

April 9, 2015

Michael J. Kahana, Ph.D.

Address

Department of Psychology
University of Pennsylvania
Suite 302C, 3401 Walnut Street
Philadelphia, PA 19104
Lab: (215) 746-3500, Office: (215) 746-3501, Fax: (215) 746-6848
e-mail: kahana@sas.upenn.edu
website: <http://memory.psych.upenn.edu>

Personal

Born: May 7, 1969, St. Louis, MO
Citizenship: USA
Married to Jessica A. Wachter, Ph.D.
finance.wharton.upenn.edu/~jwachter/

Children:

Nathan Abraham, April 26, 2006
Joseph Morris, February 29, 2008
Benjamin Aryeh, January 25, 2011
Samuel Tzvi, May 14, 2013

Professional

- 2004 — present, Professor, Department of Psychology, University of Pennsylvania
- 2000 — 2004, Associate Professor, Department of Psychology and Center for Complex Systems, Brandeis University.
- 1994 — 2000, Assistant Professor, Department of Psychology and National Center for Complex Systems, Brandeis University

Education

- 1989 B. A., Case Western Reserve University.

- 1993 Ph.D., University of Toronto (Psychology); (Ph.D. Thesis: *Interactions between item, associative, and serial order information*, B. B. Murdock, chair).
- 1993–1994 Postdoctoral Fellow, Harvard University (Psychology). Individual National Research Service Award (N.I.H. Grant NS09559, Sponsor: W. K. Estes) *A temporal coding model of human memory*)

Honors and Awards

- Troland Award, *National Academy of Sciences*, 2010.
- Fellow, *Society of Experimental Psychologists*, 2008
- Fellow, *American Psychological Society*, 2010
- Plenary address – 40th Annual Meeting of the Society for Mathematical Psychology, Irvine, CA, 2007
- Plenary address – Computational Cognitive Neuroscience Conference, Houston, 2006
- Invited symposium – Society for Neuroscience, Washington, D.C., 2005
- Invited address – American Psychological Society, Chicago, 2004
- Featured Alumnus – Centennial Celebration of the University of Toronto Graduate Program in Psychology, 1997
- Bernstein Fellow, Brandeis University, 1998-1999

Editorial Activities

- Associate Editor: *Psychological Review*, 2015–
- Associate Editor: *Cognitive Psychology*, 2005 – 2009
- Associate Editor: *Memory & Cognition*, 2001 – 2005
- Guest Editor: *NeuroImage* special issue “New Horizons for Neural Oscillations”, 2014
- Consulting Editor: *Journal of Experimental Psychology: General*, 2008 – 2010
- Consulting Editor: *Journal of Mathematical Psychology*, 2012 –
- Consulting Editor: *Psychonomic Bulletin & Review*, 2005 – 2007.
- Consulting Editor: *Memory & Cognition*, 1997 – 2001.
- Consulting Editor: *Journal of Experimental Psychology: Learning, Memory and Cognition*, 1999 – 2001.

Other Professional Activities

- Founder and Organizer of the Context and Episodic Memory Symposium, an annual meeting since 2002
- Director of graduate studies, Psychology Graduate Group, University of Pennsylvania, 2008-2011
- Chair of the 2010 meeting of the *Society of Experimental Psychologists*
- Member, BBBP-4 (Cognition and Perception) study section, *Centers for Scientific Review, National Institutes of Health*, 2003–2007
- Member, Advisory Board, Princeton Neuroscience Institute, 2012
- Organizer – 39th Annual Meeting of the Society for Mathematical Psychology, 2006
- Member, Advisory Panel. Doris Duke Charitable Foundation, 2005
- Member, Advisory Panel. N.I.H. Silvio O. Conte Center for Neuroscience Research: Cognitive and Neural Mechanisms of Conflict and Control (Princeton University), 2003
- N.I.M.H. First Award, 1996
- **Invited Colloquia:** Albert Einstein College of Medicine, Albert-Ludwigs-Universität Freiburg, Boston University, Brown University, California Institute of Technology, Carnegie Mellon University, Columbia University (Psychology), Columbia University (Neuroscience), Courant Institute (NYU), Dartmouth College, Harvard University, Indiana University, Johns Hopkins University, Max Planck Institute-Berlin, Monell research institute, Montreal Neurological Institute, McGill University, New York University, Northwestern University, Ohio State University, Princeton University, Rutgers University, Salk Institute, Shriver Center, Syracuse University, Thomas Jefferson University, Tufts University, Donders Institute, Nijmegen, Netherlands, Stanford University, University of Delaware, University of Massachusetts at Amherst, University of Toronto, U.C. Irvine, U.C. San Diego, U.C.L.A. School of Medicine, University of California at San Francisco, U.C.L.A. Psychology, U.C. Davis, Williams College, Yale University.

Professional Society Memberships:

- Psychonomic Society
- Society for Neuroscience
- Memory Disorders Research Society
- Society for Cognitive Neuroscience,

