

# Vytas SunSpiral

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## RESEARCH OBJECTIVES

Humans are what fascinate me most in life: how we move and think, the emotional and subconscious aspects of life, group dynamics and communities, and our physical embodiment. Autonomous robotic systems hold great promise to improve the human experience, and are a fantastic lens by which one can study many aspects of human life, especially intelligence, physical embodiment, and social interaction. In the pursuit of autonomy, I take a systems approach which considers all aspects of the robot, from physical to algorithmic design. Currently I am focused on Biotensegrity models of human physiology, fascia and force propagation in the human body, distributed control between the spine (force) and the motor cortex (position), trained human motion (yoga, dance, martial arts), and understanding the role of synchronization as a basis for neural computation and the control of motion.

## PROFESSIONAL EXPERIENCE

### Chief Technology Officer

**Apisphere Inc., Berkeley, CA, USA**

**Nov 2008 - Present**

Apisphere is a 3-year-old startup that has built a cloud-based platform for automated location based services for location aware mobile devices. As CTO I've been involved in almost every aspect of the company, providing the center of gravity between the divergent needs and directions of engineering, sales, marketing, funding, customer support, and forward looking technical leadership. Filed two provisional patents.

### Athlete Footfall Project Lead and

**Oct 2006 – Jan 2009**

**PI of Robotic Manipulation Research Lab (ArmLab)**

**Sept 2005 – Jan 2009**

**NASA Ames Research Center, Moffett Field, CA, USA**

**Employed by Carnegie Mellon University**

Athlete is a 2.75 meter diameter, six legged, 36-DOF robot which was built at JPL. I led the effort to automate the walking process, which was being manually teleoperated. This project entailed the development and integration of ground tools for telemetry processing, stereo image processing and integration from 9 stereo pairs, stability analysis, force/torque analysis, motion planning and terrain/obstacle avoidance, 3D visualizations for operator situational awareness, gait generation and leg sequencing, command sequencing and execution monitoring, and field testing at lunar analog sites. I continue to provide occasional advisory services to this project as it transitions to redeployment on the newly built Tri-Athlete robots, whose designs have been influenced by lessons learned during the first years of the project. A good introduction to the Athlete robot can be seen at: <http://www.jpl.nasa.gov/videos/technology/athlete-20070806/>

The ArmLab is dedicated to researching dexterous and non-dexterous manipulation. Its assets include two Amtec 7-DOF arms, two Barrett Hands, integrated fingertip 6-axis force torque sensors, stereovision camera systems, and a 5 DOF planetary relevant manipulator. As PI of the ArmLab I managed between 2 to 11 students (undergrad, masters and PhD) as various forms of

manipulation were explored, such as: soil manipulation and trenching, compliant grasping, grasping and retrieving deployed communication nodes, remote science instrument placement mechanisms, and DH parameter optimization techniques.

Outstanding Service Award, NASA Ames, 2008

Outstanding Service Award, NASA Ames, 2007

**Robotics Researcher**

**June 2002 – Sept 2005**

**NASA Ames Research Center, Moffett Field, CA, USA**

**Employed by QSS Group, Inc.**

During this time I worked on multiple projects within the Model Based Diagnostics Group and the Embedded Decisions Systems Group. Significant research was done on applying particle filters to hybrid models for fault diagnostics. This work was applied both to planetary rovers and to autonomous drilling rigs. Also, a system to predict operator intention for the control of Robonaut (a humanoid robot) was created. This research involved using Bayesian inference techniques and other statistical models to segment and categorize six dimensional (pose and orientation) motion trajectories. The results could easily be extended to gesture recognition or other HRI applications. A number of papers were published based on these projects.

