ROBERT V. KENYON

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Professional Experience

2007-Present	University of Illinois at Chicago, Department of Computer Science; Professor.
2007-Present	University of Illinois at Chicago, Department of Bioengineering; Adjunct Professor
2007-Present	Northwestern Medical School, Northwestern University, Department of
	Physical Medicine and Rehabilitation, Adjunct Professor.
2001-2007	University of Illinois at Chicago, Department of Computer Science; Associate Professor.
2004-2007	University of Illinois at Chicago, Department of Bioengineering: Adjunct
	Associate Professor.
2004-2007	Northwestern Medical School, Northwestern University, Department of
2007	C II I E I I I I I I I I I I I I I I I I
2006	College de France, Laboratoire de Physiologie de la Perception et de
	l'Action, and Centre National de la Recherche Scientifique, Visiting
	Associate Professor, January - August.
2000-2003	University of Washington, Department of Industrial Engineering, Human
	Interface Technology Laboratory, Visiting Associate Professor.
1996	Summer Research Associate at Wright-Patterson AFB, OH.
1996	Summer Research Associate at Wright-State Univ., Dayton, OH.
1986-2001	University of Illinois at Chicago, Department of Electrical Engineering and Computer Science: Associate Professor.
1985-1986	Massachusetts Institute of Technology, Department of Aeronautics and
	Astronautics: Associate Professor.
1979-1986	Joint appointment: Whitaker Health Sciences and Technology, Harvard Medical School-MIT Joint Programs.
1979-1985	Massachusetts Institute of Technology Department of Aeronautics and
1777 1700	Astronautics; Assistant Professor.
Consulting	
1070	University of Davison Concultant on Eve Meyoment technology applied to
1979	Flight Simulation.
1980-1983	State University of New York: Consultant on real-time computers applied
	to human experimentation.
1982	Ad Hoc Advisor on Airlift, USAF Military Airlift Command: Visual factors associated with air refueling.
1982-1984	HH Aerospace Design: Consultant on Flight Simulator Imaging technology.
1085-1087	Environmental Tectonics Corn : Consultant on newformance maccures of
1903-1907	Pilots in high-g centrifuge environment.

1985-1987	Applied Sciences Laboratory: Consultant on Flight Simulator Display Technology.	
1985-1988	Director/Instructor of M.I.T. Summer course on: Fundamentals of Flight Simulation (for Industry/Government Professionals). Course taught with two other faculty.	
1990	USAF School of Aerospace Medicine: Workshop on manual control methods and visual research; real-time data acquisition systems.	
1990	Advanced Data Systems: Consultant for NFS report on thirty year projection of US computer needs and uses in science and industry.	
1990-Present	Legal Consultant on: Engineering, Computers, and Graphics.	
1996	USAF Armstrong Aerospace Med. Res. Lab, Wright-Patterson, AFB, OH	
1999-Present	General Motors Research and Development Center, Warren, Mi: Perception in Surround-Screen Stereoscopic Display Systems	
2000-2003	Eastman Kodak Co., Human Factors in Virtual Environments.	
	Wright State University, Department of ECS, Dayton, OH.	

Awards and Fellowships

1971-1972	Presbyterian St. Luke's Hospital, Chicago & University of Illinois Chicago
	Circle; Research Assistant.
S: 1973	Smith Kettlewell Institute of Visual Science; Research Assistant.
1973-1979	Pre-doctoral Trainee, National Institutes of Health.
1978-1979	Post Doctoral Fellowship, National Institutes of Health.
1975-1979	Assistant Director of Neuro-optometry Clinic, School of Optometry,
	Berkeley.
1978-1979	University of California, San Francisco; Neuro-Ophthalmology Unit,
	Research Assistant.
S: 1979	Fellow, Faculty Research Program, U.S. Air Force Office of Scientific
	Research.
S: 1979	Southeastern Center for Electrical Engineering Education; Summer Faculty
	Research Fellow.
2001	External Team Member: Innovation Achievement Award, Eastman Kodak
	Co.

Education

University of California, Berkeley	1973-1978	Ph.D.	Physiological Optics
University of Illinois, Chicago	1971-1972	M.S.	Bioengineering
University of Rhode Island,	1966-1971	B.S.	Electrical Engineering
Kingston			

PUBLICATIONS

Peer Reviewed Journals

 Ciuffreda, K.J., Bahill, A.T., Kenyon, R.V., and Stark, L.: <u>Eye movements during</u> <u>reading: Case Reports</u>. Amer. Journal of Optometry and Physiological Optics 53: 389-395, 1976.