- Society for Mathematical Psychology,
- Society of Experimental Psychologists

Grant Support

- DARPA RAM Cooperative Agreement N66001-14-2-4-31 *Memory Enhancement with Modeling, Electrophysiology, and Stimulation*. M. J. Kahana, P.I. July 16, 2014 – July 15, 2016. \$3,562,841 annual direct costs.
- NIH Grant 3RO1 MH61975 *Electrophysiology of Spatial Cognition*. M. J. Kahana, P.I. March 1, 2014 – Feb 28, 2019. \$252,687 annual direct costs.
- Educational Testing Grant *EEG Correlates of Engagement*. M. J. Kahana, P.I. August 15, 2013 – December 31, 2014. \$41,445 annual direct costs.
- NIH Grant 4RO1 MH55687 *Associative Processes in Episodic Memory*. M. J. Kahana, P.I. May 1, 2011 – Feb 28, 2016. \$288,707 annual direct costs.
- NSF grant 1058886 *Retrieved Context Models of Episodic Memory*. M. J. Kahana, P.I. June 1, 2011– May 31, 2014. \$94,510 annual direct costs.
- NIH Grant 2RO1 MH61975 *Electrophysiology of Spatial Cognition*. M. J. Kahana, P.I. Sept 26, 2007 – July 31, 2013. \$252,687 annual direct costs.
- NIH Grant 1R21 NS067316 *Intracranial EEG for Neuronal Oscillatory Contingency during Cognitive Tasks*. M. J. Kahana, P.I. September 30, 2009 – August 31, 2011. \$163,228 annual direct costs.
- NIH Grant R90 DA023424 *Integrated Interdisciplinary Training in Computational Neuroscience*. M. J. Kahana, P.I. September 30, 2006 – July 31, 2011. \$296,519 annual direct costs.
- NIH Grant T90 DA022763 *Integrated Interdisciplinary Training in Computational Neuroscience*. M. J. Kahana, P.I. September 30, 2006 – July 31, 2011. \$166,888 annual direct costs.
- NIH Grant 2R01 MH68404 *Short Term Visual Episodic Recognition Memory*, R. Sekuler, P.I., M. J. Kahana, Co-I. June 6 2009 – June 5, 2011.
- Dana Foundation Grant *Intracranial EEG for Theta Rhythm Contingency During Cognitive Tasks*. December, 2007 – February, 2011. \$100,000 annual direct costs.
- NIH/NIMH Grant P50 MH062196. Subproject on Conte Center Grant *Retrieval Dynamics in Item and Source Memory*. October 1, 2005 – August 31, 2011
- NIH Grant 3RO1 MH55687 *Associative Processes in Episodic Memory*. M. J. Kahana, P.I. February 1, 2007 – Jan 30, 2011.

- NSF grant SBE 0354378 Subproject 14 on Science of Learning Center Grant *CELEST: A Center for Learning in Education, Science, and Technology*. S. Grossberg P.I. October 1, 2004 – September 30, 2009.
- NIH Grant R01 MH68404 *Short Term Visual Episodic Recognition Memory*, R. Sekuler, P.I., M. J. Kahana, Co-P.I.. April 1, 2004 – March 31, 2009.
- Swartz Foundation Grant 2004/10-04 *Electrophysiology of Human Memory Formation*. M. J. Kahana P.I. November 28, 2003 – November 27, 2004.
- NIH Grant 2R01 MH55687 *Associative Processes in Episodic Memory*. M. J. Kahana, P.I. April 1, 2002 – January 30, 2007.
- NIH Grant R29 MH55687 *Mathematical Models of Human Memory*. M. J. Kahana, P.I., April 1, 1997 – March 30, 2002.
- NIH Grant RO1 MH61975 *Using intracranial recordings to study task-dependent theta..* M. J. Kahana, P.I. December 12, 2001 – December 11, 2006.
- AFOSR Grant F49620-03-1-0376 *Model driven study of visual memory*. R. Sekuler, P.I., M. J. Kahana, Co-P.I.. July 1, 2003 – December 31, 2003.
- NIH Grant R01 AG15852 *Aging and the temporal dynamics of self-initiated recall* A. Wingfield, P.I., M. J. Kahana, Co-P.I. August 1, 1998 – July 30, 2003.

Postdoctoral Supervision

- Dan Kimball, J.D., Ph.D. (Postdoc, 2002 – 2003). Morris Associate Professor, Department of Psychology, *University of Oklahoma*.
- Sean Polyn, Ph.D. (Postdoc, 2005 – 2008). Assistant Professor, Psychology, *Vanderbilt University*.
- Christoph Weidemann, Ph.D. (Postdoc, 2006 – 2010). Assistant Professor, Psychology, *Swansea University*
- Kareem Zaghloul, M.D. Ph.D. (Postdoc, 2007 – 2008). Assistant Professor of Neurosurgery, *National Institutes of Health and George Washington University*.
- Mijail Serruya, M.D., Ph.D. (Postdoc, 2009 – 2011). Assistant Professor, Department of Neurology, *Jefferson Hospital*.
- Brad Lega, M.D. (Postdoc, 2009 – 2011). Assistant Professor, Department of Neurosurgery, *University of Texas, Dallas*.
- Karl Healey, Ph.D. (Postdoc, 2011 –).

- Max Merkow, M.D. (Postdoc, 2013 –).
- Youssef Ezzyat, Ph.D. (Postdoc, 2014 –).

Doctoral Supervision

- Marc W. Howard, Ph.D. (1995 – 2000). Associate Professor, Psychology, *Boston University*. Thesis Title: *Temporal Context in Free Recall*
- Jeremy B. Caplan, Ph.D. (1997 – 2002). Associate Professor, Psychology, *University of Alberta*. Thesis Title: *Serial and navigational learning: behavior, theory and the roles of theta oscillations*.
- Daniel S. Rizzuto, Ph.D. (1997 – 2002). Director of Cognitive Modulation, *University of Pennsylvania*. Thesis Title: *The computational and electrophysiological foundation of item and associative memory*.
- Arne D. Ekstrom, Ph.D. (2001 – 2004). Associate Professor, Psychology and Neuroscience, *University of California, Davis*. Thesis Title: *The Cellular Networks Underlying Human Spatial Navigation*.
- Kelly Addis, Ph.D. (2000 – 2004). Postdoctoral Fellow, Mathematical Psychology, *Indiana University*. Thesis Title: *Constraining models of serial learning*.
- Per Sederberg (2001 – 2006). Assistant Professor, Department of Psychology, *Ohio State University*.
- Grace Hwang, Ph.D. (2002 – 2005). Engineer, *Mitre Corporation*.
- Marieke van Vugt, Ph.D. (2003 – 2008). Assistant Professor, Cognitive Science, *University of Groningen*.
- Joshua Jacobs, Ph.D. (2004 – 2008). Assistant Professor, Bioengineering, *Columbia University*.
- Jeremy Manning, Ph.D. (2006 – 2011). Postdoctoral Fellow, *Princeton University*.
- Lynn Lohnas, Ph.D. (2007 – 2012). Postdoctoral Fellow, *New York University*.
- John Burke, Ph.D. (2010 – 2013). Resident in Neurosurgery *U.C.S.F*

- Ashwin Ramayya (2011 – 2014). Neuroscience MD/Ph.D. student, *University of Pennsylvania*.
- Nicole Long (2010 –). Psychology Ph.D. student, *University of Pennsylvania*.

