

Curriculum Vitæ

Andrew H. Fagg

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Education

- Ph.D. in Computer Science from the *University of Southern California* (1996)
Dissertation: *A Computational Model of the Cortical Processes Involved in Primate Grasping*
Doctoral Committee: M. A. Arbib (chair), G. A. Bekey, S. T. Grafton.
- M.S. in Computer Science from the *University of Southern California* (1991)
- B.S. in Applied Mathematics, Computer Science Track (with honors) from *Carnegie Mellon University* (1989)

Research Interests

My research focuses on the relationships between biological systems and machines. In this area of *sybiotic computing*, I study the interaction of humans with machines, machines as models of biological systems, and biological systems as inspiration for new robot control and learning techniques. Specific areas of interest include:

- Motor skill learning in robots and models of primate skill learning. I specifically work in the areas of reaching, grasping, and manipulation.
- Interplay of multiple learning systems, including supervised- and reinforcement-style learning algorithms. I am interested in robot learning through human interaction.
- Learning task-oriented representations.
- Brain-machine interfaces for advanced prosthetic devices.
- Assistive robotics.
- Interactive art.

Positions

2008 - current	Associate Professor , Biomedical Engineering, University of Oklahoma.
2004 - current	Associate Professor , School of Computer Science, University of Oklahoma.
1998 - 2004	Research Scientist , Department of Computer Science, University of Massachusetts Amherst.
1996 - 1998	Senior Postdoctoral Research Associate , Autonomous Learning Laboratory, under Prof. Andrew
1992 - 1995	Research Assistant , Human Frontiers Science Project (HFSP), under Prof. Michael A. Arbib. Focu

Publications

Dissertation

A Computational Model of The Cortical Mechanisms Involved in Primate Grasping, Ph.D. Dissertation, Computer Science Department, University of Southern California, 1996

Journal Articles

- Vaidya, M., Balasubramanian, K., Southerland, J., Badreldin, I., Eleryan, A., Shattuck, K., Gururangan, S., Slutzky, Osborne, L., Fagg, A. H., Oweiss, K. and Hatsopoulos, N. G. (2017) *Emergent Coordination Underlying Learning to Reach-to-Grasp with a Brain-Machine Interface*, Journal of Neurophysiology, electronically published, PMID:29357477, DOI: 10.1152/jn.00982.2016
- Balasubramanian, K., Vaidya, M., Southerland, J., Badreldin, I., Eleryan, A., Takahashi, K., Qian, K., Slutzky, M. W., Fagg, A. H., Oweiss, K. and Hatsopoulos, N. G. (2017) *Changes in Cortical Network Connectivity with Long-term Brain-Machine Interface Exposure after Chronic Amputation*, Nature Communications, **8 (1796)**, DOI: 10.1038/s41467-017-01909-2
- Xiao, R., Qi, X., Patino, A., Fagg, A. H., Kolobe, T. H.-A., Miller, D. P. and Ding, L. (2016) *Characterization of Infant Mu Rhythm Immediately before Crawling: A High-Resolution EEG Study*, NeuroImage, **146**:47–57, PMID: 27847348, DOI: 10.1016/j.neuroimage.2016.11.007
- Dodd, O. T., Houck, K. C., Palmer, T. J., Sloan, A. M., Kilgard, M. P., Miller D. P., Fagg, A. H., and Rennaker, R. L. (in revision) *Neural correlates of frequency discrimination in behaving rats.*
- Eleryan, A., Vaidya, M., Southerland, J., Badreldin, I., Balasubramanian, K., Fagg, A. H., Hatsopoulos, N. G. and Oweiss, K. (2014) *Tracking Single Units in Chronic, Large scale, Neural Recordings for Brain Machine Interface Applications*, Frontiers in Neuroengineering, **7(23)**, PMCID: PMC4086297
- Shah, A., Barto, A. G., Fagg, A. H. (2013) *A Dual Process Account of Coarticulation in Motor Skill Acquisition*, Journal of Motor Behavior, **45(6)**:531–549 doi: 10.1080/00222895.2013.837423, PMID: 24116847
- Willett, F. R., Suminski, A. J., Fagg, A. H. and Hatsopoulos, N. G. (2013) *Improving Brain-Machine Interface Performance by Decoding Intended Future Movements*, Journal of Neural Engineering, **10(2)**:206011, April. PMCID: PMC4019387
- Suminski, A. J., Tkach, D. C., Fagg, A. H., and Hatsopoulos, N. G. (2010) *Incorporating Feedback from Multiple Sensory Modalities Enhances Brain-Machine Interface Control*, Journal of Neuroscience, **30(50)**:16777-16787, December, PMCID: PMC3046069
- Platt, R., Fagg, A. H., and Grunen, R. A. (2010) *Null Space Grasp Control: Theory and Experiments*, IEEE Transactions on Robotics, **26(2)**:282–295, April

10. Fagg, A. H., Ojakangas, G., Miller, L., Hatsopoulos, N. (2009) *Kinetic Trajectory Decoding Using Motor Cortical Ensembles*, IEEE Transactions on Neural Systems and Rehabilitation Engineering, **17(5)**:487–496, PMID:19666343, doi: 10.1109/TNSRE.2009.2039398
11. Ou, S., Fagg, A. H., Shenoy, P., Chen, L. (2009) *Application of Reinforcement Learning in Multisensor Fusion Problems with Conflicting Control Objectives*, Intelligent Automation and Soft Computing, **15(2)**:277–289
12. Fagg, A. H., Hatsopoulos, N. G., de Lafuente, V., Moxon, K. A., Nemati, S., Rebesco, J. M., Romo, R., Solla, S. A., Reimer, J., Tkach, D., Pohlmeier, E. A., and Miller L. E. (2007) *Biomimetic brain machine interfaces for the control of movement*, Journal of Neuroscience, **27(44)**:11842–11846, PMID: 17978021
13. Morales, A., Sanz, P. J., del Pobil, A. P., and Fagg, A. H. (2006) *Vision-based three-finger grasp synthesis constrained by hand geometry* Robotics and Autonomous Systems, **54(6)**:419–512
14. Brock, O., Fagg, A. H., Grupen, R. A., Karuppiah, D., Platt, R., Rosenstein, M., (2005), *A Framework For Humanoid Control and Intelligence*, International Journal of Humanoid Robotics, **2(3)**:301–336
15. Morales, A., Chinellato, E., Fagg, A. H., del Pobil, A. P. (2004) *Using Experience for Assessing Grasp Reliability*, International Journal of Humanoid Robotics, **1(4)**:671-691
16. Shah, A., Fagg, A. H., Barto, A. G. (2004) *Cortical Involvement in the Recruitment of Wrist Muscles*, Journal of Neurophysiology, **91**:2445 - 2456. PMID: 14749314
17. Fagg, A. H., Shah, A., Barto, A. G. (2002) *A Computational Model of Muscle Recruitment for Wrist Movements*, Journal of Neurophysiology, **88(6)**:3348-3358, PMID: 12466451
18. Marcos, L., Oliveira, A. F., Grupen, R. A., Wheeler, D. S., and Fagg, A. H. (2000), *Tracing Patterns and Attention: Humanoid Robot Cognition* IEEE Intelligent Systems **15 (4)**:70–75, July/August
19. Barto, A. G., Fagg, A. H., Sitkoff, N., Houk, J. C. (1999) *A Cerebellar Model of Timing and Prediction in the Control of Reaching*, Neural Computation **11**:565–594, PMID: 10085421
20. Fagg, A. H., Arbib, M. A. (1998) *Modeling Parietal-Premotor Interactions in Primate Control of Grasping*, Neural Networks **11(7/8)**:1277–1303
21. Grafton, S. T., Fagg, A. H., Arbib, M. A. (1998) *Dorsal Premotor Cortex and Conditional Movement Selection: A PET Functional Mapping Study*, Journal of Neurophysiology, **79(2)**:1092–1097
22. Grafton, S. T., Fagg, A. H., Arbib, M. A., Woods, R. (1996) *Functional Anatomy of Pointing and Grasping in Humans*, Cerebral Cortex, **6(2)**:226–237
23. Arbib, M. A., Bischoff, A., Fagg, A. H., Grafton, S. T. (1995) *Synthetic PET: Analyzing Large-Scale Properties of Neural Networks*, Human Brain Mapping, **2**:225–233
24. Montgomery, J. F., Fagg, A. H., Bekey, G. A. (1995) *The USC AFV-I: A Behavior-Based Entry in the 1994 International Aerial Robotics Competition*, IEEE Expert: Intelligent Systems and Their Applications, **10 (2)**:16–22, April
25. Fagg, A. H., Arbib, M. A. (1992) *A Model of Primate Visual/Motor Conditional Learning*, Journal of Adaptive Behavior, Summer, **1(1)**:3–37

