
MICHAEL PATRICK JOHNSON, Ph.D.

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Selected Skills & Interests

**3D Graphics & UI • Interactive Environments • Tangible UI • Machine Vision •
Evolutionary Computation • Artificial Life & Intelligence • Mathematical Modeling**

Object-Oriented Software Architecture & Engineering [~15 yrs] : C++, Java, Lisp, C; Windows &
Unix; Matlab, LaTeX; OpenGL; Realtime & Sensor Device I/O; Multithreaded & Distributed

Education

Doctor of Philosophy in Media Arts and Sciences, 2003 (GPA: 5.0/5.0)

Massachusetts Institute of Technology (Cambridge, MA)

The Media Lab, Synthetic Characters Group.

Dissertation Title: *Exploiting Quaternions to Support Expressive Interactive Character Motion*

Master of Science in Media Arts and Sciences, 1995 (5.0/5.0)

MIT, The Media Lab, Autonomous Agents Group.

Thesis title: *Evolving Visual Routines*

Bachelor of Science in Computer Science with Minor in Creative Writing, 1993 (4.7/5.0)

MIT, Department of Electrical Engineering and Computer Science

Thesis title: *Algorithms for Pinball Simulation, Ball Tracking and Learning Flipper Control*

Industry

Software Engineer/Consultant

Ingeeni Studios. (Cambridge, MA): Mar 2006 - Present

Software Engineer/Art Tools Programmer

Blue Fang Games. (Waltham, MA): Aug 2004 - Aug 2005

- Extended and maintained 3D art tools (multi-threaded C++ & MFC) with daily artist feedback.
- Programmer on 3D graphics team for *Zoo Tycoon 2: Endangered Species* Expansion Pack since dev cycle began Q4 2004 (shipped Q4 2005). Advised team on 3D math.

Artificial Intelligence Engineer

Ingeeni Studios. (Cambridge, MA): Aug 2003 - July 2004

- Designed & programmed trainable AI, 3D graphics routines, and gameplay for Web games.
- Evaluated novel technologies for incorporation into potential future products.

Games Programmer

Mad Doc Software. (Lawrence, MA): Nov 2002 - June 2003

- Developed fast 3D collision prediction and avoidance control system for physics-based game.
- Programmed 2D unit pathfinding AI and 3D graphical debug routines.

Research

Research Assistant

Massachusetts Institute of Technology (Cambridge, MA)

The Media Lab, Synthetic Characters Group, Prof. Bruce Blumberg (URL: characters.media.mit.edu).

Sept 1996 – October 2002

- Researched & developed real-time, expressive animation algorithms for interactive character motor control, including: parametric, example-based 3D animation interpolation, statistical analysis & synthesis of 3D animation data, and inverse kinematics.

- Invented *sympathetic interfaces*, a new paradigm for tangible control of 3D virtual characters via sensor-embedded plush toys, primarily for children.
- Contributed significantly to R&D of a high visibility multi-year project to create a virtual dog that senses, behaves, emotes, learns and moves similarly to a real dog.
- Also: Designed and implemented numerous research demonstrations; Established and maintained a large Windows/Unix & Java/C++ codebase; Published and presented at international conferences; Extensive contact with corporate sponsors and international media; Mentored junior graduate students, undergraduate research students and 3D artists; Proactively designed and taught a software engineering crash course for novices.
- (Keywords: Computer Graphics, Interactive Environments, Tangible Interfaces, Statistical Modeling, Quaternions, Inverse Kinematics, Sensor I/O)

Research Assistant

Massachusetts Institute of Technology

The Media Lab, Autonomous Agents Group, Prof. Pattie Maes.

Sept 1993 – Sept 1996

- Investigated Genetic Programming (GP) as a supervised machine learning method for the automated creation of visual feature detectors.
- Developed and implemented real-time computer vision algorithms and gesture recognition routines in the development of the Artificial Life Interactive Video Environment (ALIVE).
- Also: Research Assistant responsibilities similar to above.
- (Keywords: Evolutionary Computation, Machine Vision, Artificial Life, Interactive Environments, Autonomous Agents, Reinforcement Learning)

Undergraduate Researcher

Massachusetts Institute of Technology

Artificial Intelligence (AI) Lab, Prof. Chris Atkeson and Dr. Andrew Moore.

June 1992 – June 1993

- Implemented genetic algorithm for optimizing feature selection in statistical machine learning.
- Designed and implemented pinball simulation and robust ball trajectory predictor. Applied reinforcement learning to flipper control to maximize score. Collected human performance data and performed statistical comparison with computer results (CPU won).