- Bahill, A.T., Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Dynamic and static violations</u> of <u>Hering's Law of Equal Innervation</u>. Amer. Journal of Optometry and Physiological Optics 53: 798-808, 1976.
- Stark, L., Bahill, A.T., Ciuffreda, K.J., Kenyon, R.V., and Phillips, S.: <u>Neuro-Optometry:</u> <u>An evolving specialty clinic</u>. Amer. Journal of Optometry and Physiological Optics 54: 85-96, 1977.
- 4. Kenyon, R.V., Ciuffreda, K.J., and Stark, L.: <u>Binocular eye movements during</u> <u>accommodative vergence</u>. Vision Research **18**: 545-555, 1978.
- 5. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Increased saccadic latencies in amblyopic</u> <u>eves</u>. Inves. Optht. & Vis. Sci. 17: 697-702, 1978.
- 6. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Processing delays in amblyopic eyes:</u> <u>Evidence from increased latencies</u>. Amer. J. Opt. & Physiol. Optics **55**: 187-196, 1978.
- Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Different rates of functional recovery of eye</u> <u>movements during orthoptics treatment in an adult amblyope</u>. Invest. Ophth. & Vis. Sci. 18: 213-219, 1979.
- Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Abnormal saccadic substitution during</u> <u>constant velocity tracking in amblyopic eyes</u>. Invest. Ophth. & Vis. Sci. 18: 506-516, 1979.
- 9. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Saccadic intrusions in strabismus</u>. Arch. Ophth. **97**: 1673-1677, 1979.
- 10. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Suppression of fixational saccades in</u> <u>strabismic and anisometroptic amblyopia</u>. Ophthalmic. Res. **11**: 31-39, 1979.
- 11. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Increased drift in amblyopic eyes</u>. Brit. J. Ophth. **64**: 7-14, 1980.
- 12. Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: Fixational eye movements in amblyopia and strabismus. Am. Ophth. Assoc. J. 50: 1251-1258, 1979.
- Kenyon, R.V., Ciuffreda, K.J., and Stark, L.: <u>Dynamic vergence eye movements in</u> <u>strabismus and amblyopia</u>: <u>Symmetric vergence</u>. Invest. Ophth. & Vis. Sci. 18: 60-74, 1980.
- Kenyon, R.V., Ciuffreda, K.J., and Stark, L.: <u>An unexpected role for accommodative</u> <u>vergence in strabismus and amblyopia</u>. Am. J. Ophth. and Physiol. Optics. 57: 566-577, 1980.
- Kenyon, R.V., Ciuffreda, K.J., and Stark, L.: <u>Unequal saccades during vergence</u>. Am. J. Ophth. & Physiol. Optics. 57: 586-594, 1980.

- Stark, L., Kenyon, R.V., Krishnan, V.V., and Ciuffreda, K.J.: <u>Disparity Vergence: A</u> proposed name for a dominant component of binocular vergence eye movements. Am. J. Ophth. & Physiol. Optics. 57: 606-609, 1980.
- 17. Kenyon, R.V., Ciuffreda, K.J., and Stark, L.: <u>Asymmetric and accommodative vergence</u> <u>eye movements in strabismus and amblyopia.</u> Brit. J. Ophthal. **66**: 167-176, 1981.
- Ciuffreda, K.J., Kenyon, R.V., and Stark, L.: <u>Saccadic intrusions contributing to reading</u> <u>disability: A Case Report</u>. Am. J. Ophthal. and Physiol. **60**: 242-249, 1983.
- 19. Kenyon, R.V., and Stark, L.: <u>Unequal saccades generated by velocity interactions in the</u> <u>peripheral oculomotor system</u>. Mathematical Biosciences, 63: 187-198, 1983.
- 20. Parker, A.J., Kenyon, R.V. and Troxel, D.: <u>Comparison of interpolating methods for</u> <u>image resampling</u>. IEEE Trans. Med. Imaging, MF-2: 31-39, 1983.
- Stark, L., Ciuffreda, K.J., Grisham, J.D., Kenyon, R.V., Liu, J., Polse, K.: <u>Accommodative disfacility presenting as intermittent exotropia</u>. Ophthalmic. & Physiol. Optics, 4: 233-244, 1984.
- Kenyon, R.V., Becker, J.T., Butters, N. and Hermann H.: <u>Oculomotor function in</u> <u>Wernicke-Korsakoff's syndrome: saccadic eye movements</u>, Intern. J. NeuroSciences 25: 67-79, 1984.
- Kenyon, R.V., Becker, J.T., and Butters, N.: <u>Oculomotor function in</u> <u>Wernicke-Korsakoff's Syndrome: Smooth pursuit eye movements</u>, Intern. J. NeuroSciences 25: 53-65, 1984.
- Parker, A.J., Kenyon, R.V. and Young, L.R.: <u>Measurement of torsion from</u> <u>multi-temporal images of the eye using digital signal processing techniques</u>, IEEE Trans. Biomed. Eng. **BME-32**: 28-36, 1985.
- Kenyon, R.V. <u>A soft contact lens search coil for measuring eye movements</u>. Vision Research 25: 1629-1633, 1985.
- Kenyon, R.V. and Young, L.R.: <u>MIT Canadian vestibular experiments on Spacelab-1</u> <u>mission: 5. Postural responses following exposure to weightlessness.</u> Exp. Brain Res. 64: 335-346, 1986.
- Young, LR, Oman, CM, Watt, DGD, Money, KE, Lichtenberg, BK, Kenyon RV, and Arrott, AR. <u>MIT Canadian vestibular experiments on Spacelab-1 mission: 1. Sensory</u> <u>adaptation to weightlessness and readaptation to one-g: an overview</u>. Exp. Brain Res. 64: 291-298, 1986.
- 28. Kenyon, R.V. Kerschmann R. and Silbergleit R: <u>Streptomycin in the chick embryo:</u> <u>Post-hatching vestibular behavior and morphology</u>. Exp. Brain Res. **69**: 260-271, 1988.
- 29. Cruz-Neira C, Sandin D, Defanti T, Kenyon R, and Hart J., <u>The CAVE Audio-Visual</u> <u>Environment</u>. ACM Trans. on Graphics, **35**: 65-72, 1992.