Monographs

- Kahana, M. J. (2012). *Foundations of Human Memory*. Oxford University Press.

Working Papers

1. Weidemann C.T. and Kahana, M.J. Assessing the Strength of Cognitive States. *Submitted*.
2. Healey, M. K. and Kahana, M. J. A new approach to understanding age-related memory impairments. *Submitted*.
3. Ramayya, A.G., Sperling, M.R., Beck, E., Pedisich, I., and Kahana, M.J. Intracranial high frequency activity reveals that valence representations throughout the human cortex and medial temporal lobe are modulated by reward expectation. *Submitted*.
4. Long, N.M. and Kahana, M.J. Contextual encoding mechanisms in hippocampus and prefrontal cortex support successful memory formation. *Submitted*.

Refereed Journal Articles

1. Greenberg, J.A., Burke, J.F., Haque, R., Kahana, M. J. and Zaghoul, K. Decreases in theta and increases in high frequency activity underlie associative memory encoding. *Neuroimage*, in press.
2. Long, N.M., Danoff, M.S., Kahana, M.J. Recall dynamics reveal the retrieval of emotional context. *Psychonomic Bulletin & Review*, in press.
3. Lohnas, L. J., Polyn, S. M., and Kahana, M. J. Expanding the scope of memory search: Modeling intralist and interlist effects in free recall. *Psychological Review*, 122 (2), 337-363
4. Burke, J., Merkow, M., Jacobs, J., Kahana, M.J., Zaghoul, K. (2014). Brain computer interface to enhance episodic memory in human participants. *Frontiers in Human Neuroscience*, 8 (1055), 1-10
5. Burke J. F., Ramayya, A. G., and Kahana, M. J. (2015). Human intracranial high-frequency activity during memory processing: neural oscillations

or stochastic volatility? *Current Opinion in Neurobiology*, 31, 104-110.

6. Lega, B., Burke, J., Jacobs, J. and Kahana, M.J. (2014). Slow theta-to-gamma phase-amplitude coupling in human hippocampus supports the formation of new episodic memories. *Cerebral Cortex*, in press.
7. Merkow, M.B., Burke, J.F., Stein, J.M. and Kahana, M.J. (2014). Pres-stimulus theta in the human hippocampus predicts subsequent recognition but not recall. *Hippocampus*, 24, 1562-1569.
8. Ramayya, A.G., Zaghoul, K.A., Weidemann, C.T., Baltuch, G.H., and Kahana, M.J. (2014). Electrophysiological evidence for functionally distinct neuronal populations in the human substantia nigra. *Frontiers in Human Neuroscience*, 8, 1-9.
9. Geller, A. S., Burke, J. F., Sperling, M. R., Sharan, A.D., Litt, B., Baltuch, G. H., Lucas, T.H., and Kahana, M.J. (2014) Eye closure causes widespread low-frequency power increase and focal gamma attenuation in the human electrocorticogram. *Clinical Neurophysiology*, 9, 1764-1773.
10. Misra, A., Burke, J., Ramayya, A., Jacobs, J., Sperling, M., Moxon, K., et al. (2014). Methods for implantation of micro-wire bundles and optimization of single/multiunit recordings from human mesial temporal lobe. *Journal of Neural Engineering*, 11(2), 1-13
11. Healey, M. K. and Kahana, M. J. (2014) Is memory search governed by universal principles or idiosyncratic strategies? (2014). *Journal of Experimental Psychology: General*, 143, 575-596.
12. Burke, J., Sperling, M.R., Sharan, A.D., Evans, J.J., Ramayya, A., Healy, M.K., Beck, E.N., Davis, K.A., Lucas, T.H. and Kahana, M.J. (2014) Theta and high-frequency activity mark spontaneous recall of episodic memories. *Journal of Neuroscience*, 34, 11355-11365
13. Healey, M. K., Crutchley, P., and Kahana, M. J. Individual differences in memory search and their relation to intelligence. (2014) *Journal of Experimental Psychology: General*, 143, 1553-1569.
14. Manning, J., Lew, T. F., Li, N., Sekuler, R., and Kahana, M. J. (2014) MAGELLAN: A cognitive map-based model of human wayfinding. *Journal of Experimental Psychology: General*, 143, 1314-1330.
15. Ramayya, A., Misra, A., Baltuch, G., and Kahana, M. J. (2014). Microstimulation of the human substantia nigra alters reinforcement learning. *Journal of Neuroscience*, 20, 6887-6895.
16. Lohnas, L. J. and Kahana, M. J. (2014) A retrieved context account of spacing and repetition effects in free recall. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 40, 755-764.