Art Exhibitions

1. Brown, A., Fagg, A. H. (2010), *Bion*, **Consciencia Cibêrnética** [?], in São Paulo, Brazil, invited exhibition, June 8 – August 6
2. Brown, A., Fagg, A. H. (2017), *Bion*, **Emoção Art.ficial 5.0: Autonomia Cibernética**, in São Paulo, Brazil, invited exhibition, July 1 – September 15
3. Brown, A., Fagg, A. H. (2010), *Bion*, **Kresege Art Museum**, Michigan State University, September 15 – October 10
4. Brown, A., Fagg, A. H. (2007–2010), *Bion*, **Stephenson Research and Technology Center, University of Oklahoma**, Norman, OK, May 1, 2007 – January 15, 2010
5. Brown, A., Fagg, A. H. (2007), *Bion*, **Singularity in the Communal Tide**, **Pierro Gallery**, South Orange, NJ, May 13–July 15
6. Archinal, A., Bleckley, S., Courtney, C., Cunningham, P., Gay J., Goddard, B., Gomez, J., Hunt, T. Renyer, J., Roman, M., Brown, A., Fagg, A. H. (2007), *PulsePool*, **Boston Cyber-Arts Festival, Boston Museum of Science**, Boston, MA, April 21–29; co-supervisor of this student project
7. Brown, A., Fagg, A. H. (2006), *Bion*, **Bridge Art Fair**, Curated by: Rupert Ravens Contemporary, Miami, Florida, December
8. Brown, A., Fagg, A. H. (2006–2007), *Bion*, **Engaging Technology: A History & Future of Intermedia**, Ball State University, November 16 – March 11
9. Brown, A., Fagg, A. H. (2006), *Bion*, **Newark Between Us**, Newark, NJ, October 22–December 17
10. Brown, A., Fagg, A. H. (2006), *Bion*, **Living Arts of Tulsa**, Tulsa, OK, September 7–28
11. Brown, A., Fagg, A. H. (2006), *Bion*, **33rd International Conference and Exhibition on Computer Graphics and Interactive Techniques**, Boston, MA, July 30–August 3
12. Brown, A., Fagg, A. H. (2006), *Bion*, **iDEAs Exhibition at the International Digital Media and Arts Association Conference**, Miami University, Oxford, OH, April 6–8
13. Brown, A., Fagg, A. H. (2006), *Bion*, **Archival to Contemporary: Six Decades of the Sculptors Guild**, Hillwood Art Museum, Long Island University, Brookville, NY, January 30–May 15

Refereed Conference and Workshop Publications

1. Ghazi, M. A., Ding, L., Fagg, A. H., Kolobe, T. H.-A., Miller, D. P. (2017), *Vision-Based Motion Capture System for Tracking Crawling Motions of Infants.*, Proceedings of the 2017 IEEE International Conference on Mechatronics and Automation, Electronically Published
2. Patino, A., Fagg, A. H., Kolobe, T. H.-A., Miller, D. P. and Ding, L. (2017) *Dynamic Spatio-Spectral Patterns of Rhythmic EEG in Infants*, Proceedings of the 8th International IEEE/EMBS Conference on Neural Engineering (NER), Electronically Published
3. Xiao, R., Qi, X., Fagg, A. H., Kolobe, T. H.-A., Miller, D. P. and Ding, L. (2015) *Spectra of Infant EEG within the First Year of Life: A Pilot Study*, Proceedings of the 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS15), Electronically Published (ThFPoT14.7)

4. Ghazi, M., Nash, M., Fagg, A. H., Ding, L., Kolobe, T. H.-A. and Miller, D. P. (2015) *Novel Assistive Device for Teaching Crawling Skills to Infants*, Proceedings of the 10th Conference on Field and Service Robotics, Electronically Published (paper #58).
Physical publication: Ghazi, M., Nash, M., Fagg, A. H., Ding, L., Kolobe, T. H.-A. and Miller, D. (2016) *Novel Assistive Device for Teaching Crawling Skills to Infants*, Springer Tracts in Advanced Robotics (Bruno Siciliano and Oussama Khatib, Eds.), Volume 113, pp. 593-605. March 16. ISSN: 1610-7438
5. Willett, F., Suminski, A. J., Fagg, A. H. and Hatsopoulos, N. G. (2014), *Differences in Motor Cortical Representations of Movement Variables between Action Observation and Action Execution and Implications for Brain-Machine Interfaces*, Proceedings of the 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), WC11.29
6. Suminski, A. J., Fagg, A. H., Willett, F., Bodenhamer, M. and Hatsopoulos, N. G. (2013) *Online Adaptive Decoding of Intended Movements with a Hybrid Kinetic and Kinematic Brain Machine Interface*, Proceedings of the 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 1583–1586
7. Eleryan, A., Vaidya, M., Southerland, J., Badreldin, I., Balasubramanian, K., Fagg, A. H., Hatsopoulos, N. G. and Oweiss, K. (2013) *Tracking Chronically Recorded Single-Units in Cortically Controlled Brain Machine Interfaces*, Proceedings of the 6th International IEEE EMBS Conference on Neural Engineering (NER), pp. 427–430
8. Badreldin, I., Southerland, J., Vaidya, M., Eleryan, A., Balasubramanian, K., Fagg, A. H., Hatsopoulos, N. G. and Oweiss, K. (2013) *Unsupervised Decoder Initialization for Brain-Machine Interfaces Using Neural State Space Dynamics*, Proceedings of the 6th International IEEE EMBS Conference on Neural Engineering (NER), pp. 997–1000
9. Palmer, T. J., Bodenhamer, M. and Fagg, A. H. (2012) *Learning to Predict Action Outcomes in Continuous, Relational Environments*, Proceedings of the International Conference on Development and Learning (ICDL)
10. Willett, F. R., Suminski, A. J., Fagg, A. H. and Hatsopoulos, N. G. (2012), *Compensating for Delays in Brain-Machine Interfaces by Decoding Intended Future Movement*, Proceedings of the International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC–12), FrA15.1, August
11. Suminski, A. J., Willett, F. R., Fagg, A. H., Bodenhamer, M., and Hatsopoulos, N. G. (2011) *Continuous Decoding of Intended Movements with a Hybrid Kinetic and Kinematic Brain Machine Interface*, Proceedings of the International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC–11), August
12. Hatsopoulos, N. G., Suminski, A. J., and Fagg, A. H. (2011) *Using Naturalistic Kinesthetic Feedback for Brain Machine Control*, Proceedings of the International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC–11), August
13. Bodenhamer, M., Bleckley, S., Fennelly, D., Fagg, A. H., and McGovern, A. (2009) *Spatio-Temporal Multi-Dimensional Relational Framework Trees*, In the Proceedings of the International Workshop on Spatial and Spatiotemporal Data Mining, IEEE Conference on Data Mining, Miami, FL, Electronically Published
14. Palmer, T. J. and Fagg, A. H. (2009) *Learning Grasp Affordances with Variable Centroid Offsets*, Proceedings of the International Conference on Intelligent Robots and Systems, MoIIT7.1, St. Louis, MO