- Kenyon R. and Kneller, E., <u>The Effects of Field-of-View Size on the Control of Roll</u> <u>Motion.</u> IEEE Trans. Systems, Man and Cybern., 23:183-193, 1993.
- Previc, F., Kenyon R., Boer, E., and Johnson, B., <u>The Effects of Visual Roll Stimulation</u> <u>on Postural and Manual Control and Self-Motion Perception.</u> Perception and Psychophysics, 54: 93-107, 1993.
- Kenyon R., Kerschman, R., Sgarioto, R., Jun S., and Vellinger J. <u>Normal Vestibular</u> <u>Development in the Chicks after Exposure to Microgravity during Development</u>. J. Vestibular Research, 5: 289-298, 1995.
- 33. Kenyon RV, DeFanti TA, Sandin DJ. <u>Visual Requirements for Virtual Environment</u> <u>Generation</u>. Journal of the Society for Information Display, 3 (4), 211-214, 1995.
- Kenyon R and Afenya M, <u>Training in Virtual and Real Environments</u>, Annals of Biomedical Engineering, 23: 445-455, 1995.
- Boer, E. R. and Kenyon R. V., <u>Estimation of Time Varying Delay Time in Non-Stationary Linear Systems: An Approach to Monitor Human Operator Adaptation in Manual Tracking Tasks</u>, IEEE Trans. Man, Systems and Cybern., 28(1): 89-99, 1998.
- 36. Shapiro, MB and Kenyon, RV. <u>Control variables in mechanical muscle models: A mini-review and a new model</u>. Motor Control, 4, 329-349, 2000.
- Keshner E.A. and Kenyon R.V. <u>The influence of an immersive virtual environment on</u> <u>the segmental organization of postural stabilizing responses</u>. Journal of Vestibular Research, 10:207-219, 2000.
- Duh, H.B.L., Lin, J.J.W., Kenyon, R.V., Parker, D.E., Furness, T.A, <u>Effects of</u> <u>Characteristics of Image Quality in an Immersive Environment</u>. Presence, Vol. 11, No. 3, 2002.
- Keshner E.A., Kenyon R.V., and Langston, J. <u>Postural Responses Exhibit Intra-Modal</u> <u>Dependencies with Discordant Visual and Support Surface Motion</u>, Journal of Vestibular Research 14, 307-319, 2004.
- Kenyon, R.V., Leigh, J, and Keshner, E.A. <u>Considerations for the Future Development of Virtual Technology as a Rehabilitation Tool.</u> Journal of NeuroEngineering and Rehabilitation, (1) 1: 13, 2004.
- 41. Keshner E.A. and Kenyon R.V. <u>Using immersive technology for postural research and</u> <u>rehabilitation.</u> J. Assistive Technology, 16:1, 54-62, 2004.
- Patton, J., Dawe, G., Scharver, C., Mussa-Ivaldi, F., Kenyon, R.V. <u>Robotics and Virtual</u> <u>Reality: A Perfect Marriage for Motor Control Research and Rehabilitation</u>, J. Assistive Technology, 18 (2), 2006.