17. Dube, C., Zhou, F., Kahana, M.J., and Sekuler, R. (2014). Similarity-based distortion of visual short-term memory is due to perceptual averaging. *Vision Research*, 96, 8-16.
18. Serruya, M.D., Sederberg, P.B., and Kahana, M. J. (2014) Power shifts track serial position and modulate encoding in human episodic memory. *Cerebral Cortex*, 24, 403-413.
19. Lohnas, L. J., and Kahana, M. J. (2014). Compound cueing in free recall. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 12-24.
20. Burke, J. F., Long, N.M., Zaghoul, K.A., Sharan, A.D., Sperling, M.R., and Kahana, M.J. (2014). Human intracranial high-frequency activity maps episodic memory formation in space and time. *Neuroimage*, 85, 834-843.
21. Long, N. M., Burke, J. F., and Kahana, M.J. (2014). Subsequent memory effect in intracranial and scalp EEG, *Neuroimage*, 84, 488-494.
22. Solway, A., Miller, J. F., and Kahana, M. J. (2013). PandaEPL: A library for programming spatial navigation experiments. *Behavior Research Methods*, 45, 1293-1312.
23. Lohnas, L. J. and Kahana, M. J. (2013). Parametric effects of word frequency on recall and recognition. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 39, 1943-1946.
24. Miller, J.F.* , Neufang, M.* , Solway, A., Brandt, A., Hefft, S., Trippel, M. Mader, I., Polyn, S.M., Jacobs, J., Kahana, M. J.*, and Schulze-Bonhage, A*. (2013). Neural activity in human hippocampal formation reveals the spatial context of retrieved memories, *Science*, 342, 1111-1114. (* denotes equal contributions).
25. Morton, N. W., Kahana, M. J., Rosenberg, E. A., Sperling, M. R., Sharan, A. D., and Polyn, S. M. (2013). Category-specific neural oscillations predict recall organization during memory search. *Cerebral Cortex*, 23, 2407-2422.
26. Miller, J. F., Lazarus, E., Polyn, S. M., and Kahana, M. J. (2013). Spatial clustering during memory search. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 39, 773-781.
27. Jacobs, J., Weidemann, C.T., Miller, J., Solway, A., Wei, X., Suthana, N., Sperling, M., Sharan, A. D., Fried, I., and Kahana, M. J. (2013). Direct recordings of grid-like neuronal activity in human spatial navigation. *Nature Neuroscience*, 16, 1188-1190.
28. van Vugt, M. K., Sekuler, R., Wilson, H. R., and Kahana, M. J. (2013).

An electrophysiological signature of summed similarity in visual working memory. *Journal of Experimental Psychology: General*, 142, 412-425.

29. Burke, J. F., Zaghoul, K. A., Jacobs, J., Williams, R. B., Sperling, M. R., Sharan, A. D., and Kahana, M. J. (2013). Synchronous and asynchronous theta and gamma activity during episodic memory formation. *Journal of Neuroscience*, 33, 292–304.
30. Han, X., Byrne, P., Kahana, M. J., and Becker, S. (2012). When do objects become landmarks? A VR study of the effect of task relevance on spatial memory, *PLoS One*, 7(5), e35940.
31. Manning, J. R. and Kahana, M. J. (2012). Interpreting semantic clustering effects in free recall. *Memory*, 20, 511–517.
32. Manning, J. R., Sperling, M. R., Sharan, A., Rosenberg, E. A., and Kahana, M. J. (2012). Spontaneously reactivated patterns in frontal and temporal lobe predict semantic clustering during memory search. *Journal of Neuroscience*, 32, 8871–8878.
33. Miller, J. F., Weidemann, C. T., and Kahana, M. J. (2012) Recall termination in free recall. *Memory & Cognition*, 4, 540–550.
34. Solway, A., Murdock, B.B., and Kahana, M.J. (2012). Positional and temporal clustering in serial order memory. *Memory & Cognition*, 40(2), 177–190.
35. van der Meij, R., Kahana, M., and Maris, E. (2012). Phase-amplitude coupling in human ECoG is spatially distributed and phase diverse. *Journal of Neuroscience*, 32, 111–123
36. Zaghoul, K., Weidemann, C. T., Lega, B.C., Jaggi, J., Baltuch, G.H., and Kahana, M. J. (2012). Neuronal activity in the human subthalamic nucleus encodes decision conflict during action selection. *Journal of Neuroscience*, 32, 2453–2460.
37. Lega, B. C., Jacobs, J. and Kahana. M. J. (2011). Human hippocampal theta oscillations and the formation of episodic memories. *Hippocampus*, 22(4), 748–761.
38. Lega, B.C., Kahana, M. J., Jaggi, J. Baltuch, G. H. and Zaghoul, K. (2011). Neuronal and oscillatory activity during reward processing in the human ventral striatum. *Neuroreport*, 22, 795–800.
39. Lohnas, L. J., Polyn, S. M., and Kahana, M. J. (2011). Contextual variability in free recall. *Journal of Memory and Language*, 64(3), 249–255.
40. Manning, J. R., Polyn, S. M., Baltuch, G., Litt, B., and Kahana, M. J. (2011). Oscillatory patterns in temporal lobe reveal context reinstatement

during memory search. *Proceedings of the National Academy of Sciences, USA*, 108(31), 12893–12897.

