ridder, H. (eds.), <i>Proc. IS&amp;T Int'l. Symp. on Electronic Imaging: Human Vision and Electronic Imaging</i> , pp. 210-1 - 210-7, <a href="https://doi.org/10.2352/ISSN.2470-1173.2020.11.HVEI-210">https://doi.org/10.2352/ISSN.2470-1173.2020.11.HVEI-210</a> .
	Arsintescu, L., Chachad, R., Gregory, K. B., Mulligan, J. B. and Flynn-Evans, E. E. (2020). "The relationship between workload, performance and fatigue in a short-haul airline." <i>Chronobiology International</i> , DOI: 10.1080/07420528.2020.1804924. <a href="#">PDF</a>
2018	Mulligan, J. B. (2018). "Statistical identifications of fixations in noisy eye movement data." in Rogowitz, B. E. Pappas, T. N., and de Ridder, H. (eds.), <i>Human Vision and Electronic Imaging 2018, IS&amp;T International Symposium on Electronic Imaging 2018</i> .
	Flynn-Evans, E. E., Arsintescu, L., Gregory, K., Mulligan, J., Nowinski, J. and Feary, M. (2018). "Sleep and neurobehavioral performance vary by work start time during non-traditional day shifts." <i>Sleep Health</i> , v. 4, pp. 476-484, <a href="https://doi.org/10.1016/j.sleh.2018.08.002">https://doi.org/10.1016/j.sleh.2018.08.002</a> .

- 2017 Mulligan, J. B. (2017). "Illusory variations in apparent dot brightness induced by density modulations." In Shapiro, A. G., and Todorovic, D. (eds.), *Oxford Compendium of Visual Illusions*, Oxford University Press, Oxford.
- Arsintescu, L., Mulligan, J. B., and Flynn-Evans, E. E. (2017). "Evaluation of psychomotor vigilance task for touch screen devices." *Human Factors*, DOI:10.1177/0018720816688394. [PDF](#)
- 2016 Mulligan, J. B. (2016). "A method for rapid measurement of contrast sensitivity on mobile touch-screens." in Rogowitz, B. E. Pappas, T. N., and de Ridder, H. (eds.), *Human Vision and Electronic Imaging 2016, IS&T International Symposium on Electronic Imaging 2016*, pp. HVEI-104.1 - HVEI-104.6. [PDF](#)
- 2013 Mulligan, J. B., Stevenson, S. B., and Cormack, L. K. (2013). "Reflexive and voluntary control of smooth eye movements." in Rogowitz, B. E. Pappas, T. N., and de Ridder, H. (eds.), *Human Vision and Electronic Imaging XVIII*, Proc. SPIE, v. 8651. [PDF](#)
- 2012 Mulligan, J. B. (2012). "A GPU-accelerated software eye tracking system." *Proc. ACM Symposium on Eye Tracking Research and Applications (ETRA)*, pp. 265-268. [PDF](#)
- 2010 Mulligan, J. B., and Gabayan, K. N. (2010). "Robust optical eye detection during head movement." *Proc. ACM Symposium on Eye Tracking Research and Applications (ETRA)*, pp. 129-132. [PDF](#)
- McDermott, K. C., Malkoc, G., Mulligan, J. B., and Webster, M. A. (2010). "Adaptation and visual salience." *J. Vis.*, v. 10(13), pp. 1-32.
- 2009 Mulligan, J. B. (2009). "Presentation of calibrated images on the web." in Rogowitz, B. E. and Pappas, T. N. (eds.), *Human Vision and Electronic Imaging XIV*, Proc. SPIE, v. 7240. [PDF](#)
- Ahumada, A. J., Jr., Kaiser, M. K., and Mulligan, J. B. (2009). "The dynamic range of visual imagery in space." in Rogowitz, B. E. and Pappas, T. N. (eds.), *Human Vision and Electronic Imaging XIV*, Proc. SPIE, v. 7240.
- Mulligan, J. B. (2009) "Motion parallax enhances depth in a perspective air-traffic display." *SID Symposium Digest of Technical Papers*, v. 40(1), pp. 1231-1233. [PDF](#)