- Keshner, EA, Dokka, K. and Kenyon, RV. <u>Influences of the Perception of Self-Motion on Postural Parameters in a Dynamic Visual Environment</u>. Cyber Psychology and Behavior, 9 (2), 163-166, 2006.
- 44. Dvorkin, AY., Kenyon, RV, and Keshner, EA. <u>Reaching Within a Dynamic Virtual</u> <u>Environment</u>. *Journal of NeuroEngineering and Rehabilitation* 2007, **4**:23, 2007.
- 45. Fischer HC, Stubblefield K, Kline TL, Luo X, Kenyon RV, Kamper DG. <u>Hand</u> <u>Rehabilitation Following Stroke: A Pilot Study of Assisted Finger Extension Training in</u> <u>a Virtual Environment</u>. Topics in Stroke Rehab 2007; 14: 1-12.
- Kenyon, R.V., Sandin, D. Smith, R., Pawlicki, R. and Defanti, T. <u>Size-Constancy in the</u> <u>CAVE</u>, Presence: Teleoperators & Virtual Environments, Vol. 16, No. 2, pp. 172-187, 2007.
- 47. Streepey, J, Kenyon, RV, and Keshner, EA. <u>Field of view and base of support width</u> <u>influence postural responses to visual stimuli during quiet stance</u>. Gait and Posture, Vol. 25, Issue 1, pp. 49-55, 2007.
- Streepey, J, Kenyon, RV, and Keshner, E.A. <u>Visual motion combined with base of</u> <u>support width reveals variable field dependency in healthy young adults</u>. Exp. Brain Res, Vol. 176, No. 1, pp. 182-187, 2007.
- Gauthier, Gabriel; Hansmann, Doug; Kenyon, Bob; Semmlow, John; Usui, Shiro and Young, Larry. Editorial: <u>The arts and sciences of Lawrence Stark</u>. Computers in Biology and Medicine, Vol. 37, Issue 7, 898-902, 2007.
- 50. Dvorkin, A., Kenyon, R.V., and Keshner, E.A. <u>Reaching within a dynamic virtual</u> <u>environment</u>. Journal NeuroEngineering and Rehabilitation, 4(23), 2007.
- Kenyon, R.V., Phenany, M., Sandin, D. and Defanti, T. <u>Accommodation and Size-Constancy of Virtual Objects</u>. Annals of Biomedical Engineering, Vol 36, No 2, pp. 342-348, 2008.
- Dvorkin, Assaf; Kenyon, Robert; Keshner, Emily. <u>Effects of roll visual motion on online</u> <u>control of arm movement: reaching within a dynamic virtual environment</u>. Experimental Brain Research. 193(1):95-107, 2009.
- 53. Dokka, K, Kenyon, R. and Keshner, K. <u>Influence of visual scene velocity on segmental</u> <u>kinematics during stance</u>. Gait and Posture, Gait and Posture, 30(2): 211-216, 2009.
- 54. Dokka K, Kenyon RV, Keshner EA, Kording KP. <u>Self versus Environment Motion in</u> <u>Postural Control</u>. PLoS Comput Biol 6(2): e1000680, 2010.
- 55. Wang Y, Kenyon RV, Keshner EA. <u>Identifying the control of physically and</u> perceptually evoked sway responses with coincident visual scene velocities and tilt of the <u>base of support</u>. Exp Brain Res. 201(4):663-72, 2010.

- 56. Connelly L, Jia Y, Toro ML, Stoykov ME, Kenyon RV, Kamper DG. <u>A pneumatic glove</u> <u>and immersive virtual reality environment for hand rehabilitative training after stroke</u>. IEEE Trans Neural Syst Rehabil Eng. 18(5):551-9. 2010.
- 57. Gurses, S, Kenyon, R. and Keshner, K. <u>Examination of time-varying kinematic responses</u> <u>to support surface disturbances</u>. Biomedical Signal Processing and Control. 6(1), pp: 85-93, 2011.
- 58. F. Abdollahi, E. Case, M. Listenberger, R. Kenyon, M. Kovic, R. Bogey, D. Hedeker, B. Jovanovic, J. Patton. "<u>Error augmentation enhancing arm recovery in individuals with chronic hemiparetic stroke: a randomized crossover design</u>." Journal of Neurorehabilitation and Neural Repair, 2013.
- 59. F. Abdollahi, R. Kenyon, J. Patton. "<u>Mirror versus parallel bimanual reaching</u>" Journal of NeuroEngineering and Rehabilitation, 10:71, 2013.