15. Fagg, A. H., Hatsopoulos, N. G., London, B., Reimber, J., Solla, S., Wang, D., Miller, L. E. (2009) *Toward a Biomimetic, Bidirectional, Brain Machine Interface*, Proceedings of the 31st Annual International IEEE EMBS Conference, Minneapolis, MI, Electronically Published
16. Miller, L. E., Fagg, A. H., Hatsopoulos, N., Mussa-Ivaldi, F. A., Solla, S. (2009) *Bidirectional Brain-Machine Interfaces: Sensory Fusion and Adaptive Maps* (Workshop), Proceedings of the Spring Meeting on the Neural Control of Movement, electronically published
17. Fagg, A. H., Hatsopoulos, N. G., Miller, L. E., (2007) *M1 and the Dynamic Limb: Decoding Joint Torque for Prediction and Control*, component of the *Biomimetic Brain Machine Interfaces for the Control of Limb Movement* Mini-symposium (Chair, L. E. Miller) at the Annual Meeting for the Society of Neuroscience, Presentation #650.2.
18. Wang, D., Watson, B. T., Fagg, A. H. (2007) *A Switching Control Approach to Haptic Exploration for Quality Grasps*, Proceedings of the Robotics: Science & Systems 2007 Workshop on Sensing and Adapting to the Real World, Electronically Published
19. Nemati, S., Yeary, M., Yu, T.-Y., Wang, Y., Zhai, Y. and Fagg, A. H., (2007) *Spectral Signature Classification Using A Support Vector Classifier*, Proceedings of the IEEE Instrumentation and Measurement Technology Conference, Warsaw, May
20. Brown, A., Fagg, A. H. (2006), *Is it alive? Sensor Networks and Art*, (artist sketch) Proceedings of the 33rd International Conference and Exhibition on Computer Graphics and Interactive Techniques
21. Platt, Jr., R., Grupen, R. A., Fagg, A. H. (2006), *Learning Grasp Context Distinctions that Generalize*, Proceedings of the IEEE-RAS International Conference on Humanoid Robots, Electronically Published
22. de Granville, C., Southerland, J., Fagg, A. H. (2006), *Learning Grasp Affordances Through Human Demonstration*, Proceedings of the International Conference on Development and Learning (ICDL'06), Electronically Published
23. Platt, Jr., R., Grupen, R. A., Fagg, A. H. (2006), *Improving Grasp Skills Using Schema Structured Learning*, Proceedings of the International Conference on Development and Learning (ICDL'06), Electronically Published
24. Brown, A., Fagg, A. H. (2006), *Is it alive? Sensor Networks and Art*, Proceedings of the International Digital Media and Arts Association Conference, Miami University, Oxford, OH
25. Platt, Jr., R., Fagg, A. H., Grupen, R. A. (2005), *Re-Using Schematic Grasping Policies*, Proceedings of the IEEE-RAS International Conference on Humanoid Robots, Electronically Published
26. Rosenstein, M. T., Fagg, A. H., Ou, S., Grupen, R. A. (2005) *User Intentions Funneled Through A Human-Robot Interface*, Proceedings of the 10th International Conference on Intelligent User Interfaces, pp. 257–259
27. Platt, Jr., R., Fagg, A. H., Grupen, R. A. (2004), *Manipulation Gaits: Sequences of Grasp Control Tasks*, Proceedings of the IEEE International Conference on Robotics and Automation (ICRA'04), pp. 801–806
28. Rosenstein, M. T., Fagg, A. H., and Grupen, R. A. (2004), *Robot Learning with Predictions of Operator Intent*, In the Proceedings of the 2004 AAAI Fall Symposium on the Intersection of Cognitive Science and Robotics: From Interfaces to Intelligence, pp. 107–8. AAAI Press, Menlo Park, CA
29. Morales, A., Chinellato, E., Fagg, A. H., del Pobil, A.P. (2004), *An active learning approach for assessing robot grasp reliability*, In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2004), Sendai, Japan, September, Electronically Published.

30. Morales, A. , Chinellato, E., Sanz, P. J., Fagg, A. H., del Pobil, A. P. (2004), *Vision based planar grasp synthesis and reliability assessment for a multifinger robot hand: a learning approach*, In the International Conference on Intelligent Manipulation and Grasping (IMG04), Genoa, Italy, Electronically Published.
31. Morales, A., Chinellato, E., Sanz, P. J., Fagg, A. H., del Pobil, A.P. (2004), *Learning to predict grasp reliability with a multifinger robot hand by using visual features*, In IASTED International Conference on Artificial Intelligence and Soft Computing, Marbella, Spain, September
32. Bluethmann, W., Ambrose, R., Diftler, M., Huber, E., Fagg, A. H., Rosenstein, M., Platt, R., Grupen, R., Breazeal, C., Brooks, A., Lockerd, A., Peters, R. A., Jenkins, O. C., Mataric, M., Bugajska, M. (2004) *Building an Autonomous Humanoid Tool User*, Proceedings of the IEEE-RAS International Conference on Humanoid Robots, Electronically Published
33. Platt, R., Brock, O., Fagg, A. H., Karuppiah, D., Rosenstein, M., Coelho, J., Huber, M., Piater, J., Wheeler, D., and Grupen, R. A. (2003), *A Framework For Humanoid Control and Intelligence*, Proceedings of the IEEE-RAS International Conference on Humanoid Robots, Electronically Published
34. Morales, A., Chinellato, E., Fagg, A. H., del Pobil, A. P. (2003), *Using Experience for Assessing Grasp Reliability*, Proceedings of the IEEE-RAS International Conference on Humanoid Robots, Electronically Published
35. Morales, A., Chinellato, E., Fagg, A. H., del Pobil, A. P. (2003), *Experimental Prediction of the Performance of Grasp Tasks from Visual Features*, Proceedings of International Conference on Intelligent Robots and Systems (IROS'03), Electronically Published
36. Platt, Jr., R., Fagg, A. H., Grupen, R. A. (2003), *Extending Fingertip Grasping to Whole Body Grasping*, Proceedings of International Conference on Robotics and Automation (ICRA'03), pp. 2677–2682
37. Platt, Jr., R., Fagg, A. H., Grupen, R. A. (2002), *Nullspace Composition of Control Laws for Grasping*, Proceedings of the International Conference on Intelligent Robots and Systems (IROS'02), Electronically Published
38. Wang, Y., Thibodeau, B., Fagg, A. H., Grupen, R. A. (2002), *Learning Optimal Switching Policies for Path Tracking Tasks on a Mobile Robot*, Proceedings of the International Conference on Intelligent Robots and Systems (IROS'02), Electronically Published
39. Morales, A., Sanz, P. J., del Pobil, A. P., Fagg, A. H. (2002), *An Experiment in Constraining Vision-Based Finger Contact Selection with Gripper Geometry*, Proceedings of the International Conference on Intelligent Robots and Systems (IROS'02), Electronically Published
40. Wheeler, D. S., Fagg, A. H., Grupen, R. A. (2002), *Learning Prospective Pick and Place Behavior*, Proceedings of the International Conference on Development and Learning (ICDL'02), Electronically Published
41. Amstutz, P. and Fagg, A. H. (2002), *Real Time Visualization of Robot State with Mobile Virtual Reality*, Proceedings of the International Conference on Robotics and Automation (ICRA'02), pp. 241–247
42. Davis, J. A., Fagg, A. H., Levine, B. N. (2001), *Wearable Computers as Packet Transport Mechanisms in Highly-Partitioned Ad-Hoc Networks*, Proceedings of the International Symposium on Wearable Computing, Zurich, Switzerland, October 2001, pp. 141–148
43. Fagg, A. H., Barto, A. G., Houk, J. C. (1998) *Learning to Reach Via Corrective Movements*, Proceedings of the Tenth Yale Workshop on Adaptive and Learning Systems, New Haven, CT, June 10-12, pp. 179-185

44. Fagg, A. H., Sitkoff, N., Barto, A. G., Houk, J. C. (1997) *Cerebellar Learning for Control of a Two-Link Arm in Muscle Space*, Proceedings of the IEEE Conference on Robotics and Automation, May, pp. 2638-2644
45. Fagg, A. H., Sitkoff, N., Barto, A. G., Houk, J. C. (1997) *A Model of Cerebellar Learning for Control of Arm Movements Using Muscle Synergies*, Proceedings of the IEEE International Symposium on Computational Intelligence in Robotics and Automation, July 10-11, pp. 6-12
46. McGovern, A., Sutton, R. S., Fagg, A. H. (1997) *Roles of Macro-Actions in Accelerating Reinforcement Learning*, Grace Hopper Celebration of Women in Computing, pp. 13-18
47. Fagg, A. H., Lotspeich, D. L., Hoff, J. Bekey, G. A. (1994) *Rapid Reinforcement Learning for Reactive Control Policy Design for Autonomous Robots*, Proceedings of the World Congress on Neural Networks, June, pp. II 118-26, San Diego, California
48. Fagg, A. H., Lotspeich, D. L., Bekey, G. A. (1994) *Reinforcement-Learning Approach to Reactive Control Policy Design for Autonomous Robots*, Proceedings of the IEEE Conference on Robotics and Automation, May, pp. 39-44, San Diego, California
49. Fagg, A. H., Lewis, M. A., Montgomery, J. F., Bekey, G. A. (1993) *The USC Autonomous Flying Vehicle: an Experiment in Real-Time Behavior-Based Control*, Proceedings of the IEEE Conference on Intelligent Robots and Systems, July, pp. 1173-1180, Yokohama, Japan
50. Fagg, A. H., Fiser, J. (1993) *Low Level Modeling of the Development of Directionally Selective Microcircuits in Cat Striate Cortex*, IEEE Conference on Neural Networks, March, pp. 772-777, San Francisco, California
51. Fagg, A. H., King, I. K., Lewis, M. A., Liaw, J.-S., Weitzenfeld, A. (1992) *A Neural Network Based Testbed for Modeling Sensorimotor Integration in Robotic Applications*, Proceedings of the International Joint Conference on Neural Networks, June, pp. I 86-91, Baltimore
52. Lewis, M. A., Fagg, A. H., Solidum, A., Bekey, G. A. (1992) *Genetic Programming Approach to the Construction of a Neural Network for Control of a Walking Robot*, Proceedings of the IEEE Conference on Robotics and Automation, May, pp. 2618-2623, Nice, France
53. Fagg, A. H., Lewis, M. A., Iberall, T., Bekey, G. (1991) *R²AD : Rapid Robotics Application Development Environment*, Proceedings of the IEEE Conference on Robotics and Automation, April, pp. 1420-1426, Sacramento, California
54. Taber, W. R., Deich, R., Simpson, P., Fagg, A. H. (1988) *The Recognition of Orca Calls with a Neural Network*, Proceedings of the Japan Conference on Fuzzy Logic