41. Maris, E., van Vugt, M. and Kahana, M.J. (2011). Spatially Distributed Patterns of Oscillatory Coupling between High-Frequency Amplitudes and Low-Frequency Phases in Human iEEG. *Neuroimage*, 54, 836–850.
42. Polyn, S. M., Erlikhman, G., and Kahana, M. J. (2011). Semantic cuing and the scale-insensitivity of recency and contiguity. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 37, 766–775.
43. Jacobs, J., Kahana, M. J., Ekstrom, A. D., Mollison, M. V., and Fried, I. (2010). A sense of direction in human entorhinal cortex. *Proceedings of the National Academy of Sciences*, 107, 6487–6492.
44. Sederberg, P. B., Miller, J. F., Howard, M. W., and Kahana, M.J. (2010). The temporal contiguity effect predicts episodic memory performance. *Memory & Cognition*, 38, 689–699.
45. Jacobs, J. and Kahana, M. J. (2010). Direct brain recordings fuel advances in cognitive electrophysiology. *Trends in Cognitive Science*, 4, 162–171.
46. van Vugt, M.K., Schulze-Bonhage, A., Litt, B., Brandt, A. and Kahana, M.J. (2010). Hippocampal gamma oscillations increase with working memory load, *Journal of Neuroscience*, 30, 2694–2699.
47. Kahana, M. J., Mollison, M. V., and Addis, K. M. (2010). Positional cues in serial learning: The spin-list technique. *Memory & Cognition*, 38, 92–101.
48. Viswanathan, S., Perl, D. R., Visscher, K. M., Kahana, M.J., and Sekuler, R. (2010). Homogeneity computation: How interitem similarity in visual short term memory alters recognition. *Psychonomic Bulletin & Review*, 2010, 17, 59–65.
49. Solway, A., Geller, A. S., Sederberg, P. B., and Kahana, M. J. (2010). Py-Parse: A semiautomated system for scoring spoken recall data. *Behavior Research Methods*, 42, 141–147.
50. Galster, M., Kahana, M. J., Wilson, H. R., and Sekuler, R. (2009). Identity modulates short-term memory for facial emotion. *Cognitive, Affective, and Behavioral Neuroscience*, 9, 973–984.
51. Howard, M. W., Sederberg, P. B., and Kahana, M. J. (2009). Reply to Farrell and Lewandowsky: Recency-contiguity interactions predicted by the temporal context model. *Psychonomic Bulletin & Review*, 15, 973–984.
52. Huang, J., Kahana, M. J., and Sekuler, R. (2009). A task-irrelevant stim-

ulus attribute affects perception and short-term memory. *Memory & Cognition*, 37, 1088–1102.

53. Jacobs, J., Korolev, I. O., Caplan, J. B., Ekstrom, A. D., Litt, B., Baltuch, G., Fried, I., Schulze-Bonhage, A., Madsen, J. R., and Kahana, M.J. (2009). Right Lateralization of Human Brain Oscillations during Navigational Movement and Search. *Journal of Cognitive Neuroscience*, 25, 824–836.
54. Weidemann, C. T., Mollison, M. V., and Kahana, M. J. (2009). Electrophysiological correlates of high-level perception during spatial navigation. *Psychonomic Bulletin & Review*, 16, 313–319.
55. van Vugt, M. K., Schulze-Bonhage, A., Sekuler, R., Litt, B., Brandt, A., Baltuch, G. and Kahana, M. J. (2009). Intracranial electroencephalography reveals two distinct similarity effects during item recognition. *Brain Research*, 1299, 33–44.
56. Manning, J. Jacobs, J. Fried, I. and Kahana, M.J. (2009). Broadband shifts in LFP power spectra are correlated with single-neuron spiking in humans. *Journal of Neuroscience*, 29, 13613–13620.
57. Jacobs, J. and Kahana, M. J. (2009). Neural representations of individual stimuli in humans revealed by gamma-band ECoG activity. *Journal of Neuroscience*, 29, 10203–10214.
58. Polyn, S. M., Norman, K. A., and Kahana, M. J. (2009). Task context and organization in free recall. *Neuropsychologia*, 47, 2158–2163.
59. Seligman, M.E.P. and Kahana, M. J. (2009). Unpacking intuition: A conjecture. *Perspectives on Psychological Science*, 4(4), 399–402.
60. Zaghoul, K. A., Blanco, J. A., Weidemann, C. T., McGill, K., Jaggi, J. L. Baltuch, G. H., and Kahana, M. J. (2009). Human Substantia Nigra Encodes Unexpected Financial Rewards. *Science*, 323, 1496–1499.
61. Polyn, S. M., Norman, K. A. and Kahana, M. J. (2009) A context maintenance and retrieval model of organizational processes in free recall. *Psychological Review*, 116, 129–156.
62. Visscher, K. M., Kahana, M. J., and Sekuler, R. (2009). Trial-to-trial carry-over in auditory short-term memory. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 4, 893–912.
63. Agam, Y., Hyun, J.-S., Danker, J., Zhou, F., Kahana, M. J., and Sekuler, R. (2009). Early neural signatures of visual short-term memory. *Neuroimage*, 2, 531–536.
64. Kahana, M. J., Sederberg, P. B., and Howard, M.W. (2008) Putting short-

term memory into context: Reply to Usher and colleagues (2008). (Postscript: Howard, M. W., Kahana, M. J., and Sederberg, P. B. Distinctions between temporal context and short-term store.) *Psychological Review*, 115, 1119–1126.

65. Sederberg, P. B., Howard, M. W., and Kahana, M. J. (2008). A context-based theory of recency and contiguity in free recall. *Psychological Review*, 115, 893–912.
66. Pantelis, P. C., van Vugt, M. K., Sekuler, R., Wilson, H. R., and Kahana, M. J. (2008). Why are some people's names easier to learn than others? The effects of similarity on memory for face-name associations. *Memory & Cognition*, 36, 1182–1195.
67. Danker, J. Hwang-Grodzins, G., Gauthier, L. Geller, A. Kahana, M.J., and Sekuler, R. (2008). Characterizing the ERP old-new effect in a short-term memory task *Psychophysiology*, 45, 784–793.
68. Serruya, M. D., and Kahana, M. J. (2008). Techniques and Devices to Restore Cognition. *Behavioural Brain Research*, 192, 149–165.
69. Golomb J. D., Peelle J. E., Addis, K. M., Kahana, M. J., and Wingfield A. (2008). Effects of Adult Aging on Utilization of Temporal and Semantic Associations during Free and Serial Recall. *Memory & Cognition*, 36, 947–956.
70. Yotsumoto, Y., McLaughlin, C., Kahana, M. J., and Sekuler, R. (2008). Recognition and position information in working memory for visual textures. *Memory & Cognition*, 36, 282–294.
71. Davis, O., Geller, A.S., Rizzuto, D., and Kahana, M. J. (2008). Temporal associative processes revealed by intrusions in paired-associate recall. *Psychonomic Bulletin & Review*, 15, 64–69.
72. Polyn, S. M. and Kahana, M. J. (2008) Memory search and the neural representation of context. *Trends in Cognitive Science*, 12, 24–30.
73. Sekuler, R. and Kahana, M. J. (2008). A stimulus-oriented approach to memory. *Current Directions in Psychological Science*, 16, 305–310.
74. Geller, A. S. Schleifer, I. Sederberg, P. B., Jacobs, J., and Kahana, M.J. (2007). PyEPL: A Cross-Platform Experiment Programming Library *Behavior Research Methods*, 39 (4).
75. Sederberg, P. B., Schulze-Bonhage, A., Madsen, J. R., Bromfield, E.B., Litt, B., Brandt, A., and Kahana, M.J. (2007). Theta and gamma oscillations distinguish true from false memories. *Psychological Science*, 18, 927-932.