Peer Reviewed Conference Papers

- 1. Stark, L, Shults, T., Ciuffreda, K.J., Hoyt, W.F., Kenyon, R.V., and Ochs, A.: Voluntary nystagmus is saccadic: Evidence for motor and sensory mechanisms. Proc. of the Joint Automatic Control Conference, v. 2, June, 1977, pp: 1410-1414.
- 2. Kenyon, R.V., and Stark, L.: <u>Unequal saccades produced by non-linear plant dynamics</u>. IEEE Inter. Conf. on Cybern. & Soc. pp: 596-599, October 8-10, 1980.
- 3. Kenyon, RV., and Lichtenberg, BK.: <u>Measurement of ocularcounterrolling (OCR) by</u> <u>polarized light</u>. Proceedings of SPIE: Polarizers and Applications, 307, pp: 79-82, 1981.
- Kenyon RV, and Kneller, EW. <u>Human performance and field-of-view</u>. Soc. for Inform. Display Intern. Sympos., 23, pp:290-293, 1992.
- 5. Boer ER and Kenyon RV, <u>Identification of Time Varying Systems</u>, IEEE Inter. Conf. on Biomedical Engineering, Oct 29- Nov 1 pp: 1481-1482, Paris, 1992.
- Ghazisaedy M, Adamczyk D, Sandin D, Kenyon R, and Defanti T, <u>UltraSonic Calibration</u> of a <u>Magnetic Tracker in a Virtual Reality Space</u>. Proceedings of the IEEE Annual Virtual Reality International Symposium (VRAIS) (Raleigh, NC, March 11-15), pp: 179-188, 1995.
- Reynolds, W.D. and Kenyon, R.V., <u>The Wavelet Transform and the Suppression Theory</u> of Binocular Vision for Stereo Image Compression. 3rd IEEE International Conference on Image Processing, Lausanne, Switzerland, Sep. 16-19, pp: 557-560, 1996.
- Isabelle, SK, Gilkey, RH, Kenyon, RV, Valentino, G, Flach J, Spenny, C., Anderson TR., <u>Defense applications of the CAVE (CAVE automatic virtual environment)</u>. Proceedings of SPIE: 11th Annual Conference on Aerospace/sensing simulation and control. Cockpit Displays IV: Flat Panel Displays for Defense Applications, Ed: D, Hopper, SPIE Vol. 3057, pp: 118-125, Orlando, Fl, April 20-25, 1997.

- Boer, E.R.; Kenyon, R.V. <u>Adaptation asymmetry in manual tracking</u>. IEEE Intern. Conf. Systems, Man, and Cybernetics 'Computational Cybernetics and Simulation', Oct 12-15. pp: 3630-3635, vol.4 Orlando, FL, 1997.
- Leigh, J, Park, K, Kenyon, RV, Johnson, AE, DeFanti, TA. Wong, H. <u>Preliminary</u> <u>STARTAP Tele-Immersion Experiments between Chicago and Singapor</u>e, 3rd High Performance Computing Asia Conference & Exhibition, 22-25, pp. 687-693, September, 1998, Singapore.
- 11. Mascarenhas, R., Karumuri, D., Buy, U., and Kenyon, R. <u>Modeling and analysis of a</u> <u>virtual reality system with time Petri nets</u>. Proceedings of the 20th International Conference on Software Engineering, pp: 33-42, Kokyo, Japan, April 20-22, 1998.
- Park, K and Kenyon, RV. <u>Effects of Network Characteristics on Human Performance in the Collaborative Virtual Environment</u>. IEEE Virtual Reality '99 Conference, Ed: L. Rosenblum, P. Astheimer, D. Teichmann, pp: 104-111, March 14-17, 1999, Houston Tx, 1999.
- 13. J Leigh, A Johnson, T DeFanti, M Brown, M Ali, S Bailey, A Banerjee, P Banerjee, J Chen, K Curry, J Curtis, F Dech, B Dodds, I Foster, S Fraser, K Ganeshan, D. Glen, R. Grossman, R. Heiland, J Hicks, A. Hudson, T Imai, M Khan, A Kapoor, R Kenyon, J Kelso, R Kriz, C Lascara, X Liu, Y Lin, T Mason, A Millman, K Nobuyuki, K Park, B Parod, P. Rajlich, M Rasmussen, M Rawlings, D.Robertson, S Thongrong, R. Stein, K Swartz, S Tuecke, H Wallach, H Wong, G.Wheless, <u>A Review of Tele-Immersive</u> <u>Applications in the CAVE Research Network</u>. IEEE Virtual Reality '99 Conference, Ed: L. Rosenblum, P. Astheimer, D. Teichmann, pp: 180-187, March 14-17, 1999, Houston Tx.
- Duh, H.B.L., Lin, J.J.W., Kenyon, R.V., Parker, D.E., Furness, T.A., (2001), <u>Effects of field of view on balance in an immersive environment</u>, Proceedings of IEEE Virtual Reality 2001 (IEEE VR 2001), Yokohama, Japan, pp 235-240, 2001.
- 15. Keshner, E.A. and Kenyon R.V. (2002) The development of an immersive laboratory for postural research and rehabilitation. Proceedings of the First International Workshop on Virtual Reality in Mental Health and Rehabilitation, EPFL, Lausanne Switzerland, November, 2002.
- Keshner, EA and Kenyon RV. <u>Postural control shifts with sensory discordance</u>. International Society for Posture and Gait Research. March 23 - 27, Sydney, Australia. 2003
- Patton, J. L., G. Dawe, Scharver, C., Muss-Ivaldi, F. A., Kenyon, R. <u>Robotics and</u> <u>Virtual Reality: A Perfect Marriage for Motor Control Research and Rehabilitation</u>. IEEE Engineering in Medicine and Biology Society Conference (EMBS), pp:4840-4843, San Francisco, CA, USA, 2004.
- Keshner, EA., Kenyon, RV., Dhaher, Y. <u>Using Immersive Technology for Postural</u> <u>Research and Rehabilitation</u>, 26th Intern. Conf IEEE EMBS, pp: 4862-4865, San Francisco, September 1-5, 2004.

