

# Brandon King, PhD

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## Research Interests

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- Brain-computer interfaces (BCI), Brain-machine interfaces (BMI), and Neural interface systems (NIS)
- Perceptual (visual, auditory, somatosensory) and motor neuroscience
- Cognitive science related to volition, agency, and interaction
- Virtual, augmented, and mixed reality
- Time series data analysis, machine learning, and artificial intelligence

## Education

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**PhD, Neuroscience**  
Brown University

2017  
Providence, RI

Thesis title: *Volitional Strategies Engaged During Neural Interface Control: The Impact of Watching, Imagining, and Attempting Movement on Neural Activity*

Supervisor: Dr. John Donoghue

Committee members: Dr. David Sheinberg  
Dr. Leigh Hochberg  
Dr. Michael Paradiso

External Examiner: Dr. Philip Kennedy, Neural Signals, Inc.

Defended successfully without revision, July 14, 2016.

**BSc, Neuroscience and Behavioral Biology**  
Emory University

2001  
Atlanta, GA

**BSc, Computer Science**  
Emory University

2001  
Atlanta, GA

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## Research Experience

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- Neuroscience Doctoral Candidate**, Dr. John P. Donoghue Lab  
Brown University, BrainGate/BrainGate2 Clinical Trial  
2005 - 2017  
Providence, RI
- Investigated brain-computer interface safety and usability factors essential for transitioning BCI technology from a controlled lab environment to the outside world.
  - Catalyzed project-wide changes to experimental design, post-implant initial evaluation, and participant instruction.
  - Analyzed, validated, and verified high volume, high resolution neural data sets across large variable spaces for dissertation study and collaborating projects, requiring precise knowledge of signal conditioning, filtering, aligning, and processing.
- Neurophysiologist/Programmer**, Dr. Philip R. Kennedy Lab  
Neural Signals, Inc.  
1999 - 2002  
Atlanta, GA
- Broad duties, spanning all project facets, from working with participants to presenting to investors.
  - Trained patients with advanced ALS and brainstem stroke to communicate through the first implanted human brain-computer interface.
  - Collected and analyzed data leading to published findings.
  - Designed and implemented programs to aid data collection and analysis.
  - Implemented a fully mobile data analysis rack system.
  - Full-time position while full-time student.
- Research Assistant**, Dr. James R. Wilson Lab  
Yerkes Regional Primate Research Center - Visual Science Department  
1997 - 1998  
Atlanta, GA
- Trained rhesus macaques on visual pursuit and fixation tasks.
  - Assisted during lateral geniculate nucleus single neuron recordings.
  - Configured and implemented experiment tasks and analyzed data.
- Programmer**, Dr. Darryl B. Neill Lab  
Emory University - Department of Psychology  
1999  
Atlanta, GA
- Designed and implemented software to measure research variables during rat striatum intracranial self-stimulation experiments.

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## Teaching Experience

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- Teaching Assistant**  
Brown University  
2006  
Providence, RI

**BN1/NEUR0010: Introduction to Neuroscience**

- Coordinated 12 undergraduate assistant TAs for class of 300+ students.
- Led two-hour-long weekly review sessions for groups of 20-50 students.
- Held regular office hours for tutoring and large pre-exam review sessions.

**Technology Tutor**

Abbott Laboratories

2003 - 2005

Chicago, IL

- Trained and tutored district counterparts on company technology initiatives.

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**Organizational Experience**

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**WIA Task Project Lead** (Thesis project)

Brown University

2007 - 2016

Providence, RI

- Coordinated programming, data analysis, and experimental protocol for a subset of researchers within the BrainGate project.
- Designed behavioral task technical requirements and line of scientific questioning to compensate for two major BrainGate transitions. This parallel, independent implementation allowed thesis work to progress unaffected by major changes to the larger BrainGate project, while acting as an independent data validation resource for other subprojects during early development stages of the larger system.
- Regularly presented findings at lab meetings, project meetings, and visiting researcher sessions.

**Host, "The Digital Trends Podcast"**

DigitalTrends.com

2006 - 2008

Sherwood, OR

- Engineered, produced, and hosted weekly technology news podcast.