Book Chapters

1. de Granville, C., Wang, D., Southerland, J., Platt, Jr. R., and Fagg, A. H. (2009), *Grasping Affordances: Learning to Connect Vision to Hand Action*, "The Path to Autonomous Robots; Essays in Honor of George A. Bekey" (Gaurav S. Sukhatme, Ed.), Springer, pp. 59-80
2. Arbib, M. A., Fagg, A. H., and Grafton, S. T. (2002), *Synthetic PET Imaging for Grasping: From Primate Neurophysiology to Human Behavior*, in *Explorative analysis and data modelling in functional neuroimaging*, (F. Sommer and A. Wichert, Eds.), Cambridge MA: The MIT Press, pp. 231-250
3. Houk, J. C., Fagg, A. H., Barto, A. G. (2002), *Fractional Power Damping Model of Joint Motion*, Progress in Motor Control: Structure-Function Relations in Voluntary Movements (M. Latash, Ed.), Vol. II, pp. 147-178

4. Fagg, A. H., Weitzenfeld, A. (2002) *A Model of Primate Visual-Motor Conditional Learning*, NSL – Neural Simulation Language: Systems and Applications (A. Weitzenfeld, M. A. Arbib, and A. Alexander, Eds.), MIT Press
5. Fagg, A. H., Lotspeich, D. L., Hoff, J. Bekey, G. A. (1998) *Rapid Reinforcement Learning for Reactive Control Policy Design for Autonomous Robots*, in Artificial Life in Robotics (T. Shibata and T. Fukuda, Eds.)
6. Iberall, T., Fagg, A. H. (1996) *Neural Network Models for Selecting Hand Shapes*, in Hand and Brain: The Neurophysiology and Psychology of Hand Movements (A. M. Wing, P. Haggard, J. R. Flanagan Eds.), pp. 243-264, Academic Press, San Diego, CA
7. Lewis, M. A., Fagg, A. H., Bekey, G. A. (1994) *Genetic Algorithms for Gait Synthesis in a Hexapod Robot*, Chapter 11 of Recent Trends in Mobile Robots (Y. Zheng Ed.), pp. 317-331, World Scientific Press
8. Fagg, A. H. (1993) *Reinforcement Learning for Robotic Reaching and Grasping*, Chapter 14 of New Perspectives in the Control of the Reach to Grasp Movement (K. M. B. Bennett and U. Castiello, Eds.), pp. 281-308, North Holland Press
9. Fagg, A. H. (1991) *Developmental Robotics : A New Approach to the Specification of Robot Programs*, Chapter 26 of Neural Networks in Robotics (G. A. Bekey and K. Y. Goldberg, Eds.), pp. 459-486, Kluwer Academic Publishers

Abstracts and Non-Refereed Conference Papers

1. Kolobe, T. H.-A., Patino, A. Ding, L., Fagg, A. H., Miller, D. P. (2018) *Electroencephalography and Infant motor proficiency during development of Prone Locomotion*, Appears in the American Physical Therapy Association Combined Sections Meeting, New Orleans, LA, February 21-24, #2803944
2. Twum-Ampofo, N., Porter, A., Johnson, L., Fagg, A. H., Kolobe, T. H.-A. (2018) *Movement Proficiency and Center of Pressure in Infants with and without CP during Development of Prone Progression*, Appears in the American Physical Therapy Association Combined Sections Meeting, New Orleans, LA, February 21-24, #2803881
3. Kolobe T. H.-A. and Fagg, A. H. (2017) *Robotic Reinforcement and Error-based Movement Learning during Skill Acquisition in Infants with and without risk for Cerebral Palsy*, Developmental Medicine and Child Neurology, 59:76. doi:10.1111/dmcn.116.13511
4. Twum-Ampofo, N. S., Kolobe, T. H.-A., Porter, A., Rauh-Johnson, L. and Fagg, A. H. (2017) *Postural Control And Movement Proficiency In Infants With And Without Cerebral Palsy Using The Self Initiated Prone Progression Crawler-2*, Appears in the American Physical Therapy Association Combined Sections Meeting, 29(1), San Antonio, TX, February 15-18, doi: 10.1097/PEP.000000000000035
5. Miller D., Fagg, A. H., Ding, L., Kolobe, H.-A. and Ghazi, M. (2015) *Robotic Crawling Assistance for Infants with Cerebral Palsy*, Proceedings of the AAAI Workshop on Assistive Technologies Emerging from Artificial Intelligence Applied to Smart Environments, January
6. Kolobe T. H.-A., Fagg, A. H., Pidcoe, P., Williams, P. (2015) *Effectiveness of Reward- and Error-Based Movement Learning in Enhancing Self-Initiated Prone Locomotion in Infants with or at Risk for Cerebral Palsy*. Proceedings of the The World Confederation of Physical Therapy Congress. Abstract A-613-0000-03707. Singapore. May. **Selected as a State of the Art Presentation and awarded the Outstanding Platform Presentation Award.**

7. Kolobe T. H.-A., Fagg, A. H., Pidcoe, P., Brown, D., Bulanda, M. and Rauh, L. (2015) *Development of prone locomotion in infants with or at risk for cerebral palsy*. Appears in the Combined Section Meeting Conference of the American Physical Therapy Association, Indianapolis, February.
8. Cox P. J., Kolobe T. H.-A., Fagg A. H. and Schmiedeberg T. (2015) *Prone Locomotion in Infants With Down syndrome using the SIPPC: A Pilot Study*. Appears in the Combined Section Meeting Conference of the American Physical Therapy Association, Indianapolis, February.
9. Kolobe, T. H.-A. and Fagg, A. H. (2014) *The effect of sensor robotic technology on the development of prone mobility in infants with or at risk for cerebral palsy*. Journal of Developmental Medicine & Child Neurology (Special Issue: Abstracts of the American Academy for Cerebral Palsy and Developmental Medicine 68th Annual Meeting), **56(5):99**
10. Kolobe T. H.-A., Fagg A. H. and Ng, Y (2014). *Comparison of the effect of robotic reinforced movement learning technology on the development of prone locomotion in infants with and without risk for cerebral palsy*. Appears in the Annual Meeting of the Child Neurology Society, Columbus OH, October.
11. Kolobe, T. H.-A., Fagg, A. H., Pidcoe, P. and Miller D. (2014) *The effect of robotic reinforced movement learning technology on the development of prone mobility in infants at low and high risk for cerebral palsy*. Appears in the Annual Meeting for the Society of Neuroscience, Washington DC, November.
12. Suminski, A. J., Fagg, A. H., Willett, F., Bodenhamer, M. and Hatsopoulos, N. G. (2013), *Hybrid On-line Adaptive Decoding of Intended Movements using a Feedback Error Learning Approach*, Proceedings of the Society for Neuroscience Annual Meeting, 835.13/PP22
13. Kolobe, T. H. A., Fagg A. H., Pidcoe P., Miller D. and Southerland J. (2013) *Kinetic-Kinematic Patterns in Acquisition of Prone-Locomotion in Infants with/out Cerebral Palsy*, Proceedings of the Fourth International Conference on Cerebral Palsy, Pisa, Italy, October 10–13, OP72
14. Badreldin, I., Balasubramanian, K., Vaidya, M., Southerland, J., Fagg, A. H., Hatsopoulos, N. G. and Oweiss, K. (2013) *Evaluation of Single Unit Error Contribution to Neural State Space Dynamics in Linear BMI Decoders*, Proceedings of Computational and Systems Neuroscience (Cosyne), II-31
15. Bodenhamer, M., Willett, F. R., Suminski, A. J., Hatsopoulos, N. G. and Fagg, A. H. (2012), *A Feedback Error Learning Approach to Online-Adaptive Decoding for Dynamic Prosthetic Arm Control*, Proceedings of Computational and Systems Neuroscience (Cosyne), I-38
16. Willett, F. R., Fagg, A. H., Suminski, A. J. and Hatsopoulos, N. G. (2012), *Improving neural control of a simulated arm by decoding intended future movement*, Proceedings of Computational and Systems Neuroscience (Cosyne), III-39
17. Catalino, T., Kolobe, T., McEwen, I., and Fagg, A. H. (2012). *Development of Prone Locomotion in Infants Using an Assistive Device*, Proceedings of the Combined Sections Meeting Conference of the American Association of Physical Therapy
18. Sloan, A. M, Dodd, O. T., Houck, K., Palmer, T. J., Fagg, A. H. and Rennaker, R. L. (2011), *Multi-Unit Responses in Behaving Rat Auditory Cortex Predict Frequency Discrimination Behavior*, Society for Neuroscience Annual Meeting, 173.24, November
19. Goossaert, E. and Fagg, A. H. (2009), *A Corrective Movement Approach to Online Adaptive Decoders* (poster), Proceedings of the Spring Meeting on the Neural Control of Movement, electronically published
20. Hatsopoulos, N. G., Suminksi, A., Tkach, D. and Fagg, A. H. (2009) *Augmenting Brain-Machine Interfaces with Proprioceptive Feedback* (poster), Proceedings of the Spring Meeting on the Neural Control of Movement, electronically published