- 19. Kenyon, RV., Leigh, J., <u>Networked Virtual Environments and Rehabilitation</u>, 26th Intern. Conf IEEE EMBS, pp: 4832-4835, San Francisco, September 1-5, 2004.
- Keshner, E.A., Kenyon, R.V. (2005). Visual context affects postural strategies in healthy and labyrinthine deficient elderly. International Society for Posture and Gait Research, Marseilles, France, May 29-June 2, 2005.
- Kenyon, R.V., Gurses, S., Keshner, E.A. (2005). Determining the effects of visual and self-motion inputs on intersegmental postural responses. International Society for Posture and Gait Research, Marseilles, France, May 29-June 2, 2005
- 22. Scharver, C, Patton, J, Kenyon, R, Kersten, E (2005) <u>Comparing adaptation of constrained and unconstrained movements in three dimensions</u>, Proceedings of 2005 International Conference on Rehabilitation Robotics, pp: 434-439, Chicago, IL . 28 June-1 July 2005
- Luo, X., Kline, T., Fischer, H.C., Stubblefield, K.A., Kenyon, R.V., Kamper, D.G. <u>Integration of Augmented Reality and Assistive Devices for Post-Stroke Hand Opening</u> <u>Rehabilitation</u>. 27th Intern. Conf IEEE EMBS, Sept 1-4., pp: 6855-6858, Shanghai, China, 2005.
- 24. X. Luo, R. V. Kenyon, D. G. Kamper. <u>An Augmented Reality Training Environment for</u> <u>Post-Stroke Finger Extension Rehabilitation</u>. In: IEEE-International Conference on Rehabilitation Robotics, pp: 329 - 332, Chicago, IL, 28 June-1 July 2005
- Patton, J.L., Wei, Y., Scharver, C., Kenyon, R.V., Scheidt, R., (2006) <u>Motivating</u> <u>Rehabilitation by Distorting Reality</u>, BioRob 2006: The first IEEE / RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics, Pisa, Tuscany, Italy, pp. 869 – 874, February 20-22, 2006.
- Dvorkin A.Y., Kenyon R.V. & Keshner E.A. (2006) <u>Reaching within a dynamic virtual environment</u>. In: IEEE 5th International Workshop on Virtual Rehabilitation. p. 182-186, NY, Aug. 2006.
- Xun Luo, Kenyon, R., Kamper, D., Sandin, D., DeFanti, T. "<u>The Effects of Scene</u> <u>Complexity, Stereovision, and Motion Parallax on Size Constancy in a Virtual</u> <u>Environment</u>," IEEE Virtual Reality Conference, 2007. VR '07, pp.59-66, 10-14 March 2007.
- Dokka K, .Keshner EA, and Kenyon RV. <u>Influence of visual and support surface</u> <u>velocities on head position</u>. International Society for Posture and Gait Research, p. 121, Vermont, July 14-18, 2007.
- Yun Wang; Kenyon, R.V.; Keshner, E.A., "<u>Virtual scene velocity influences postural</u> responses to an inclined base of support," Virtual Rehabilitation, pp.41-44, 25-27 Aug. 2008
- 30. Rozario S, Housman S, Kovic M, Kenyon R, Patton J. Therapist-mediated post-stroke

<u>rehabilitation using haptic/graphic error augmentation</u>. In: IEEE Engineering In Medicine and Biology Conference (EMBC), Minneapolis, MN, USA, 2009:1151-6, 2009.