**Pharmaceutical Representative**

Abbott Laboratories

2002 - 2006

Abbott Park, IL

- Coordinated district sales objectives across salesforce divisions and pod members, covering over 100 offices and 300 physicians.
- Identified and tracked key opinion leader prescription trends, allowing accurate prioritization in response to changes in prescribing behavior and management of war chest funds.
- Acted as district point-person for resolving conflicts between district reps and medical professionals.
- Regularly granted access to physicians who barred all pharmaceutical reps.

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## Public Speaking Experience

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<b>Guest Lecturer</b> , Introduction to Biomedical Technology Dept. of Neurology, University Campus Bio-Medico	2007 Rome, Italy
<b>Guest Lecturer</b> Taugavísindafélags Íslands (Icelandic Society for Neuroscience)	2009 Reykjavík, Iceland
<b>Speaker</b> , Annual Research Summary Dept. of Neuroscience, Brown University	2007 - 2011 Providence, RI
<b>Presenter</b> , Annual Project Update BrainGate2 Multicenter Retreat, Brown University	2008 - 2010 Providence, RI
<b>Speaker</b> , Technology and Analysis Update Annual Sales Meeting, Abbott Laboratories	2003 - 2005 Chicago, IL

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## Publications

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Kennedy PR, King B. "Dynamic Interplay of Neural Signals during the Emergence of Cursor Related Cortex in a Human Implanted with the Neurotrophic Electrode." *Neural Prostheses for Restoration of Sensory and Motor Function*. Ed. John Chapin. Danvers, MA: CRC Press, 2001. 221-233.

Kennedy PR, Kirby MT, Moore MM, King B, Mallory A. "Computer Control Using Human Cortical Local Field Potentials." *IEEE Transactions on Neural Systems and Rehabilitation Engineering* 12.3 (2004).

Kennedy PR, Andreasen D, Ehirim P, King B, Kirby MT, Mao H, Moore MM. "Using Human Extra Cortical Field Potentials to Control a Switch." *Journal of Neural Engineering* 1 (2004): 72-77.

Kennedy PR, Andreasen DS, King B, Kirby MT, Mao H, Moore MM, Ehirim P. "Correlations between human motor cortical local field potentials, action potentials, contralateral arm EMG activity and digit movements." Submitted to *Journal of Neural Engineering* (2005).

Vargas-Irwin CE\*, Feldman JM\*, King B\*, Simeral JD, Sorice BL, Oakley EM, Cash SS, Eskandar EN, Friehs GM, Hochberg LR, Donoghue JP. "Watch, Imagine, Attempt: Motor Cortex Single-Unit Activity Reveals Context-Dependent Movement Encoding in Humans With Tetraplegia." *Frontiers in Human Neuroscience* 12 (2018): 1-13.

\* **Equal contribution**

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## Conference Posters and Presentations

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- Kennedy PR, Moore MM, King B. Directionality coding in human cortical area 4: role of phase relationships of individual action potentials. Program No. 590.10. 2000 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2000. Online.
- Kennedy PR, King B, Kirby MT, Moore MM, Blankowski M. Motor cortical control of a Cyber digit by a patient implanted with the Neurotrophic Electrode. Program No. 63.5. 2001 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2001. Online.
- Kennedy PR, Kirby MT, Adams K, Mallory A, King B. (2001). The role of tactile feedback in the control of cortical neural signals two years after implantation in patient TT with mitochondrial myopathy. In Thirty Second Annual Neural Prosthesis Workshop (October 17, 2001). Bethesda, MD: NINDS, NIH.
- Kennedy PR, King B, Kirby MT, Adams K. Directionality may be inherent in Local Field Potentials (LFPs) recorded via the Neurotrophic Electrode in human cortex. Program No. 357.15. 2002 Neuroscience Meeting Planner. Orlando, FL: Society for Neuroscience, 2002. Online.
- King B, Truccolo W, Friehs GM, Stein J, Donoghue JP, Hochberg LR. Motor cortex local field potentials and multi-unit activity during intended movements in humans with tetraplegia. Program No. 517.15/VV1. 2007 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2007. Online.
- King B, Feldman JM, Hochberg LR, Donoghue JP. Verbal instructions to watch, imagine, or attempt movement differentially engage neurons in the motor cortex of humans with tetraplegia. Program No. 899.4/HHH45. 2010 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2010. Online.
- Feldman JM, King B, Truccolo W, Hochberg LR, Donoghue JP. Decoding neural representations of action from motor cortex ensembles during action observation in humans with tetraplegia. 2011 Neuroscience Meeting Planner (p. 142.14). Washington, DC: Society for Neuroscience, 2011. Online.
- Hochberg LR, Bacher D, Barefoot L, Berhanu E, Black MJ, Cash SS, King B, ..., Donoghue JP. Use of the BrainGate Neural Interface System for more than five years by a woman with tetraplegia. 2011 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience. 2011. Online.

