# Rob Tow

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**BIO**

Computer systems researcher, software engineer, and project manager with 18 patents granted in color scanning, steganography, video processing, robotics, wireless sensor networks, gesture UI, AR, and artificial intelligence. VR/AR pioneer and developer. At Xerox PARC patented an amorphous-silicon color scanner design, and was the principle inventor of the Xerox “Glyph” technology. At Interval Research developed multi-user/multi-world Virtual Reality content including spatialized audio, patented robotic user interface techniques for affective computing, and developed and patented a digital video search method. At Sun Labs served on the Digital Rights Management Task Force and the Open Source Licensing Committee, working on intellectual property issues combined with new technologies for distribution, teamed on a novel IoT system, pioneered gesture UI methods and swarm intelligence iOT, and co-invented/delivered a tamper-respondent secure crypto system to U.S. Navy SPAWAR. At Art Center College of Design and at California College of the Arts lectured and advised graduate media students. At Montavista Software developed embedded Linux software and software tools for embedded Linux. At Liquid Robotics developed Linux camera and imaging software for an autonomous ocean going solar and wave powered robot. At Texas Instrument's Android Development Team in Sunnyvale, CA worked on Android imaging support for the Google Nexus smartphone and prototype Google Glass. At Skully Helmets developed an augmented reality motorcycle helmet product. At Toyota Partner Robots prototyped a wearable augmented reality device for the blind. At Toyota Research Institute lead a contract team prototyping conversational AI prototypes for cars, robots, and houses, and VR. At SyncThink, worked on VR for diagnosing and treating concussion injuries, using eye-tracking in AR Kit 2, Oculus Gear, and Magic Leap. At Glynt-AI a senior developer on a cloud-based AI system for low-shot document recognition and conversion to databases. Most recently at Neurogeneces progamming Raspberry Pi 4 and embedded Nordic SOC for EEG recording and learning stimulation.

# PROFESSIONAL EXPERIENCE

**October 2022 – July 2023 NeuroGeneces, Santa Fe, NM – Senior Staff Engineer**

* Updated Python 2 software using wxPython to Python 3 and ported from Mac to Raspberry Pi 4 for processing and displaying EEG data from a wearable EEG headband designed for enhancing memory transfer during sleep.
* Python 3 control of GPIO signals between Raspberry Pi 4 and Nordic nF52833-DK SOC.
* Python 3 AsyncIO control using the BLEAK package for BLE comm between Raspberry Pi 4 and Nordic SOC.
* Matplotlib and Jupyter notebooks with Python 3 data analysis of BLE comm using data from Wireshark.
* C review/debug/deployment of EEG control and BLE comm program running under Zephyr OS on Nordic nF52833-DK SOC, using NRF Connect, JLINK and both SEGGER Embedded Studio and VS Code with v1.9.1 and v2.4.0 Nordic toolchains.
* Documentation and software source control using git and github.

**January 2019 – July 2022 Glynt AI, Mountain View, CA – Senior Staff Engineer**

* Document and image processing, using Python, Ghostscript, Imagemagick, and sundry other softwares as part of a ground-breaking cloud-based AI system for low-shot document recognition and conversion to databases.

**May 2018 – October 2019 SyncThink, Inc., Palo Alto, CA – Technical Lead**

* Architect, implement, and manage SyncThink technology for concussion diagnosis and treatment across the EYE-SYNC mobile platform - VR, Android, and cloud.
* Introduced Atlassian suite (JIRA and Confluence). Started extensive documentation in Confluence.
* RXJava programming under Android.

**September 2017 – March 2018 Nuvation Engineering, Palo Alto, CA – Senior Software Architect (contractor)**

* Team integration for daily builds; Jenkins with Docker containers, git repos, JIRA and Confluence.
* Linux software for an embedded Raspberry Pi in a prototype DNA concentrator, including complete pi-gen build under Jenkins/Docker.
* Fixed and documented legacy QT UI build toolchain and process.
* ARM software for a handheld financial device based on a STML32.

**Nov. 2016 – August 2017 Bsquare/Toyota Research Institute, Palo Alto, CA – Senior Software Architect**

* Software architect managing a Bsquare group working for the Toyota Research Institute; working on AI agents for auto/robots/buildings/wearables.
* Evaluating commercially available conversational AI agents via prototyping under Linux, using Docker containers, AWS, and services from IBM Watson, Amazon, Pullstring, Microsoft, and Google, integrated into a car simulator.
* Designed and lead the implementation of a sensor & AI fusion “road rage” detector.
* Co-filed a U.S. patent for an augmented reality UI for the visually impaired.

