BIOGRAPHICAL SKETCH

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NAME: Mark Steven Cohen

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POSITION TITLE: Prof. of Psychiatry, Bioengineering, Psychology, Radiology, Biomedical Physics, Neurology

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Stanford University, Stanford, CA	B.A.	1979	Human Biology
Mass. Inst. of Technology, Cambridge, MA		1977-78	Electrical Engineering
Rockefeller University, New York, NY	Ph.D.	1985	Neurobiology & Behavior

A. Personal Statement

I am a Professor of Psychiatry at UCLA, with joint appointments also in Neurology, Biomedical Physics, Radiological Sciences, Bioengineering, and Psychology. I am a well-established investigator, and have made significant contributions to many areas of health sciences including functional imaging, both MRI and EEG technology, cognitive science, and methods of analysis such as mathematical modeling and machine learning. I have been the PI on more than a dozen NIH grants. My most recent work has been focused heavily on methods of statistical analysis of complex and large clinical data sets. I have collaborated with Dr. Lenartowicz, the PI of the present proposal, for more than a decade, on her groundbreaking work on attentional control, particularly as expressed in EEG and fMRI signals. As the inventor of the fMRI-EEG integration technology that will be used in these studies, I expect to continue to make meaningful advances to improve data quality and analysis, and to contribute on all scientific levels to this important work.

B. Positions and Honors

Positions and Employment

1979 - 1980 Research Assistant, Stanford University, Stanford, CA
1985 - 1988 MR Applications Scientist, Siemens Medical Systems, Inc.
1988 - 1990 Senior Application Scientist, Advanced NMR Systems, Woburn, MA
1990 - 1993 Dir. High Speed Imaging Lab; Tech. Dir., Clinical NMR, MGH-NMR Center, Charlestown, MA
1990 - 1991 Instructor of Radiology, Harvard Medical School, Boston, MA
1992 - 1993 Assistant Professor of Radiology, Harvard Medical School, Boston, MA
1993 - 2001 Associate Professor of Neurology & Radiological Sciences, UCLA Medical School
2001- Professor of Psychiatry, Biomedical Physics, Neurology & Radiology, UCLA Med. School
2004- Professor of Psychology, UCLA College of Arts and Sciences
2005 - 2014 Director, UCLA/Semel Neuroimaging Training Program
2009 - 2017 Biomedical Engineering, Field Chair in Image Acquisition and Analysis

Other Experience and Professional Memberships

1994 - 1997 Board of Directors; International Society for Magnetic Resonance in Medicine
1994 - 1997 Chairman, Education Committee; Society of Magnetic Resonance
1993 - 1998 Associate Editor; Journal of Magnetic Resonance Imaging
1993 - 1997 Board of Directors; Society for Magnetic Resonance Imaging
2002 - Board of Directors, Institute for Magnetic Resonance Safety, Education and Research

Honors

2012 UCLA Postdoctoral Mentor award
2014 Council on Undergraduate Research. Excellence in Mentoring Undergraduate Research
2017 Education in Neuroimaging Award. Organization for Human Brain Mapping

C. Contributions to Science

My work has been built upon the application and development of novel tools to be used in scientific research, principally of the human nervous system. This approach is predicated on the observation that many important

areas of neuroscience have not received the attention and study that they deserve, because powerful and appropriate methods are lacking. My training in both engineering and neuroscience have led me to the belief that if we are willing to accept the challenge of high complexity in our approaches we can tackle problems that might not yield easily to current methods. Consistent with that belief, I have been involved with the development of many important methods that have made empirical and quantitative work possible. These include ultra-fast MRI to study dynamic processes, functional MRI to interrogate otherwise covert brain activity, MRI-EEG combinations that capture rapidly evolving electrical events that interact with the readily localized BOLD signal, a focus on computational methods to integrate multimodal signals, as well as novel and rapidly evolving methods of machine learning, appropriate to the problem of classification in neuroimaging and, a strong interest in focused ultrasound as a means of neuromodulation.

Instrumentation and fMRI. The study of brain function is crucially dependent on the availability of sensitive and powerful tools for measurement. I have played crucial roles in several major developments that form the technological basis for much of the current generation of brain imaging instruments, including the creation of practical echo-planar imaging, contrast-enhanced fMRI, BOLD fMRI, and more recently concurrent EEG and fMRI.

1. KK Kwong, JW Belliveau, DA Chesler, IE Goldberg, RM Weisskoff, BP Poncelet, DN Kennedy, BE Hoppel, **MS Cohen** and R Turner, “Dynamic magnetic resonance imaging of human brain activity during primary sensory stimulation.” Proceedings of the National Academy of Science U S A, 89(12): p. 5675-5679. 1992. PMCID: 1608978
2. RI Goldman, JM Stern, J Engel, Jr. and **MS Cohen**, “Simultaneous EEG and fMRI of the alpha rhythm.” Neuroreport, 13(18): p. 2487-2492. 2002.