21. Tingle, D.T., Fagg, A.H., Rennaker, R.L. and Zee, M.C. (2008) *Decoding Odor from the Piriform Cortex Using a Free-Paced Classifier*, Society for Neuroscience Annual Meeting, student poster session
22. Nemati, S. Fagg, A. H., Hatsopoulos, N., Miller, L. (2007) *A Comparison of Linear and Kalman Filter Models for Arm Motion Prediction*, Proceedings of the Spring Meeting on the Neural Control of Movement, Electronically Published
23. Brown, A., Fagg, A. H. (2006), *The Bion Sensor Network*, Invited talk at Upgrade! International, November 30 – December 3
24. Shah, A., Barto, A. G., Fagg, A. H. (2006) *Biologically-Based Functional Mechanisms of Coarticulation*, Proceedings of the Spring Meeting on the Neural Control of Movement, Electronically Published
25. Goldberg, D., Fagg, A. H., Hatsopoulos, N., Ojakangas, G., Miller, L. (2006) *A Kernel-Based Approach to Predicting Arm Motion from MI Activity*, Proceedings of the Spring Meeting on the Neural Control of Movement, Electronically Published
26. Fagg, A. H., Grupen, R. A., Rosenstein, M., and Sweeney, J. (2005), *Intent Recognition as a Basis for Imitation Learning in Humanoid Robots*, New England Manipulation Symposium, Electronically Published
27. Fagg, A. H., Rosenstein, M. T., Platt, Jr., R., Grupen, R. A. (2004), *Extracting User Intent in Mixed Initiative Teleoperator Control*, Proceedings of the American Institute of Aeronautics and Astronautics Intelligent Systems Technical Conference, 2004-6309
28. Ou, S., Karuppiah, D. R., Fagg, A. H. and Riseman, E. (2004), *An Augmented Virtual Reality Interface for Assistive Monitoring of Smart Spaces*, Proceedings of the IEEE International Conference on Pervasive Computing and Communications, p. 33.
29. Fagg, A. H., Ou, S., Hedges, T. R., Brewer, M., Piantedosi M., Amstutz P., Hanson, A., Zhu, Z., Grupen, R., and Riseman, E. (2002), *Human-Robot Interaction Through a Distributed Virtual Environment*, Proceedings of the Workshop on Intelligent Virtual Environments and Human Augmentation (WIHAVE), Chapel Hill, NC, October 17–19.
30. Shah, A., Fagg, A. H., and Barto, A. G. (2002) *A Model of Wrist Movement Representation in Primary Motor Cortex*, Proceedings of the Spring Meeting on the Neural Control of Movement, Naples, FL, Electronically Published
31. Shah, A., Fagg, A. H., and Barto, A. G. (2001), *A Computational Model of Muscle Recruitment for Wrist Movements*, Proceedings of the Spring Meeting on the Neural Control of Movement, Sevilla, Spain, Electronically Published
32. Fagg, A. H., Alamed, B., and Warwick, J. (2001), *A Mobile Interactive Tour Guide: An Experiment in Wearable Computing*, Five College Multimedia Fair, February 28
33. Fagg, A. H., Shah, A., Barto, A. G. (2000) *A Model of Wrist Movement Representation in Muscle and Primary Motor Cortex* presented at the USC Symposium on Computational and Cognitive Neuroscience, Aug. 11-12, Los Angeles, CA
34. Fagg, A. H., Zelevinsky, L., Barto, A. G., Houk, J. C. (1998) *A Pulse-Step Model of Control for Arm Reaching Movements*, Proceedings of the Spring Meeting on the Neural Control of Movement
35. Fagg, A. H., Sitkoff, N., Barto, A. G., Houk, J. C. (1997) *A Computational Model of Cerebellar Learning for Limb Control*, Proceedings of the Spring Meeting on the Neural Control of Movement
36. Lewis, M. A., Fagg, A. H., Bekey, G. A. (1994) *Evolution of Complex Behaviors in Robotic Systems* SPIE's Robotics and Machine Perception Newsletter, March, **3(1)**, pp. 1–6

37. Fagg, A. H. (1993) *Reinforcement Learning for Robotic Reaching and Grasping*, Proceedings of the 1993 USC Workshop on Neural Architectures and Distributed AI: from Schema Assemblages to Neural Networks, Oct. 19-20, Los Angeles, California
38. Fagg, A. H., Tillery, S. I. H., Terzuolo, C. A. (1992) *Motion Velocity Profiles Influence the Perception of Hand Trajectories in the Absence of Vision*, Proceedings of the 22nd Meeting of the Society for Neuroscience, October, p. 647.9, Anaheim, California

Workshop and Tutorial Presentations

1. Platt, Jr., R., Fagg, A. H., Grupen, R. A. (2004), *Learning Dexterous Manipulation Skills Using the Control Basis* AAAI Fall Symposium on Real-life Reinforcement-Learning, Oct. 22-24
2. del Pobil, A. P., Fagg, A. H. (2000) *Robotics and Neuroscience*, Tutorial presented at Intelligent Robots and Systems (IROS), Oct. 31, Takamatsu, Japan
3. Fagg, A. H., Barto, A. G., Houk, J. C. (1998) *Learning to Reach Using Crude Corrective Feedback* presented at the NIPS workshop on *Movement Primitives: Building Blocks for Learning Motor Control*, Dec. 4, Breckenridge, CO
4. Fagg, A. H., Zelevinsky, L., Barto, A. G., Houk, J. C. (1997) *Using Crude Corrective Movements to Learn Accurate Motor Programs for Reaching*, presented at the NIPS workshop on *Can Artificial Cerebellar Models Compete to Control Robots*, Dec. 5, Breckenridge, CO

Invited Talks

1. Fagg, A. H. (2014), *A Robotic Crawling Assistant for Children at Risk for Cerebral Palsy*, Intelligent Robots and Systems (IROS) Workshop on Assistive Robotics for Individuals with Disabilities: HRI Issues and Beyond, Chicago, September 14.
2. Fagg, A. H. (2013), *Learning Grasp-Oriented Visual Representations through Interaction* Arizona State University, February 15
3. Fagg, A. H. (2007), *A Structured Approach for Control and Learning of Humanoid Reaching and Grasping Skills* Drury University. November 16
4. Fagg, A. H., Watson, B., Wang, D., Southerland, J. (2006), *Whole-Body Contact Sensing, Presentation*, Dexterous Robotics Laboratory, NASA/Johnson Space Center, May 22
5. Fagg, A. H. (2005), *Predicting Arm Motion from Motorcortical Activity* (talk and lab session), 5th International UJI Summer School on Robotics and Neuroscience, September, 19-23, 2005, Benicassim, Spain
6. Fagg, A. H. (2001), *Wearable Computers: A Changing (Inter)Face of Computing*, talk presented at Sandia National Laboratories, Livermore, CA, August 9, 2001