Undergraduate Researcher

Massachusetts Institute of Technology

AI Lab, Leg Lab, Prof. Marc Raibert.

Feb 1992 – June 1992

Modeled the dynamics of a pneumatic robot arm from patent application (4,900,218, *Sutherland*) to analyze design efficacy and control strategies.

Undergraduate Researcher

Massachusetts Institute of Technology

The Media Lab, Advanced Human Interface Group, Dr. Dick Bolt.

June 1990 – Jan 1992s

- Designed and programmed real-time, multi-threaded serial drivers, digital signal filtering, and gesture recognition algorithms for VPL DataGloves and Polhemus 6DOF sensors.
- Implemented real-time demonstration of multi-modal interaction using voice recognition and dual DataGlove gesture input for DARPA sponsor visit.

Refereed Interactive Installations

(void*): **A Cast of Characters** (*SIGGRAPH 1999*)

Technical Director, Researcher, Programmer

- Directed the technical software development cycle (Java & C++) of a successful interactive art installation that allowed control of 3D dancing characters using novel wireless sensors and gesture recognition technology.
- Designed and implemented the real-time character animation and motor control engine.

Swamped! (*SIGGRAPH 1998*)

Assistant Project Director, Researcher, Programmer, Game Designer, Producer

- Codirected and contributed to a highly successful interactive cartoon showcasing our novel *sympathetic interface*. Hundreds of participants directed a 3D character via a wirelessly sensed plush toy coupled with gesture recognition and expressive motor control algorithms.
- Researched & implemented new realtime animation blending technologies, motor control system and significant other infrastructure code (including audio f/x system) in Java & C++.

SmartSpaces (*SIGGRAPH 1997*)

Game Designer and Programmer

- Designed and programmed (C++) a successful videogame (*Whacka!*) to showcase 3D hand and head visual tracking research by a senior student (Azarbayejani).
- Developed a believable real-time inverse kinematics algorithm and managed a 3D artist.

ALIVE: Dreams & Illusions (*SIGGRAPH 1995*)

Researcher and Programmer

Programmed C++ background subtraction and gesture recognition routines for a networked augmented reality installation (Coauthor of associated U.S. Patent 5,563,988).

Publications, Patents & Presentations

“Integrated Learning for Interactive Synthetic Characters,” B. Blumberg, M. Downie, Y. Ivanov, M. Berlin, M. P. Johnson, B. Tomlinson. *Computer Graphics* (SIGGRAPH 2002), 2002.

“Physically interactive story environments,” C.S. Pinhanez, J.W. Davis, S. Intille, M. P. Johnson, A. D. Wilson, A. F. Bobick, and B. Blumberg. *IBM Systems Journal* 39, 3&4, 2000.

“Multi-Dimensional Quaternion Interpolation,” M. P. Johnson. SIGGRAPH 2000, Technical Sketches and Applications.

“Sympathetic Interfaces: Using a Plush Toy to Direct Synthetic Characters.” M. P. Johnson, A. Wilson, B. Blumberg, C. Kline, and A. Bobick. In Proceedings of SIGCHI 99, 1999.

“Out of the Box: Toys Break the Screen Barrier,” SIGGRAPH 1998 Invited Panel Speaker.

“Automated Creation of Visual Routines Using Genetic Programming,” M. P. Johnson. In Proceedings of the International Conference on Pattern Recognition, ICPR(A) pp. 951—956, 1996.

“Method and System for Facilitating Wireless, Full-Body, Real-Time User Interaction with a Digitally Represented Visual Environment.” P. Maes, B. Blumberg, T. Darrell, T. Starner, M.P. Johnson, K. Russell, A. Pentland. (**U.S. Patent 5,563,988**). Issued: Oct 8, 1996.

“Evolving Visual Routines,” M. P. Johnson, P. Maes, and T. Darrell. *Artificial Life* 1:4 (Selected for ‘Best of Artificial Life IV Conference’ Issue), pp. 373—390, 1994.

“Evolving Visual Routines,” M. P. Johnson, P. Maes, and T. Darrell. Proceedings of the Fourth International Workshop on the Synthesis and Simulation of Living Systems (*Artificial Life IV*), pp. 198—209, 1994.

“An Empirical Investigation of Brute Force to Choose Features, Smoothers, and Function Approximators,” A. Moore, D.J. Hill, M.P. Johnson. *Computational Learning Theory and Natural Learning Systems* Vol III. ed. T. Petsche, S. J. Hanson, and J. Shavlik. MIT Press, Cambridge, MA. 1995.