**Project Lead for Tele-presence Robot**

**Oct 2001 - Nov 2001**

**Contract with Mobot Inc., Pittsburgh, PA, USA**

I was brought in as an independent contractor to manage this project through a critical stage of development and ensure it was completed on time. The RAVEN project is an interactive tele-presence robot built for the National Aviary in Pittsburgh that allows remote students to take guided tours of the Aviary. This project involved building the complete robot from the ground up (as opposed to buying a pre-built mobile base). You can read more about the results of this project at: [http://upclose.lrdc.pitt.edu/people/louw\\_assets/RAVEN.PDF](http://upclose.lrdc.pitt.edu/people/louw_assets/RAVEN.PDF)

**Robot Personality Engineer and Technical Manager**

**Oct 1998 – Nov 2000**

**Mobot Inc., Pittsburgh, PA, USA**

Mobot built and sold unsupervised fully autonomous socially interactive robots. These robots were mainly tour guides in public museums, but we also branched out into other roles for them. As the first employee hired by this small start-up, I had my hand in every aspect of the company. On the technical side, I designed, built, debugged, installed, and personalized robots. Creating practical robots requires a holistic understanding of: electrical and mechanical engineering; AI, vision, and machine learning; human cognition and social interaction; entertainment, education and issues of operating in a public space. As technical manager, I was responsible for overseeing development of new products and technologies. I also worked closely with customers, wrote contracts, worked on PR and marketing, applied for and received government grants, and helped develop a business plan. The robots we built achieved unprecedented records of long term autonomous deployment as they operated autonomously on a daily basis in public spaces for multiple years with no direct human supervision. Pictures of some the robots we built are available at: <http://www.mobotinc.com/>

## EDUCATION

**M.S. Computer Science**

**June 1998**

**Stanford University, CA, USA**

Masters Advisor: Dr. Ouassama Khatib. A self-designed course of study on various aspects of autonomous robotics was completed, along with research into TR trees for Dr. Nils Nilsson (for a report on this work see: <http://ai.stanford.edu/users/nilsson/trweb/learningcontrol.pdf>).

**B.A. With Honors, Symbolic Systems**

**June 1997**

**Stanford University, CA, USA**

Symbolic Systems is an interdisciplinary major that includes courses from the departments of Philosophy, Psychology, Linguistics, and Computer Science. A self-designed concentration on robotics and artificial intelligence was completed. Independent research on autonomous robotics, map building in dynamic settings, and hypothesis generation was conducted with Dr. Illah Nourbakhsh and Clay Kunz (see publications).

## PATENTS

(Note: Prior to marriage in 2005, published as Thomas Willeke)

**Thomas Willeke** (with Illah Nourbakhsh, Clayton Gregory Kunz, Carolyn O'Brien Green, and Vinton Coffman III). "Socially Interactive Autonomous Robot." US Patent Number 6760647, granted 7/6/2004, and also US Patent Number 6539284, granted March 25, 2003.

## PUBLICATIONS

(Note: Prior to marriage in 2005, published as Thomas Willeke)

All papers are available to download at: <http://www.sunspiral.org/vytas/cv>

### JOURNAL ARTICLES

Clayton Kunz, **Thomas Willeke**, Illah Nourbakhsh. "Automatic Mapping of Dynamic Office Environments." *Autonomous Robots Journal*. Editor George A. Bekey. Kluwe Academic Publishers, Vol. 7, No. 2, September 1999.

### CONFERENCE PAPERS

**Vytas SunSpiral**, Mark B. Allan, Rodney Martin, Kevin R. Wheeler, "Modeling and Classifying Six-Dimensional Trajectories for Tele-operation Under Time Delay", in proceedings, AAI Spring Symposium, Stanford, CA, 2006

Rodney Martin, Kevin Wheeler, **Vytas SunSpiral**, Mark Allan, "Optimized Algorithms for Prediction within Robotic Tele-Operative Interfaces", in Proceedings, *Human Robot Interaction*, Salt Lake City, UT, March 2006.

Kevin Wheeler, Rodney Martin, Mark Allan, **Vytas SunSpiral**, "Predictive Interfaces for Long-Distance Tele-Operations", in Proceedings, *ISAIRAS Conference*, Munich Germany, 2005.