Regional Invited Talks

1. Fagg, A. H. and McGovern, A. (2006), *Pushing the Boundaries: An Interdisciplinary Perspective on Computer Science* Southwestern Oklahoma State University, November
2. Fagg, A. H. (2005), *Robot Manipulation*, Guest lecture, (RADI 5403; Instructor: Dee Wu) Introduction to Clinical Biomedical Informatics For Quantitative Scientists and Engineers
3. Fagg, A. H. (2005), *Research Experiences for Undergraduates Program*, the OU American Indian Science and Engineering Society

4. Fagg, A. H. (2005), *Research Experiences for Undergraduates Program*, East Central University
5. Fagg, A. H. (2005) *Research Experiences for Undergraduates Program*, Southeastern Oklahoma State University
6. Fagg, A. H. (2005) *Embedded Systems and Machine Learning*, Southwestern Oklahoma State University

Technical Reports

1. Palmer, T. J., Bodenhamer, M. and Fagg, A. H. (2014), Multiple Instance Learning via Covariant Aggregation, Artificial Intelligence and Robotics Technical Report #1139, University of Oklahoma
2. Bodenhamer, M., Palmer, T. J., Sutherland D. and Fagg, A. H. (2012), Grounding Conceptual Knowledge with Spatio-Temporal Multi-Dimensional Relational Framework Trees Artificial Intelligence and Robotics Technical Report #1138, University of Oklahoma
3. de Granville, C., Fagg, A. H. (2008), *Learning Grasp Affordances Through Human Demonstration*, Artificial Intelligence and Robotics Technical Report #1137, University of Oklahoma
4. Thibodeau, B. J., Fagg, A. H., Levine, B. N. (2004), Signal Strength Coordination for Cooperative Mapping Technical Report #04-64, Department of Computer Science, University of Massachusetts, Amherst
5. Fagg, A. H. (2000), A Model of Muscle Geometry for a Two Degree-Of-Freedom Planar Arm Technical Report #00-03, Department of Computer Science, University of Massachusetts, Amherst

Art Reviews and other Commentary

Bion has been reviewed and discussed in a variety of venues. Several examples follow.

- William V. Ganis, “Archival to Contemporary: Six Decades of the Sculptors Guild” (2006), *Sculpture*, **25(7):71-2**

“Though the installation [of the entire exhibit] was quite dense, several pieces stood out for their conceptual and formal quality. ... Adam Brown’s light and sound installation *Bion* (2005) was skillfully integrated into a separate architectural environment so that it could be seen glowing from afar, delighting the senses in an immersive encounter with its 1000 artificially intelligent elements.”
- Gae Savannah, “Newark, NJ, ‘Newark Between Us,’ National Newark Building” (2007), *Sculpture*, **26(10):71-2**

“Entertaining the dark rectangular grove of suspended objects, one was caught delightfully off guard as luminous blue orbs lit up in cascade. Responding to the spectator’s energy, the frolicky alien beings glowed and blinked, emitting a chorus of high-pitched chirping that increased in intensity, like birdsong at dawn. Then, as the visitor slowly calmed down, the bions also settled into stillness, emitting only an intermittent twittering.”
- James D. Watts, Jr. “Exhibit Explores Electronics, Artificial Intelligence” (2006) *Tulsa World*, Thursday, Sept 7.

“Art and science come together with a touch of mystery and whimsy in ‘Bion’ ...”
- *Bion* will be discussed in an upcoming art history book by Stephen Wilson “Border Patrol: Artists Working at the Frontiers of Science and Technology,” published by Thames & Hudson.

- Bion is one of four projects featured in Vision Magazine: Looking at the Future of Learning, Summer/Autumn 2007, p. 16

“It is essential for learners to be creative, to generate new ideas and to experiment in the application of those ideas. In this section, we celebrate those that do not always take the safe and proven route, but instead are committed to trying something truly innovative. Here are just some of the exciting creative ideas that have made us sit up and listen recently”

- Bion is featured in the documentary *Oklahoma: Spirit of the People*, which is being shown regularly at the Oklahoma Heritage Society Museum

Funding: External

- Fagg, A. H., Miller, D. P., Ding, L. and Kolobe, T. *NRI-Small: Robot Assistants for Promoting Crawling and Walking in Children at Risk of Cerebral Palsy*, 10/1/12 – 9/30/17; NSF National Robotics Initiative, Award Number 1208639; Total Award Amount: \$1,135,000
- Oweiss, K., Fagg, A. H., Hatsopolous, N. G. and Slutzky, M. W. *Reliable Central-Nervous-System Interfaces (RCI)*, 12/12/11–6/11/13, Defense Advanced Research Projects Agency (Michigan State University subcontract); Total Award (to OU): \$208,029
- Rennaker, R. and Fagg, A. H. *Ensemble Coding in Olfactory Cortex*, 5/1/10 – 4/31/12; National Institutes of Health ARRA Supplement (University of Texas Dallas Subcontract); Total Award Amount (to OU): \$138,977
- Miller, L. E., Hatsopoulos, N. G., Fagg, A. H. and Solla, A. *Development of a Bidirectional Brain Machine Interface*, 5/1/10 – 4/31/14; National Institutes of Health Bioengineering Research Partnership. OU/Fagg Total: \$841,797
- Kolobe, T., Fagg, A. H., Miller, D. A., Pidcoe, P., and Stoner, J. A. *Prone locomotion in infants with or at risk for disabilities*, National Institute on Disability and Rehabilitation Research; OU total: \$69,870
- Fagg, A. H., *Development of a Bidirectional Brain Machine Interface*, Budget Period: 5/1/05 – 4/31/09; Sponsor: NIH (Northwestern University Subcontract); Total Award Amount: \$580,494.00;
- Fagg, A. H., McGovern, A., Fierro, R., Hougen, D. F., and Lane, T., *REU Site: Integrated Machine Learning Systems*, Budget Period: 1/01/08 – 12/31/10; Sponsor: NSF; Award amount: \$310,952;
- McGovern, A. and Fagg, A. H., *REU Supplement: Integrated Machine Learning Systems*, Budget Period: 5/01/08 – 9/01/08; Sponsor: Oklahoma EPSCoR; Award amount: \$5,000; . This award allows our REU program to add one additional student from Oklahoma.
- Fagg, A. H., Hougen, D. F., Droegemeier, K. K., Lane, T., and McGovern, A., *REU Site: Embedded Machine Learning Systems*, Budget Period: 2/15/05 – 1/31/08; Sponsor: NSF; Total Award Amount: \$299,997.00;
- Brown, A. and Fagg, A. H., *PulsePool Art Installation*, Budget Period: 9/06 – 5/07; Sponsors: Turbulence, Boston Museum of Science, and Rhizome.org, Total Award Amount: \$4,000; . Partial support for the fabrication of the art piece.
- Fagg, A. H., *Learning Grasp Affordances for Control of Humanoid Robot Grasping and Manipulation*, Budget Period: 10/7 – 12/7; Sponsor: NASA/EPSCoR; Total Award Amount: \$1,500; . This supported travel to NASA/Johnson Space Center for me and two students to report on ongoing work and to discuss future projects.

- Brown, A. and Fagg, A. H. *Bion* (Tilles Center Installation); Period: 1/30/06 – 4/30/06; Sponsored in part by Elliott Stroka, Director of the Institute of Arts and Culture, Hillwood Art Museum at Long Island University. This sponsorship covered the transportation and installation costs of Bion.
- Brown, A. and Fagg, A. H. *Bion* (Living Arts of Tulsa Installation); 9/7/06 – 9/28/06; Sponsored in part by the Andy Warhol Foundation for the Visual Arts. This sponsorship covered the transportation and installation costs of Bion.
- Grupen, R. A., Mahadevan, S. R., and Fagg, A. H., *Instructing Robotic Assistants to Acquire Autonomous Behavior*, 8/1/02-12/31/04; Sponsor: DARPA (NASA/Johnson Space Center Subcontractor); Total: \$1,305,000;
- Neeman, H. J., Roe, B. J., Wu, D. and Severini, H., *CI-TEAM Demonstration Project: Cyberinfrastructure Education for Bioinformatics and Beyond*, National Science Foundation, 12/1/06 - 11/30/08, Fagg Percentage (as a senior personnel member): 0%. This project provides computational resources to my group.