- 2008 Mulligan, J. B. (2008). "Measurement of eye velocity using active illumination." *Proc. ACM Symposium on Eye Tracking Research and Applications (ETRA)*, pp. 35-38. [PDF](#)
- 2008 Hamoud, R. I. and Mulligan, J. B., (2008). "Introduction to Eye Monitoring." In Hamoud, R. I. (ed.), *Passive Eye Monitoring*, Springer-Verlag, Berlin.
- 2006 Mulligan, J. B. (2006). "Optical eye models for gaze tracking." *Proc. ACM Symposium on Eye Tracking Research and Applications (ETRA)*, p. 51. [PDF](#)
- McDermott, K., Mulligan, J. B., Bebis, G., and Webster, M. A. (2006). "Visual search and eye movements in novel and familiar contexts." in Rogowitz, B. E., Pappas, T. N., and Daly, S. J. (eds.), *Human Vision and Electronic Imaging XI*, Proc. SPIE, v. 6057.
- 2005 Mulligan, J. B. (2005). "A tree-structured model of visual appearance applied to gaze-tracking." In Bebis, G., Boyle, R., Koracin, D., and Parvin, B. (eds.), *First International Symposium on Visual Computing*, Springer Lecture Notes on Computer Science v. 3804, pp. 303-312. [PDF](#)
- Mulligan, J. B., and Brolly, X. L. C. (2005). "Pilot behavior and course deviations during precision flight." in Rogowitz, B. E. and Pappas, T. N. (eds.), *Human Vision and Electronic Imaging X*, Proc. SPIE, v. 5666, pp. 362-373. [PDF](#)
- 2004 Mulligan, J. B., and Brolly, X. L. C. (2004). "Surface determination by photometric ranging." *Conference on Computer Vision and Pattern Recognition Workshop (CVPRW04)*, v. 3, pp. 40-47. [PDF](#)
- Brolly, X. L. C., and Mulligan, J. B. (2004). "Implicit calibration of a remote gaze tracker." *Conference on Computer Vision and Pattern Recognition Workshop (CVPRW04)*, v. 8, pp. 134-141. [PDF](#)
- Meyer, G. F., Mulligan, J. B., and Wuerger, S. M. (2004). "Continuous audio-visual digit recognition using N-best decision fusion." *Information Fusion*, v. 5(2), pp. 91-101.
- 2003 Brolly, X. L. C., Stratelos, C., and Mulligan, J. B. (2003). "Model-based head pose estimation for air-traffic controllers." *Proc. IEEE International Conf. on Image Processing (ICIP)*, Barcelona, Spain, v. 3, pp 113-116. [PDF](#)
- 2002 Mulligan, J. B., (2002). "A software-based eye tracking system for the study of air-traffic displays." *Proc. ACM Symposium on Eye Tracking Research and Applications (ETRA)*, pp. 69-76. [PDF](#)

- Mulligan, J. B., (2002). "Vision-based approaches to digital halftoning." *Proc. 55th Annual Conference of the Society for Imaging Science and Technology*, Portland OR, pp. 1-4. [PDF](#)
- 2001 Mulligan, J. B., (2001). "Sensory processing delays measured with the eye movement correlogram." in Kaminski, H. J., and Leigh, R. J. (eds.), "Neurobiology of eye movements: from molecules to behavior." *Annals of the New York Academy of Science*, v. 956, pp. 476-478.
- 1999 Watson, A. B., Hu, Q. J., McGowan, J. F. III, and Mulligan, J. B., (1999). "Design and performance of a digital video quality metric." *Human Vision and Electronic Imaging IV*, Proc. SPIE, v. 3644, pp. 168-174.
- 1997 Mulligan, J. B., (1997). "Application of Motion-JPEG to dynamic stimulus presentation." *Spatial Vision*, v. 11, pp. 19-32. [PDF](#)
- Mulligan, J. B., (1997). "Image processing for improved eye tracking accuracy." *Behavior Research Methods, Instrumentation and Computers*, v. 29, pp. 54-65. [PDF](#)
- Mulligan, J. B., (1997). "Application of temporal error diffusion to motion JPEG." in Rogowitz, B. E. and Pappas, T. N. (eds.), *Human Vision and Electronic Imaging II*, Proc. SPIE, v. 3016, pp. 288-295.
- Mulligan, J. B., (1997). "Recovery of motion parameters from distortions in scanned images." in Le Moigne, J. (ed.), *Proc. Image Registration Workshop*, NASA Goddard Space Flight Center, Greenbelt, Maryland, November 20-21, 1997. NASA Publication # CP-1998-206853. [PDF](#)
- 1996 Beutter, B. R., Mulligan, J. B., and Stone, L. S., (1996). "The barberplaid illusion: plaid motion is biased by elongated apertures." *Vision Res.*, v. 36, pp. 3061-3075.
- Mulligan, J. B., (1996). "When are supercomputers worth the bother?" *Behavior Research Methods, Instrumentation and Computers*, v. 28, pp. 239-240.
- 1995 Mulligan, J. B., and Beutter, B. R., (1995). "Eye-movement tracking using compressed video images." *Vision Science and its Applications*, 1995 Technical Digest Series, v. 1, Optical Society of America, pp. 163-166.
- 1994 Mulligan, J. B., and MacLeod, D. I. A., (1994). "In search of an optoretinogram." *Vision Science and its Applications*, 1994 Technical Digest Series, v. 2, Optical Society of America, pp. 167-170.