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### Other Professional Experience

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**Pharmaceutical Representative**

Abbott Laboratories

2002 - 2006

Abbott Park, IL

- Liaised between medical professionals and company research division, providing medical information related to company products.
- Increased sales to 125% over quota annually.

- Developed Excel macros for physician data portability and analysis featuring novel, effective methods of identifying key prescribers. Distributed to coworkers on a multimedia CDROM which included medical information and scientific studies.

**Senior Editor**

DigitalTrends.com

2003 - 2009  
Sherwood, OR

- Reviewed cutting edge hardware from technology companies prior to being released to market.
- Designed, produced, engineered, and hosted weekly podcast.
- Addressed questions and comments concerning products and trends in technology through online forums.

**Community Liaison**

Mendeley Ltd.

2009  
London, UK

- Cofounded the Community Liaison Program, an early social media outreach program connecting the company with users and university libraries.
- Tested and compiled community feedback on social reference management service and desktop client application with cloud syncing.

**Founder/Blogger**

Direct Neural Interface Blog

2007 - 2010  
Providence, RI

- Launched and maintained blog on brain-computer interface topics, including human-computer interaction, augmented reality, statistical modeling, robotics, alternative interfaces (touch, pen, computer vision, etc.), and other related biotechnology topics.
- Maintained curated lists of recent publications used by many leading brain-computer interface research labs.

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**Professional Society Memberships**

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- Society for Neuroscience (SfN)
- Institute of Electrical and Electronics Engineers (IEEE)

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**Additional Training**

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Neurobotics Summer School  
Topic: Brain-Machine Interfaces2007  
Volterra, Italy

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## Skills

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- Programming languages: Matlab, LabView, C, Java, HTML, Pascal, BASIC.  
Familiar with: Python, R, XML, C++, SQL, Lisp, CSS, Lua, shell scripting, regex.
- Operating systems: Windows, MacOS, Linux, iOS, Android.
- Neural data acquisition: Blackrock Cerebus, Plexon, Datawave, Neuralynx.
- Interface technology: Neural data (spike, LFP, MUA, EEG, other field potentials), EMG, EOG, eye tracking, motion capture, assistive keyboards and devices, audio and video capture and mixing/sequencing, human interface devices, video game controllers, HTC Vive, Samsung GearVR.
- Scientific equipment: Oscilloscopes, amplifiers, DACs and A/D converters, signal generators, data recorders.
- Other: Consumer, prosumer, and enthusiast electronics and computer components. Office software (Microsoft, Libre), image/photo/video software (Adobe, GIMP), SmithMicro Poser (3D character animation, texturing, rendering), media transcoding.

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## Relevant Links

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- Resume (online): <https://xbkingx.github.io>
- Resume and CV (download): [http://bit.ly/BKing\\_Resume](http://bit.ly/BKing_Resume)
- LinkedIn profile: <https://www.linkedin.com/in/xbkingx>
- Direct Neural Interface Blog: <https://directneuralinterface.blogspot.com/>
- Mendeley profile: <https://www.mendeley.com/profiles/brandon-king/>
- BrainGate clinical trial IDE: <https://www.braingate.org/>
- Neural Signals, Inc.: <http://www.neuralsignals.com/>
- Digital Trends: <https://www.digitaltrends.com/>