76. Kimball, D. R., Smith, T. A., and Kahana, M.J. (2007). The fSAM model of false recall. *Psychological Review*, 114, 954-993.
77. Howard, M. W., Venkatadass, V., Norman, K. A., and Kahana, M. J. (2007). Associative Processes in Immediate Recency *Memory & Cognition*, 35, 1698-1709.
78. Ekstrom, A., Viskontas, I. Kahana, M.J., Jacobs, J., Upchurch, K. Bookheimer, S., and Fried, I. (2007). Contrasting roles of neural firing rate and local field potentials in human memory. *Hippocampus*, 17, 606-617.
79. Kahana, M.J., Zhou, F., Geller, A., and Sekuler, R. (2007). Lure-similarity affects visual episodic recognition: Detailed tests of a noisy exemplar model. *Memory & Cognition*, 35, 1222-1232.
80. Yotsumoto, Y, Kahana, M. J. Wilson, H. R., and Sekuler, R. (2007). Recognition memory for realistic synthetic faces. *Memory & Cognition*, 35, 1233-1244.
81. Newman, E. L., Caplan, J. B., Kirschen, M. P., Korolev, I.O. Sekuler, R., and Kahana, M. J. (2007). Learning your way around town: Virtual taxi drivers reveal the secrets of navigational learning. *Cognition*, 104, 231-253.
82. van Vugt, M. K., Sederberg, P. B., and Kahana, M. J. (2007). Comparison of spectral analysis methods for characterizing brain oscillations. *J. Neuroscience Methods*, 162, 49-63.
83. Sederberg, P. B., Schulze-Bonhage, A., Madsen, J. R., Bromfield, E. B., McCarthy, D. C., Brandt, A., Tully, M. S., and Kahana, M. J. (2007). Hippocampal and neocortical gamma oscillations predict memory formation in humans. *Cerebral Cortex*, 17, 1190-1196.
84. Visscher, K. A., Kaplan, E. Kahana, M. J., and Sekuler, R. (2007). Auditory Short-Term Memory Behaves Like Visual Short-Term Memory. *PLOS Biology*, 5, 662-672.
85. Monaco, J., Abbott, L., and Kahana, M.J. (2007). Lexico-Semantic Structure and the Word-Frequency Effect. *Learning and Memory*, 14, 204-213.
86. Jacobs, J., Kahana, M. J., Ekstrom, A. D., and Fried, I. (2007). Brain oscillations synchronize single-neuron activity in humans, *J. Neuroscience*, 27, 3839-3844.
87. Sekuler, R., McLaughlin, C., Kahana, M. J., Wingfield, A., and Yotsumoto, Y. (2006). Short-term visual recognition and temporal order memory are both well-preserved in aging. *Psychology and Aging*, 21, 632-637.
88. Howard, M. W., Kahana, M. J., and Wingfield, A. (2006). Aging and contextual binding: modeling recency and lag-recency effects with the Tem-

- poral Context Model. *Psychonomic Bulletin & Review*, 13, 439-445.
89. Sederberg, P. B., Gauthier, L. V., Terushkin, V., Miller, J. F., Barnathan, J. A., and Kahana, M. J. (2006). Oscillatory Correlates of the Primacy Effect in Episodic Memory. *Neuroimage*, 32, 1422-1431.
 90. Jacobs, J., Hwang, G., Curran, T., and Kahana, M. J. (2006). EEG oscillations and recognition memory: Theta correlates of memory retrieval and decision making. *Neuroimage*, 32, 978-987.
 91. Zaromb, F. M., Howard, M. W., Dolan, E. D., Sirotin, Y. B., Tully, M., Wingfield, A., and Kahana, M. J. (2006). Temporal associations and prior list intrusions in free recall. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 32, 792-804.
 92. Kahana, M. J. (2006). The cognitive correlates of human brain oscillations. *Journal of Neuroscience*, 26, 1669-1672
 93. Rizzuto, D. S., Madsen, J. R., Bromfield, E., Schulze-Bonhage, A., and Kahana, M. J. (2006). Phase dynamics of neocortical oscillations during working memory. *Neuroimage*, 31, 1352-1358.
 94. Raghavachari, S., Lisman, J. E., Tully, M., Madsen, J. R., Bromfield, E. B., and Kahana, M. J. (2006). Theta oscillations in human cortex during a working memory task: evidence for local generators. *Journal of Neurophysiology*, 95, 1630-1638.
 95. Hwang, G., Jacobs, J., Geller, A., Danker, J., Sekuler, R., and Kahana, M. J. (2005). EEG Correlates of Subvocal Rehearsal in Working Memory *Behavioral and Brain Functions*, 1-20.
 96. Sirotin, Y. B., Kimball, D., and Kahana, M. J. (2005). Going beyond a single list: Semantic-episodic interactions in a large-scale model of episodic recall. *Psychonomic Bulletin & Review*, 12, 787-805.
 97. Kahana, M. J., Rizzuto, D. S., and Schneider, A. R. (2005). Theoretical correlations and measured correlations: Relating recognition and recall in four distributed memory models. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 5, 933-953.
 98. Ekstrom, A. E., Caplan, J. B., Ho, E., Shattuck, K., Fried, I., and Kahana, M. J. (2005). Human Hippocampal Theta Activity During Virtual Navigation. *Hippocampus*, 15, 881-889.
 99. Schwartz, G., Howard, M. W., Jing, B., and Kahana, M. J. (2005). Shadows of the past: Temporal retrieval effects in recognition memory. *Psychological Science*, 16, 898-904.
 100. Klein, K., Addis, K. M., and Kahana, M. J. (2005). A comparative analysis