- 1993 Mulligan, J. B., (1993). "Nonlinear combination rules and the perception of motion transparency." *Vision Res.*, v. 33, pp. 2021-2030. [PDF](#)
- Mulligan, J. B., (1993). "Methods for spatiotemporal dithering." *SID International Symposium Digest of Technical Papers*, v. 24, pp. 155-158.
- Mulligan, J. B., (1993). "Improving digital halftones by exploiting visual system properties." in Singh, A. (ed.), *Conference record, 27th Asilomar conference on Signals, Systems and Computers*, IEEE Computer Society Press, pp. 961-965. [PDF](#)
- 1992 Mulligan, J. B., (1992). "Anisotropy in an ambiguous kinetic depth effect." *J. Opt. Soc. Am. A*, v. 9, pp. 521-529. [PDF](#)
- Mulligan, J. B., and Ahumada, A. J., Jr., (1992). "Principled halftoning based on human vision models." in Rogowitz, B. E. (ed.), *Human Vision, Visual Processing, and Visual Display III*, Proc. SPIE, v. 1666, pp. 109-121. [PDF](#)
- Mulligan, J. B., and Ahumada, A. J. Jr., (1992). "Principled methods for color dithering based on models of the human visual system." *SID International Symposium Digest of Technical Papers*, v. 23, pp. 194-197.
- 1991 Mulligan, J. B. and MacLeod, D. I. A., (1991). "Visual sensitivity to spatially sampled modulation in human observers." *Vision Res.*, v. 31, pp. 895-905. [PDF](#)
- Ahumada, A. J., Jr., and Mulligan, J. B., (1991). "Network compensation for missing sensors." in Rogowitz, B. E., Brill, M. H., and Allebach, J. P. (eds.), *Human Vision, Visual Processing, and Visual Display II*, Proc. SPIE, v. 1453, pp. 134-146.
- 1990 Stone, L. S., Watson, A. B., and Mulligan, J. B., (1990). "Effect of contrast on the perceived direction of a moving plaid." *Vision Res.*, v. 30, pp. 1049-1067.
- Ahumada, A. J., Jr., and Mulligan, J. B., (1990). "Learning receptor positions from imperfectly known motions." in Rogowitz, B. E., and Allebach, J. P. (eds.), *Human Vision and Electronic Imaging: Models, Methods, and Applications*, Proc. SPIE, v. 1249, pp. 124-134.
- Mulligan, J. B., (1990). "Digital halftoning methods for selectively partitioning error into achromatic and chromatic channels." in Rogowitz, B. E., and Allebach, J. P. (eds.), *Human Vision and Electronic Imaging: Models, Methods, and Applications*, Proc. SPIE, v. 1249, pp. 261-270. [PDF](#)

- 1989 Mulligan, J. B., and Stone, L. S., (1989). "Halftoning method for the generation of motion stimuli." *J. Opt. Soc. Am.*, v. 6, pp. 1217-1227. [PDF](#)
- Ahumada, A. J., Jr., and Mulligan, J. B., (1989). "Learning in interpolation networks for irregular sampling: some convergence properties." *OSA Topical Meeting on Applied Vision*, 1989 Technical Digest Series, v. 16, pp. WC3-1 - WC3-4.
- Stone, L. S., Watson, A. B., and Mulligan, J. B., (1989). *Effect of contrast on the perception of direction of a moving pattern*. NASA Tech. Memo. #102234.
- 1988 Mulligan, J. B., and MacLeod, D. I. A., (1988). "Reciprocity between luminance and dot density in the perception of brightness." *Vision Res.*, v. 28, 503-519. [PDF](#)
- Mulligan, J. B., and Stone, L. S., (1988), *Efficient use of bit planes in the generation of motion stimuli*. NASA Tech. Memo. #101022.
- 1986 Mulligan J. B., (1986). "Optimizing stereo separation in color television anaglyphs." *Perception*, v. 15, pp. 27-36.
- Mulligan J. B., (1986). "Minimizing quantization errors in a digitally controlled CRT." *Color Res. Appl.* (suppl.), v. 11, pp. S47-S51.
- 1985 Nakayama K., Silverman G., MacLeod D. I. A., and Mulligan J. B., (1985). "Sensitivity to shearing and compressive motion in random dots." *Perception*, v. 14, pp. 225-238.
- 1982 Stromeyer C. F. III, Mulligan J. B., Birch D. G., and Dawson B. M., (1982). "Adaptation to polarized light in humans." *Vision Res.*, v. 22, pp. 217-224.