Funding: Internal

- Landers, T., Enrico, E., Brown, A. and Fagg, A. H. *Center for Symbiotic Media Research*, Office of the Vice President for Research, and Colleges of Fine Arts and Engineering, 7/1/08–6/30/09, \$55,000;
- Brown, A. and Fagg, A. H. *Presidential Dream Course: Smart Art Spaces*, Office of the Provost, 1/1/09–5/15/09, \$20,000;
- Hougen, D. F. , Cheng, Q., McGovern, A., Dong, Y. and Fagg, A. H. *Computer Science Graduate Fellowship Program*, Graduate College and College of Engineering, University of Oklahoma, 08/06 – 05/15. This fellowship program supports computer science graduate students who are working toward their PhD and has been critical to our recruitment and maintenance of quality students. I have two students funded under this program (Di Wang and Thomas Palmer).
- Brown, A. and Fagg, A. H. *Bion* (original development of piece); 12/22/5 – 12/31/6; Sponsor: Offices of the President, Vice President for Research (the Research Council); Colleges of Fine Art and Engineering; and Schools of Art and Computer Science; Total: \$30,000;

Teaching Experience

- Spring 2013: Embedded Real-Time Systems (AME 3623)
Advanced Mobile Manipulation Challenge (CS 5970)
- Fall 2012: Freshman Engineering Experience: Computing in the Physical World (ENGR 1411)
- Spring 2012: Embedded Real-Time Systems (AME 3623)
Mobile Manipulation (CS 5970)
- Fall 2011: Freshman Engineering Experience: Computing in the Physical World (ENGR 1411)
- Spring 2011: Embedded Real-Time Systems (AME 3623)
Empirical Methods for Computer Science (CS 5453)
- Fall 2010: Programming Structures and Abstractions (CS 2334)

- Spring 2010: Embedded Real-Time Systems (AME 3623)
Embedded Systems (CS 4163/5163)
- Fall 2009: Programming Structures and Abstractions (CS 2334)
- Spring 2009: Embedded Real-Time Systems (AME 3623)
Embedded Systems (CS 4163/5163)
- Fall 2008: Empirical Methods for Computer Science (CS 5970)
- Spring 2008: Embedded Real-Time Systems (AME 3623)
Embedded Systems (CS 4163/5163)
Freshman Engineering Orientation (ENGR 1420)
- Spring 2007: Embedded Real-Time Systems (AME 3623)
Embedded Systems (CS 4973/5973)
Freshman Engineering Orientation (ENGR 1420)
- Fall 2006: Empirical Methods for Computer Science (CS 5973)
- Spring 2006: Embedded Real-Time Systems (AME 3623)
Seminar on Sm[Art] Spaces (CS 5973)
- Fall 2006: Seminar on Neuro/Cognitive Robotics (CS 5973)
- Spring 2005: Embedded Real-Time Systems (AME 3623)
- Fall 2003: Graduate/Undergraduate Embedded Systems (CS 503/591c)
- Spring 2003: Undergraduate Operating Systems (CS 377)
Co-instructor (1 of 10) of the Graduate Computational Psychology Seminar (Psych 891E)
- Fall 2002: Undergraduate Operating Systems (CS 377)
- Spring 2002: Wearable Computing seminar (CS 691w)
- Fall 2001: Computational Neuroscience seminar (CS/NSB 691c)
- Spring 2001: Wearable Computing seminar (CS 691w)
- Fall 1999: Computational Neuroscience seminar (CS/NSB 691c) with Andrew G. Barto

Honors and Awards

- Nominated for the University-level Outstanding Teacher Award for the 2002-2003 academic year (University of Massachusetts).

Academic Committees and Advisees

Students shown in bold are MS or PhD thesis students for which I am/was committee chair.

- **Monique Shotande (PhD committee chair): topic TBD.**
- **Sean McDonough (MS committee chair): Integrated Printing of Robot Structure and Circuit, completed: May 2016.**
- **Marissa Beene (honors thesis co-chair): Autonomous Navigation of a Known Map with a Segway RMP, completed: May 2016.**
- **Len Wilson (MS committee chair): Kinematic Sensing of Infant Trunk and Limb Motion, expected completion: May 2017.**
- Paula Cox (PhD committee member): Prone Locomotion in Infants with Down syndrome using the SIPPC: A Pilot Study, completed December 2013.
- **Michael Craig (MS committee chair): Predicting Wrist Forces and Muscle Electromyograms from Cortical Data, completed August 2013.**
- **Kim Houck (MS committee chair): Automatically Identifying Stimuli from Firing Patterns in the Auditory Cortex of Rat, completed July 2012.**
- **Joshua Southerland (MS committee chair): Activity Recognition and Crawling Assistance Using Multiple Inexpensive Inertial Measurement Units, completed May 2012**
- Zack Tidwell (MS committee member): Expert Move Prediction for Computer Go Using Spatial Probability Trees, completed: January 2012.
- Tricia Catalino (OUHSC, MS committee member): Development of Infant Prone Progression Using an Assistive Device, completed: July, 2011.
- Min Zhu (PhD committee member): EEG/MEG Sparse Source Imaging and its Application in Epilepsy, completed December, 2013.
- Sreekanth Mallireddy (MS committee member): Run Time Compression of Image Data in Wireless Sensor Network Using Xilinx Virtex-II Pro FPGA, completed: September 2011.
- Nathaniel Troutman (MS committee member): Enhanced Spatiotemporal Relational Probability Trees and Forests, completed July 2010
- MD Sazzadur Rahman (MS committee member): SEMO6 - A Multihoming-Based Seamless Mobility Management Framework, completed May 2009
- Brent E. Eskridge (PhD committee member): Effects of State and Action Abstraction on Development of Controllers for Concurrent, Interfering, Non-Episodic Tasks, completed May 2009.
- Lesheng Hua (MS committee member):
- **Thomas Palmer (PhD student): Learning Representations for Action, completed May 2015**
- **Emmanuel Goossaert (MS committee chair, CS): A Corrective Movement-Based Approach to the Online Adaptation of Neural Decoders for Prosthesis Control, completed in January 2010.**

- **Matthew Bodenhammer (current PhD supervisor, CS): Spatiotemporal Multidimensional Relational Framework, computed May 2014**
- Matthew J. Roman (PhD committee member, AME): Effects of Perception Range on Mobile Robot Path Efficiency, completed November 2011.
- Ashvin Shah (PhD committee, UMass Neuroscience and Behavior, completed in August 2008): Biologically-based Functional Mechanisms of Motor Skill Acquisition.
- **Andrew Hill (MS committee chair, CS): A Structured Approach to Predicting Arm Motion from Neural Activity.**
- **Charles de Granville (MS committee chair, CS): Learning Grasp Affordances, completed in June 2008.**
- **Di Wang (MS committee chair, CS): A 3D Feature-Based Object Recognition System for Grasping, completed in December 2007.**
(PhD committee chair, CS): Learning Visual Features for Grasp Selection and Control, completed in May 2012.
- **David Goldberg (MS committee chair, CS): Predicting Arm Motion from Cortical Activity, completed in December 2007.**
- Pedro Diaz-Gomez (PhD committee member, CS): Optimization of Parameters for Binary Genetic Algorithms, completed in December 2007.
- **Robert Platt (co-chair of PhD committee, UMass CS): Control basis approach to learning for robot reaching, grasping, and manipulation, completed 2006.**
- Sreedevi Chandrasekaran (MS committee member, CS): Control of Bio-Nano Robots, completed in 2006.
- Joshua J. Beitelspacher (MS committee member, CS): Implicit Robot Localization through Prediction, completed 2006.
- Surendra Kumar Sivagurunathan (MS committee member, CS): PEARS: a Power Aware Sigma (Seamless IP diversity based Generalized Mobility Architecture), completed 2004.
- Ashvin Shah (PhD synthesis committee, UMass Neuroscience and Behavior): Computational models of muscle recruitment in wrist movements and implications for neural coding of movement, completed 2002.
- Shichao Ou (PhD synthesis project committee, UMass CS): A machine learning approach to context-aware power management in mobile devices.
- Antonio Morales (PhD committee member, CSE, Universitat Jaume I, Spain): Learning to Predict Grasp Reliability with a Multifinger Robot Hand by using Visual Features.
- Sam Weinger (chair, undergraduate honors thesis committee, UMass CS): Multimodal interfaces for wearable computers.
- Kevin Kohler (chair, undergraduate honors thesis committee, UMass CS): Multimodal interfaces for wearable computers.
- Joshua Gay (chair, undergraduate honors thesis committee, UMass CS): A hybrid reinforcement and supervised learning model of audio-visual calibration.