of serial and free recall. *Memory & Cognition*, 33, 833-839.

101. Kahana, M. J. and Howard, M. W. (2005). Spacing and lag effects in free recall of pure lists. *Psychonomic Bulletin & Review*, 12, 159-164.
102. Kahana, M. J., Dolan, E., Sauder, C., and Wingfield, A. (2005). Intrusions in Episodic Recall: Age Differences in Editing of Overt Responses. *Journal of Gerontology*, 60, 92-97.
103. Sekuler, R., Kahana, M. J., McLaughlin, C., Golomb, J., and Wingfield, A. (2005). Preservation of episodic visual recognition memory in aging. *Experimental Aging Research*, 31, 1-13.
104. Addis, K. M. and Kahana, M. J. (2004). Decomposing serial learning: What is missing from the learning curve?. *Psychonomic Bulletin & Review*, 11, 118-124.
105. Zhou, F., Kahana, M. J., and Sekuler, R. (2004). Episodic memory for visual textures: A roving probe gathers some memory. *Psychological Science*, 15, 112-118.
106. Sederberg, P. B., Kahana, M. J., Donner, E., and Madsen, J. R. (2003). Theta and Gamma Oscillations During Encoding Predict Subsequent Recall. *Journal of Neuroscience*, 23, 10809-10814.
107. Cantero, J. L., Atienza, M., Stickgold, R., Kahana, M. J., Madsen, J. R., and Kocsis, B. (2003). REM sleep-dependent theta waves in the human hippocampus and neocortex. *Journal of Neuroscience*, 23, 10897-10903.
108. Howard, M. W., Rizzuto, D. S., Caplan, J. B., Madsen, J. R., Lisman, J., Aschenbrenner-Scheibe, R., Schulze-Bonhage, A., and Kahana, M. J. (2003). Gamma oscillations correlate with working memory load in humans. *Cerebral Cortex*, 13, 1369-1374.
109. Ekstrom, A. D., Kahana, M. J., Caplan, J. B., Fields, T. A., Isham, E. A., Newman, E. L., and Fried, I. (2003). Cellular networks underlying human spatial navigation. *Nature*, 425, 184-187.
110. Caplan, J. B., Madsen, J. R., Schulze-Bonhage, A., Aschenbrenner-Scheibe, R., Newman, E. L., and Kahana, M. J. (2003). Human theta oscillations related to sensorimotor integration and spatial learning. *Journal of Neuroscience*, 23, 4726-4736.
111. Rizzuto, D. S., Madsen, J. R., Bromfield, E., Schulze-Bonhage, A., Seelig, D., Aschenbrenner-Scheibe, R., and Kahana, M. J. (2003). Reset of human neocortical oscillations during a working Memory task. *Proceedings of the National Academy of Sciences*, 100, 7931-7936.
112. Kahana, E., Lovegreen, L., Kahana, B., and Kahana, M. (2003). Per-

son, environment, and person-environment fit as influences on residential satisfaction of elders. *Environment and Behavior*, 35, 434-453.

113. Wingfield, A. and Kahana, M. J. (2002). The dynamics of memory retrieval in older adults. *Canadian Journal of Experimental Psychology*, 56, 187-199.
114. Kahana, M. J. (2002). Associative symmetry and memory theory. *Memory & Cognition*, 30, 823-840.
115. Kahana, M. J. and Caplan, J. B. (2002). Associative Asymmetry in Probed Recall of Serial Lists. *Memory & Cognition*, 30, 841-849.
116. Kahana, M. J. and Sekuler, R. (2002). Recognizing spatial patterns: A noisy exemplar approach. *Vision Research*, 42, 2177-2192.
117. Howard, M. W. and Kahana, M. J. (2002). A distributed representation of temporal context. *Journal of Mathematical Psychology*, 46, 269-299.
118. Kahana, M. J., Howard, M. H., Zaromb, F., and Wingfield, A. (2002). Age dissociates recency and lag-recency effects in free recall. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 28, 530-540.
119. Howard, M. W. and Kahana, M. J. (2002). When does semantic similarity help episodic retrieval? *Journal of Memory and Language*, 46, 85-98.
120. Kahana, M. J., Seelig, D., and Madsen J. R. (2001). Theta Returns. *Current Opinion in Neurobiology*, 11, 739-744.
121. Caplan, J. B., Madsen, J. R., Raghavachari, S., and Kahana, M. J. (2001). Distinct patterns of brain oscillations underlie two basic parameters of human maze learning. *Journal of Neurophysiology*, 86, 368-380.
122. Rizzuto, D. S. and Kahana, M. J. (2001). An autoassociative model of paired-associate learning. *Neural Computation*, 13, 2075-2092.
123. Raghavachari, S., Kahana, M. J., Rizzuto, D. S., Caplan, J. B., Kirschen, M., Bourgeois, B., and Lisman, J. (2001). Gating of human theta oscillations by a working memory task. *Journal of Neuroscience*, 21, 3175-3183.
124. Kirschen, M., Kahana, M. J., Sekuler, R., and Burack, B. (2000). Optic flow aids learning in virtual environments. *Perception*, 29, 801-818.
125. Kahana, M. J. and Wingfield, A. W. (2000). A functional relation between learning and organization in free recall. *Psychonomic Bulletin & Review*, 7, 516-521.
126. Kahana, M. J. and Jacobs, J. (2000). Inter-response times in serial recall: Effects of intra-serial repetition. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 26, 1188-1197.