- Xun Luo and Kenyon, R.V. "<u>HAMERA: A device for hand profile construction in the</u> <u>pervasive environment</u>," IEEE International Conference on Pervasive Computing and Communications. PerCom 2009, pp.1-6, 9-13 March 2009.
- Xun Luo and Kenyon, R.V. "<u>Scalable Vision-based Gesture Interaction for Cluster-driven</u> <u>High Resolution Display Systems</u>," IEEE Virtual Reality Conference. VR 2009, pp.231-232, 14-18 March 2009.
- 33. Gurses, S, Kenyon, RV, Keshner, EA. Time-Varying Kinematic Responses to Support Surface Disturbances. In: International Society of Posture & Gait Research XIX Satellite PreConference, pp: XX-XX, June 19-20, Pavia, Italy 2009.
- Gurses, S, Kenyon, RV, Keshner, EA. <u>Examination of Time-Varying Kinematic</u> <u>Responses to Support Surface Disturbances</u>. In: IFAC 7th Symposium on Modeling and Control in Biomedical Systems. pp: XX-XX, August 12-14, Aalborg, Denmark, 2009.
- 35. Rozario S, Housman S, Kovic M, Kenyon R, Patton J (2009) <u>Therapist-mediated post-</u> <u>stroke rehabilitation using haptic/graphic error augmentation</u>. In: IEEE Engineering In Medicine and Biology Conference (EMBC), Minneapolis, MN, USA
- L Connelly, ME Stoykov, Y Jia, ML. Toro, RV. Kenyon, and DG. Kamper. <u>Use of a</u> <u>Pneumatic Glove for Hand Rehabilitation Following Stroke</u>. IEEE EMBS, pp: 2434-2437, April 23, 2009, Minneapolis, MN.
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Invited Lectures

- 1. "Size Constancy in the CAVE". University of Pennsylvania, Philadelphia, October, 2007.
- "Size Constancy in the CAVE". Virtual Images Seminar, CNRS: College de France & Renault Corp, Paris, France, June, 2006.
- 3. "Size Constancy in the CAVE". ETH and University Zurich, Zurich, Switzerland, June, 2006.

- 4. "Size Constancy in the CAVE". Laboratoire de Mouvement et Perception, Université de la Méditerranée, Marseilles, France, May, 2006.
- "Size Constancy in the CAVE". Institut de Psychologie Université Paris V, René Descartes, Paris, France, March, 2006.
- 6. "Size Constancy in the CAVE". Laboratoire de Physiologie de la Perception et de l'Action, College de France, Paris, France, February 2006.
- 7. "Size Constancy in the CAVE". Man-Vehicle Laboratory, MIT, September, 2006.
- 8. "Virtual Reality and Machines: Research and Rehabilitation". Human Motion Simulation Laboratory, University of Michigan, November 16, 2005.
- 9. The 4th International Symposium on Future Medical Engineering based on Bionanotechnology, Sendai, Japan, June 25, 2004.
- 10. <u>Fostering Inter-Connectivity Of Health Informatics at UIC</u>, Human factors and Graphics, Chicago, IL, February 26, 2002
- Chairman, State of the Science Conference: VR-Haptics: Environments and Advanced Interface Technologies, National Rehabilitation Hospital, Washington, DC, October 12-13, 2001.
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- Rehabilitation Institute of Chicago "Segmental Postural Stabilizing Responses in an Immersive Virtual Environment", Chicago, IL., 2000
- 14. General Motors Research & Development Virtual Environments Laboratory Workshop: Perception in Surround-Screen Stereoscopic Display Systems, "Hitting 3-D Targets in the CAVE", Warren Mi., October 1999.
- 15. IEEE EMBS Workshop: Virtual Reality in Medicine, "Virtual Environment Characteristics for Training Transfer", 1997 International IEEE Engineering Medicine and Biology Conference, Chicago, 1997.
- "Virtual Environments for Engineering Education". The Annual Pathfinder Conference, Ohio Aerospace Institute, Cleveland, OH., August 21 - 22, 1997.
- 17. Cambridge Basic Research, Nissan Inc. "The Use of Virtual Environments for Research and Design". Cambridge, MA. February 1997.
- 18. USAF Armstrong Aerospace Med. Res. LAB, Wright-Patterson, "The Mandelbaum Effect and Accommodation". AFB, OH, August. 1996.
- 19. USAF Armstrong Aerospace Med. Res. LAB, Wright-Patterson, "Visual Requirements for Virtual Environment Generation". AFB, OH, March. 1996.
- 20. "Synesthesia", Presented at SuperComputing '95 International Meeting, San Diego, December, 1995.
- 21. Meta-Generics Limited, "The CAVE Virtual Environment". Cambridge, England, July, 1995.
- 22. Identica Limited, "Design using Virtual Environments". London, England, June, 1995.