Signal Processing. Collecting measurements is not enough; it is essential to have analytic tools and frameworks by which to model, test, and interpret the data. I have been very active in the creation of tools that process the incoming signals to remove artifacts, improve model fits and that are informed by neuroscience.

1. **MS Cohen**, “Parametric analysis of fMRI data using linear systems methods.” NeuroImage, 6(2): p. 93-103. 1997.
2. PK Douglas, E Lau, A Anderson, A Head, W Kerr, M Wollner, D Moyer, W Li, M Durnhofer, J Bramen and **MS Cohen**, “Single trial decoding of belief decision making from EEG and fMRI data using independent components features.” Front Hum Neurosci, 7: p. 392. 2013. PMCID: 3728485

Machine Learning. Increasingly, the output of our instruments falls into the realm of “big data” requiring sophisticated means of detecting patterns across hundreds of thousands of pixels, hundreds of subjects, megabytes of voltage signals. I have concentrated for several years on the development and extension of machine learning methods to incorporate expert knowledge from many decades of traditional neuroscience research.

1. A Anderson, JS Labus, EP Vianna, EA Mayer and **MS Cohen**, “Common component classification: what can we learn from machine learning?” NeuroImage, 56(2): p. 517-524. 2011. PMCID: 2966513
2. AE Anderson, WT Kerr, A Thames, T Li, J Xiao and **MS Cohen**, “Electronic health record phenotyping improves detection and screening of type 2 diabetes in the general United States population: A cross-sectional, unselected, retrospective study.” J Biomed Inform, 60: p. 162-168. 2016. PMCID: 26707455

Applications. From an applications perspective, I have been interested in work that addresses the physiology of the brain broadly, and disorders of normal cognition, including schizophrenia, ADHD, depression, bipolar disorder, Parkinson’s disease and others. I have also pursued an interest in epilepsy and its clinical management. I am interested in the core mechanisms of attention control.

1. DA Vaughn, MB Maggiora, KJ Vaughn, CJ Maggiora, A-V Tavakoli, W Liang, D Zava, MS Cohen, A Lenartowicz. “Modulation of attention and stress with arousal: the mental and physical effects of riding a motorcycle.” Brain Research, 1752:1-11. 2021.
2. A Lenartowicz, S Lu, C Rodriguez, EP Lau, PD Walshaw, JT McCracken, MS Cohen, SK Loo. “Alpha desynchronization and fronto-parietal connectivity during spatial working memory encoding deficits in ADHD: A simultaneous EEG-fMRI study.” Neuroimage Clin. 2016;11:210-23. doi: 10.1016/j.nicl.2016.01.023. PubMed PMID: 26955516; PMCID: PMC4761724.

Publications: My H-index according to GoogleScholar is 76 and my work has been cited in scientific publications more than 30,000 times. I have published more than 225 scientific papers. My bibliography appears here http://tinyurl.com/MSCohenGoogleScholar
and at NCBI: https://www.ncbi.nlm.nih.gov/sites/myncbi/mark.cohen.2/bibliography/40464405/public/

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

Tiny Blue Dot Foundation PIs: Cohen, Dougherty, George, Koch, Monti, Tononi 01/2016 – 12/31/2021
Measuring Consciousness: from theory to practice
The aims of the first three years of funding are to test and apply Integrated Information Theory to the development of devices that measure the complexity of evoked neural signals as proxy measures of "Φ", interpretable as degree of consciousness, and to develop means of modulating and altering conscious perception The project is exceedingly ambitious, with a fifteen year plan to improve and validate these measures, and to apply them to pressing areas of research, that include both clinical and basic applications in understanding human cognition.

Completed Research Support (*selected*)

5 T90 DA22768-07 Cohen (PI) 09/1/2011 - 08/31/2016
and 1T90DA22768 09/1/2006 - 08/31/2011
Comprehensive training in Neuroimaging Fundamentals and Applications
The major goal of this study was to provide two years of training to graduate students in the fundamentals and applications of neuroimaging. Students in the NITP complete a year of graduate training in the Neurosciences, including fundamentals of Neuroanatomy, Systems Neuroscience, Neurophysiology and/or Cognitive Neuroscience, followed by a second year of graduate training which entails an intensive program in the tools of neuroimaging, including acquisition, data processing, analysis and experimental design. The project was renewed for a total of ten years of funding.
Role: PI