- David Timothy Collins (PhD external reviewer, University of Queensland, Australia): Cerebellar Modeling Techniques for Mobile Robot Control in a Delayed Sensory Environment, completed 2003.
- Bryan Thibodea (PhD synthesis project committee, UMass CS): Communication sensitive approaches to mobile robot cooperation in search-and-retrieval tasks.
- Michael Rosenstein (PhD committee member, UMass CS): Learning to Exploit Dynamics for Robot Motor Coordination, completed 2003.
- James Davis (PhD synthesis project committee, UMass CS): Wearable Computers as Packet Transport Mechanisms in Highly-Partitioned Ad-Hoc Networks, completed 2002.
- **David Wheeler (MS committee chair, UMass CS): Learning Prospective Pick and Place Behavior, completed 2002.**
- Yunqing Wang (MS committee member, UMass CS): Learning Optimal Switching Policies for Path Tracking Tasks on a Mobile Robot, completed 2002.
- Laura Claxton (MS committee member, UMass Psychology): The kinematics of intent: A new approach to measuring intention in infants, completed 2002.
- Justus Piater (PhD committee member, UMass CS): Constructive Feature Learning and the Development of Visual Expertise, completed 2001.
- Renee Johnson (MS committee member, UMass Psychology): The role of vision in infants' precision reaching, completed 2000.
- Nathan Baughman (MS committee member, UMass CS): Cheat-Proof Payout for Centralized and Distributed Online Games, completed 2000.

Undergraduate Advisees

- Delano Usiukiewicz (2017 capstone project): Robot Learning through Exploration
- Richard Miheli (2014 capstone project): Tactile Sensing for 3D-Printed Robot Fingers
- Chase Hennion (2013 capstone project): Dynamic Modeling of Infants with Cerebral Palsy
- Jacob Young (2013 capstone project): A 3D Printed Robotic Finger Actuated with Tendons

Research Experiences for Undergraduates (REU) Advisees

- Daniel Brigance (2016–current): Measuring Infant Movement Activity Using Inertial Measurement Units.
- Leslie Barnes (2016–current): Assistive Robot Design for Manufacturing.
- Bonnie Pope (2014–2016): Predicting the Outcome of Robot Actions
- Manu Kumar (2013–current): Tracking 3D Orientation of an Inertial Measurement Unit in the Presence of a Varying Magnetic Field
- Elizabeth Craig (2011–2012): Design of a Dextrous Robotic Hand
- Ryan Alley (2010): Neutrally Buoyant, Interactive Art
- Cynthia Andujar (2010): Neutrally Buoyant, Interactive Art

- Dougal Southerland (2010): Scaling Up SMRF Trees with Cues
- Daniel Fennelly (2009): The Spatio-Temporal Multi-Dimensional Relational Framework (SMRF)
- Samuel Bleckley (2009): The Spatio-Temporal Multi-Dimensional Relational Framework (SMRF)
- Alex Eisner (2009): Face Recognition and Tracking for Human-Robot Interaction using PeCoFiSH
- Joshua Southerland (2009): Getting the Robot to School on Time: Mapping, Planning and Execution
- Derek Tingle (2008): Decoding Odor from Rat Olfactory Cortex.
- Samuel Bleckley (2008): Orgonome: a Synthetic Creature for Interactive Art.
- Rachel Shadoan (2008): Orgonome: Learning Interactive Behavior from Sparse Experience.
- Joshua Southerland (2008): Design of a Mobile Manipulation Robot for Human-Scaled Environments.
- Rudy Sandoval (2007): Learning Color Models to Segment and Map Robot Environments.
- Nicole Doorly (2007): A Robotic Mobile Manipulator Platform for Planning and Learning.
- Robert Lindsey (2007): A Dynamic Programming Approach to Mobile Robot Path Planning.
- Charles de Granville (2004-2006): Learning grasp affordances from demonstration. **Charles was named Outstanding Computer Science Senior by OU, and received an honorable mention for the 2007 CRA Outstanding Undergraduate Award.**
- Joshua Southerland (2004-2006): Learning pick-and-place task sequences from a human teacher.
- Brian Watson (2004-2006): Whole body contact detection with a 6-axis load cell.
- Elyse Steiner (2006): Learning pick-and-place task representations from human demonstration.
- Eric Sondhi (2002-2004): Formation of cortical representations of wrist movements in the primary motor cortex.
- Matthew Brewer (Summers 2000-2003): Localization and path planning for a mobile robot.
- Joshua Gay (2001-2004): Audio/visual calibration for the UMass Torso.
- Marwan Mattar (2004): Speech interfaces for robots.
- Reed Hedges (2001-2003): A virtual reality interface for multi-robot search-and-rescue tasks.
- Enrique Irigoyen (2003; New Mexico State University): Texture representations for subject tracking in a smart space.
- Christopher Atenasio (2002): Collision-free motion planning for a 14 degree-of-freedom, dual-arm robot.
- Peter Amstutz (2001-2002): A mobile virtual/augmented reality interface for wearable computers.
- Jonathan Flynn (2001): Multi-modal interfaces for wearable computers.
- David Whitehead (2001-2002): A neural model of visual and tactile fusion in the parietal and premotor cortices.
- Michael Piantedosi (2001-2002): audio spatialization for wearable computers.

Independent Study Advisees

- Charles de Granville (undergraduate): Using Learned Grasp Affordances as Reach Control Primitives (Fall 2006)
- Di Wang (graduate): A Hybrid Convex/Concave Grasp Controller for Haptic Exploration of Objects (Spring/Summer 2006)
- Shichao Ou (graduate): An Augmented Virtual Reality Interface for Assistive Monitoring of Smart Spaces. (Spring/Summer 2003)
- Michael Piantedosi (undergraduate): A 3D audio system for wearable computers. (Fall 2000)
- James Davis (graduate): Oscillation primitives for robot control. (Spring 2000)
- Benjamin Alamed (undergraduate): A Wearable Computer Tour Guide. (Spring 2000)

Professional Activities

2004–current

- Journal/Conference paper review:
 - Journal of Autonomous Robotics
 - International Conference on Robotics and Automation
 - Neurocomputing Journal
 - Journal of Systems, Man, and Cybernetics
 - International Conference on Advanced Robotics
 - International Conference on Humanoid Robotics (**program committee member: 2006, 2008**)
 - Psychological Review (journal)
 - IEEE/RSJ International Conference on Intelligent Robots and Systems
 - Robotics Science and Systems workshop on “Robot Manipulation: Sensing and Adapting to the Real World” (**program committee member: 2007–2008**)
 - IASTED International Conference on Intelligent Systems and Control
 - Neural Computation (journal)
 - Machine Learning Journal
 - Journal of Neurophysiology
 - International Conference on Epigenetic Robotics
 - International Conference of the American Association of Artificial Intelligence
 - Journal of Artificial Intelligence Research
 - Transactions on Robotics
 - Public Library of Science
- Funding Review Panels:
 - Vanderbilt University (internal review)

- National Science Foundation
- Netherlands Organisation for Scientific Research (NWO)
- University Service
 - Faculty senate
 - Faculty senate executive committee
 - Faculty committee on academic integrity
 - Information Technology committee
 - Graduate recruitment Committee
 - Ad Hoc CS Web Presence Committee
 - Speaker for Introduction to Engineering (ENGR 1410)
 - College of Engineering Committee on the Introduction to Engineering Curriculum
 - CS Research Committee
 - CS Computing Committee
 - Numerous laboratory tours to visiting students
- Miscellaneous:
 - Principal Investigator, “NRI-Small: Robot Assistants for Promoting Crawling and Walking in Children at Risk of Cerebral Palsy,” 2012–2017
 - Director, “OU/UNM REU Site on Integrated Machine Learning Systems,” 2008–2010
 - Director, “OU/UNM REU Site on Embedded Machine Learning Systems,” 2005–2008
 - Instructor for the “Interactive Art Workshop” at the Global Conference on Educational Robotics (middle and high school students), July 8–11, 2008 (co-taught with Adam Brown). This one day course focused on Finite State Machines and programming sensor network nodes for interactive art.
 - Instructor for the *K20 Research Experience for Science Teachers Institute* (middle school teachers), June 16–27, 2008 (co-taught with Amy McGovern). This nine day course focused on Finite State Machines and programming sensor network nodes for interactive art.
 - Judge, Oklahoma Botball competition, 2006 and 2008
 - External Mentor, year-long Engineering Senior Design Clinic Course at Smith College (Northampton, MA). Project: “Design of a Non-Visually Accessible Campus Mapping/Database Interface” (Course taught by Professor Susannah Howe), AY 2004–2005

Professional Organizations

- Society for the Neural Control of Movement
- IEEE; Robotics Society; Computer Society
- Association for the Advancement of Artificial Intelligence (AAAI)