- 23. Queen Mary and Westfield College, "Training in Virtual Environments". London, England, May 1995.
- Workshop on Future Directions of Human-Computer Interaction, "The CAVE Automatic Virtual Environment: Characteristics and Applications", April 25-27, Hampton, VA, 1995.
- E2-Sense: Electronic Enhancement of Sensory Dead Space. Defense Science Research Council. Arlington, VA. 3/28/2013

Biographical Sketch

Dr. Kenyon received his B.S. degree in Electrical Engineering from the University of Rhode Island, in 1970, a M.S. degree in Bioengineering from the University of Illinois, Chicago, in 1972, and a Ph.D. in Physiological Optics from the University of California, Berkeley, in 1978. From 1979 to 1986, he was a faculty member of the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology, Cambridge and Harvard Medical School - Whitaker Health Sciences and Technology Joint Programs. He is currently a Professor of Computer Science at the University of Illinois at Chicago. From 2000-2002 he was a visiting Associate Professor at the University of Washington, Seattle. In 2006, he was a visiting Research Associate at the College de France, Laboratoire de Physiologie de la Perception et de l'Action, working with Prof. Alain Berthoz. His research has spanned the areas of sensorymotor adaptation, effects of micro-gravity on vestibular development, visuo-motor and posture control, flight simulation, virtual environments, computer graphics, Tele-immersion and sensory/motor integration for navigation and wayfinding.

While at MIT he was a collaborator on several Space Shuttle experiments that studied the effects of micro-gravity on human/animal orientation: Spacelab-1, German Space-lab (D-1), and STS-29 ("Chix in Space"). He also developed and delivered an interactive visual display system to produce simulator-like experiences for AF pilots undergoing training at Brooks AFB centrifuge and disorientation trainers. For this AF funded research, both hardware and software was designed to present the pilots with an interactive wide-field-of-view computer-generated imagery superior to the current day head mounted displays. He also was originator, director, and one of the three instructors that taught one of the first flight simulator courses in the country designed for professionals (MIT's summer session program).

His work at UIC has concentrated on virtual environments (VEs) with his involvement with the CAVE. He was co-PI on two NSF grants that were instrumental in the development of the CAVE. He also has been a major contributor to understanding how limitations of a VE system (such as the CAVE) can affect human behavior. Other work has examined human performance in VEs and how to quantify the use of VEs for training and collaboration. This work was performed using stand-alone CAVE applications and also in networked (i.e., tele-immersive) applications using a variety of networks from ISDN to the latest international networks (STARTAP). Some of this work has been specifically aimed at analyzing and improving the performance of distributed VEs themselves by understanding the characteristics of the connecting networks and modeling both the CAVE and the network using Petri-nets. Other modeling work focused on humans were he and his students developed a system identification tool based on Kalman filters that can be used to estimate in real-time the delay and model coefficients of a human operator and how these characteristics change as the operator's environment is changed.

His work on applications of VE to biocybernetics, which is being carried out at the Rehabilitation Institute of Chicago, involves the coupling of robots to VE and the integration of visual and motion information in maintaining erect posture. The VE-Robot systems are being used to explore new methods that will aid in the rehabilitation of stroke survivors. Specifically, these systems are being used to apply both visual and haptic information in combinations that help the stroke patient regain control of affected limbs [arm motion]. The application of VE and posture platform motion has been used to examine how young healthy individuals, elderly, and those with a loss of vestibular function combine visual and motion has allowed the exploration of how these individuals integrate information from these sensors in the physical world. Some emerging research is investigating the integration of visual and kinesthetic information utilized to find locations in unfamiliar environments. His most recent work has explored the use of visual and kinesthetic information in the process of navigation. By manipulating the visual and haptic information during navigation tasks, our understanding of how navigation is processed will be explored.