Emmanuel Benazera, Richard Levinson, **Thomas Willeke**, Howard Cannon, "Runtime Decision Sampling and Branch Utility Re-Evaluation in the Robust Execution of

Contingent Plans”, In Proceedings of *International Conference of Robotics and Automation*, Barcelona, April 2005.

**Thomas Willeke**, Richard Dearden, “Building Hybrid Rover Models: Lessons Learned” in *Proceedings of 15<sup>th</sup> International Workshop on Principals of Diagnosis*, Carcassone, France. June 2004.

Richard Dearden, Frank Hutter, Reid Simmons, Sebastian Thrun, Vandí Verma, and **Thomas Willeke**, “Real-time Fault Detection and Situational Awareness for Rovers: Report on the Mars Technology Program Task”, In Proceedings, *IEEE Aerospace Conference, March 2004*.

Illah Nourbakhsh, Clay Kunz, **Thomas Willeke**, "The Mobot Museum Robot Installations: A Five Year Experiment" In Proceedings of IROS 2003, Las Vegas.

**Thomas Willeke**, Clayton Kunz, Illah Nourbakhsh. “The History of the Mobot Museum Robot Series: An Evolutionary Study.” *Proceedings of FLAIRS 2001*. Florida. May 2001.

Clayton Kunz, **Thomas Willeke** and Illah Nourbakhsh , "Automatic Mapping of Dynamic Office Environments,". In Proceedings, *IEEE Conference on Robotics and Automation*, volume 2, pages 1681—1687, 1997.

#### **TECHNICAL REPORTS**

**Thomas Willeke**. "Genetic Evolution of Behavior-Oriented Robots." *Genetic Algorithms and Genetic Programming at Stanford 1995*, Editor John R. Koza. Stanford University, 1995.

#### **WHITE PAPERS**

**Vytas SunSpiral**. “Automated Location Based Services – an Apisphere Whitepaper”, Feb. 2009  
[http://www.apisphere.com/pdfs/Apisphere\\_ALS\\_WP.pdf](http://www.apisphere.com/pdfs/Apisphere_ALS_WP.pdf)

### **PRESENTATIONS & ACTIVITIES**

#### **Invited Presentations**

“Biotensegrity and Force Propagation in Human and Robotic Manipulation” invited presentation at Yuri’s Night, NASA Ames, CA, April 2008.

“Control Schemes for Complex Coordinated Human Motion” invited presentation at CoLab’s Luna Philosophie, Yahoo Brickhouse, SF, CA, Feb. 2008.

“Athletic Walking,” invited presentation to the Carnegie Mellon University Robotics Institute, Pittsburgh, PA, November 2007.

“Exploration, Robotics, and the Unknown,” invited keynote presentation given at the *2006 NASA ISGC Research Symposium*, University of Idaho, Moscow, Idaho, October 2006.

“Building Hybrid Rover Models: Lessons Learned,” invited presentation for the *Robot Fault Diagnosis Workshop, International Conference of Robotics and Automation*, New Orleans, Louisiana April 2004.

“A Proposal for the Creation of a Diagnostics and Power Port Standard,” presented at the *AIAA Space Automation & Robotics Symposium*, Naval Research Laboratory, Washington, DC. March 2005.

**Session Chair**

Chair of Modeling Session, Symposia: “To Boldly Go Where No Human-Robot Team Has Gone Before,” *AAAI 2006 Spring Symposia*, Stanford, CA, March 2006

**Proposal/Grant Review Panels**

Participant on the Grant Review panel for NASA’s Planetary Instrument Definition and Development Program, Feb. 2007.

**Conference Panels**

Thomas Willeke, William Hefley, Joseph Ballay, Anatole V. Gershman, *Human Computer Interaction in Industry: Experiences from the Field*, Carnegie Mellon University, Sept 1999.

**AFFILIATIONS**

American Association for Artificial Intelligence (AAAI)  
Institute of Electrical and Electronics Engineers (IEEE)