127. Rizzuto, D. S. and Kahana, M. J. (2000). Associative Symmetry vs. Independent Associations. *Neurocomputing*, 32, 973-978.
128. Caplan, J. B., Kahana, M. J., Sekuler, R., Kirschen, M., and Madsen, J. R. (2000). Task dependence of human theta: the case for multiple cognitive functions. *Neurocomputing*, 32, 659-665.
129. Howard, M. W. and Kahana, M. J. (1999). Contextual variability and serial position effects in free recall. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 25, 923-941.
130. Kahana, M. J., Sekuler, R., Caplan, J. B., Kirschen, M., and Madsen, J. (1999). Intracranial recordings reveal task-dependent changes in theta oscillations during virtual maze navigation by human subjects. *Nature*, 399, 781-784.
131. Kahana, M. J., Caplan, J. B., Sekuler, R., and Madsen, J. (1999). Using intracranial recordings to study theta: Response to J. O'Keefe and N. Burgess (1999). *Trends in Cognitive Science*, 3, 406-407.
132. Wingfield, A., Lindfield, K., and Kahana, M. J. (1998). Adult age differences in the temporal characteristics of category free recall. *Psychology and Aging*, 13, 256-266.
133. Chance, F. S. and Kahana, M. J. (1997). Testing the role of associative interference and compound cues in sequence memory. In Bower, J. (Ed.) *Computational Neuroscience, Trends in research*. Plenum Press, NY. pp. 599-603.
134. Kahana, M. J. (1996). Associative retrieval processes in free-recall. *Memory & Cognition*, 24, 103-109.
135. Glatstein, I. Z., Hornstein, M. D., Kahana, M. J., Jackson, K. V., and Friedman, A.J. (1995). The predictive value of discriminatory human chorionic gonadotrophin levels in the diagnosis of implantation outcome in in vitro fertilization cycles. *Fertility and Sterility*, 63, 350-356.
136. Kahana, M. J. and Bennett, P. J. (1994). Classification and perceived similarity of compound gratings that differ in relative spatial phase. *Perception and Psychophysics*, 55, 642-656.
137. Kahana, M. J. and Greene, R. L. (1993). The effects of spacing on memory for homogeneous lists. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 19, 159-162.
138. Murdock, B. B. and Kahana, M. J. (1993). List-strength and list-length effects: Reply to Shiffrin, Ratcliff, Murnane and Nobel (1993). *Journal of Experimental Psychology: Learning, Memory and Cognition*, 19, 1450-1453.

139. Murdock, B. B. and Kahana, M. J. (1993). Analysis of the list strength effect. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *19*, 689-697.
140. Kahana, M.J. and Detterman, D.K. (1989). ABC: A program to convert PSYCLIT CD-ROM abstracts into APA style bibliographies. *Behavior Research: Methods, Instruments, and Computers*, *21*, 414.
141. Kaufman, M. and Kahana, M. (1988). Cayley-tree Ising model with anti-ferromagnetic nearest-neighbor and ferromagnetic equivalent-neighbor interactions. *Physical Review B*, *37*, 7638-7642

Book chapters and invited reviews

1. Manning, J., Norman, K. A. and Kahana, M.J. The role of context in episodic memory. In Gazzaniga, M. and Mangun, R. (Eds.) *The Cognitive Neurosciences* (5th Edition). MIT Press.
2. Kahana, M. J. and Miller, J. F. (2013). Memory, recall dynamics. In H. Pashler (Ed.), *Encyclopedia of the mind* (vol. 2, pp. 493-497). SAGE Publications.
3. Kahana, M. J., Howard, M. W., and Polyn, S. M. (2008). Associative Processes in Episodic Memory. H.L. Roedger (Ed.) *Learning and Memory - A Comprehensive Reference*. Elsevier.
4. Howard, M. W., Addis, K. M., Jing, B., and Kahana, M. J. (2007). Semantic structure and episodic memory. In McNamara, D., Landauer, T., Dennis, S. and Kintsch, W. Editors, *LSA: A road to meaning*, Earlbaum, Mahwah, N.J., pp. 121-141.
5. Lisman, J., Jensen, O., and Kahana, M. J. (2001). Towards a physiological explanation of the behavioral data on human memory: the role of theta-gamma oscillations and NMDAR-dependent LTP. In Holscher, C. (Ed.) *Neural Mechanisms of Memory Formation*. Cambridge University Press, N.Y., pp. 195-223.
6. Kahana, M. J. (2000). Contingency Analyses of Human Memory. In E. Tulving and F.I.M. Craik (Eds.) *The Oxford Handbook of Memory*. Oxford University Press. pp. 59-72.
7. Kahana, M. J. and Loftus, G. (1999). Response time versus Accuracy in Human Memory. In R. Sternberg (Ed.) *The Nature of Cognition*, MIT Press, MA, pp. 323-384.
8. Andrist, C. G., Kahana, M. J., Spry, K., Knevel, S., Luo, D., Persanyi, M., Evans, S., and Detterman, D. K. (1992). Individual Differences in the Biological Correlates of Intelligence: a selected overview. In (Douglas

K. Detterman Ed.) *Current Topics in Human Intelligence, Volume 2: Is mind modular or unitary?* Ablex Publishers, N.J., pp. 1-59.