National Academy Keck Futures Initiative Cohen (PI) 05/2016 – 11/2017
Sentient Architectural Systems: Transforming architecture by coupling human neurology to interactive responsive building environments
This project explores possibilities for a built, inhabited environment to be made sentient by examining the mutual influence between these interactive spaces and people's well-being and consciousness. The team will study how a building's communication and control systems can be developed in ways that actively respond and resonate with human consciousness.
Role: PI

WM Keck Foundation Weiss (PI) 1/1/2013-12/30/2015
Leveraging Sparsity
Our goal was to leverage mathematical advances to transform the way imaging and related data are acquired, analyzed, and understood. The results are a richer, more meaningful, data through significant changes in how experiments are currently conducted and, in so doing, advancing the science of imaging. We proposed and performed critical tests of the advantages of sparsification using two diverse sets of experiments, in which leading mathematicians work closely with top imaging scientists. The advances apply broadly across many fields involving imaging. We are placed uniquely to develop the theory, to carry out the tests, to generalize the results, and to disseminate the tools we created.
Role: Investigator

1R21MH096239 01A1 Cohen (PI) 06/11/2012 – 05/31/2014
Understanding attention-control across functional systems and temporal scales
By concurrent recording of instantaneous electrical activity (EEG) and slower fluctuations in regional metabolism during a variety of attentionally demanding tasks with multimodal distractors, this project will help to improve our understanding of the interactions between brain mechanisms that allows us to ignore distractions and to sustain attention for extended periods.
Role: PI

5 R33 DA026109-3 Cohen (PI) 09/01/2008 – 08/31/2013 3 calendar

Real-Time Automated Detection of Craving States with fMRI and EEG
The goal of this project is to develop, characterize and validate a method of real-time detection of cognitive states relevant to the study of drug abuse using concurrent electrophysiological recordings, first to enhance the state discriminations and, later, to serve potentially as a proxy for the neuroimaging brain-state data. The tools rely heavily on multivariate machine learning based on an understanding of the systems architecture of the brain. The project produced significant advances in machine-learning theory for sparse data sets.
Role: PI

R01DA013054 Cohen (PI) 8/20/1999 – 1/31/2004
Real Time Imaging of Mental Activity
This project developed and characterized a novel software tool set for the immediate analysis of functional MRI and other medical images. Versions of this work now appear in multiple commercial MRI products.
Role: PI

1 R01-EY12722-01A1 Cohen (PI) 05/15/2000 - 04/30/2004
MRI of Inverted Vision: Plasticity of Visuospatial Maps
This research was designed to assess the plastic changes in cortex that we hypothesize occur in the face of grossly distorted visual input from inverting goggles. Functional MRI is used to derive retinotopic, spatiotopic and auditory maps following semi-chronic exposure to the inverting device.
Role: PI

1R21-DA13627-01 Cohen (PI) 06/25/2002 - 05/31/2004
Enabling Technologies in fMRI and Cigarette Smoking
This project centers on the design of a system for the controlled delivery of cigarette smoke to subjects during functional Magnetic Resonance Imaging, and the characterization of the drug delivery and the responses of the human brain to cigarette smoke. We will look at both global and local signal changes from the smoke per se, and at local changes in BOLD responses to external stimuli as a function of the cigarette exposure.
Role: PI

1R21-DA15549-01 Cohen (PI) 06/01/2002-05/31/2004
Simultaneous Electrophysiology and Functional MRI
This project included the development of methods to record extracellular potentials during functional MRI to understand better the coupling between BOLD signals and cellular activity.
Role: PI

2P50 HD055784:06 Bookheimer (PI) 07/1/2007-06/31/2017
Biomarkers of Developmental Trajectories and Treatment in ASD
The UCLA Autism Center of Excellence is dedicated to identifying the causes of autism, discovering how risk factors translate into abnormal brain development, developing and validating novel interventions, and targeting the core deficits to change trajectories and outcomes in individuals with autism spectrum disorder.
Role: Investigator

R01 MH095878 Green (PI) 07/01/2012 - 06/30/2017
Visual Tuning and Performance in Schizophrenia and Bipolar Disorder
The study included 90 SZ patients, 90 BD patients and 90 healthy controls group matched on key demographic variables. The subjects participated in perceptual performance, electrophysiological (EEG), cognition, and functional magnetic resonance imaging (fMRI) procedures to address the following three aims: 1) To examine visual neural tuning in SZ using specialized EEG and fMRI methods; 2) To examine visual neural tuning cross-diagnostically among SZ, BD, and healthy controls with specialized EEG and fMRI methods; and 3) To examine the implications of visual tuning deficits in SZ, BD, and healthy controls for perceptual and higher-level cognitive domains.
Role: Investigator