**2015-2016 Bsquare/Toyota Partner Robots, San Jose, CA – Senior Software Architect**

* Software architect managing integration for an augmented reality embedded Android wearable device that employs cameras and sensors to guide blind users for the Toyota Partner Robots group.
* Coordinated hardware and software development between internal and external teams located in the U.S. and overseas, including Nuvation Engineering (Sunnyvale/Waterloo Canada) and Itseez (Russia).
* Hands-on Android software development and embedded STML32 programming.
* Participated in developing documentation for FDA device approval.

**2015-2016 Bsquare/Toyota Partner Robots, San Jose, CA – Senior Software Architect**

* Software architect managing integration for an augmented reality embedded Android wearable device that employs cameras and sensors to guide blind users for the Toyota Partner Robots group.
* Coordinating hardware and software development between internal and external teams located in the U.S. and overseas.
* Hands-on Android software development and embedded STML32 programming.

**2014-2015 Skully Helmets, San Francisco, CA - Director of Software, Adjunct Scientist**

* Employee No. 6; started as consultant, then Director of Software, then Adjunct Scientist for a start-up developing an augmented reality motorcycle helmet.
* Evaluation, selection, development and testing of key software components and telematics for embedded Android, and also for Android and iOS smartphones..
* Patent and intellectual property development, working with patent counsels. Filed 4 patent applications.
* Interfacing with external design, hardware, and user interface software contractors for the planning, development, and prototyping of the helmet and associated software.
* Oversight and goal setting of hardware and software contractors in India, using remote collaboration tools including Jira, Confluence, and GitHub, including testing of board systems during bring-up.
* Replicated and managed local Android build system for embedded Android, using Ubuntu Linux.
* Replicated and tested local Android and iOS builds for Android and iOS smartphones.
* Developed image warp maps for real-time image processing using GeoSemiconductor embedded processor, using proprietary software running on Windows 7.
* Testing of prototype real-time camera, image processing, and heads-up display systems in functional motorcycle helmets. Evaluation of camera and display modules.
* Collaborated with UI design team to develop story-boards, wireframes, and prototype Android and iOS companion apps for the helmet.

**2014 – Independent Consultant/Contractor**

* Patent and product analysis for intellectual property negotiation – Triple Crown Consulting LLC, Campbell, CA.
* Linux and Android systems programming, including coprocessor – Tobii Technology, Stockholm, Sweden.

**2010-2013 – Texas Instruments, Sunnyvale, CA – Linux Imaging Engineer, Android Development Team / Systems Engineering Software Development**

* Android internals software development for OMAP4/OMAP5 multi core processors (complete system sources and compilation, including Ducati).
* Java programming on Linux of Ducati coprocessor heap management performance analytics.
* C programming of Ducati coprocessor memory management.
* Supported system software development for Google Nexus Prime / Galaxy Nexus / Google Glass.
* Supported Image processing, computational photography, and camera control software development.
* Direct interaction with Google and other OMAP/Android customers.
* Open source community involvement and relations.

**2009-2010 – Liquid Robotics, Sunnyvale, CA – Senior Software Engineer**

* Software engineering for an autonomous solar and wave powered ocean going robot platform with satellite communication.
* Linux systems programming on embedded ARM and OMAP processors.
* Image processing and camera control software development, utilizing Angstrom Linux, ImageMagick, and gPhoto open source software.

**2008-2009 – MontaVista Software, Santa Clara, CA – Application Software Engineer**

* Worked with field application engineers and marketing to define next generation Linux system tools.
* Extended system development and packaging tools for MontaVista’s real-time Linux distributions as part of an agile development team spread across three states, communicating via online collaboration tools. Modified BitBake/Open-Embedded Python language based build tools. ARM/TI-3430 Linux system build development. Linux “userland” and UI software programming, in GTK and C, for the Linux subsystem provided by Montavistsa for Dell's *Latitude ON* laptops.Linux system administration and web services for CENTOS build machines used for shared development.
* Acting team leader for agile programming team in absence of project manager.

**2008 – Droplet Technology, Menlo Park, CA – Senior Software Engineer (Video Compression)**

* Developed entropy encoding methods in C under Windows XP with Cygwin/GCC for Droplet's proprietary non-blocked wavelet-based video compression codec. Analyzed image and codec statistics using Matlab.
* Ported an earlier version of Droplet's codec to the Symbian operating system (using Carbide/Eclipse) for Nokia handsets.

**2007-2012 – California College of Arts, San Francisco, CA – Science and Technology Advisor for Graduate Programs (Pro Bono)**

* Providing graduate Media Design program faculty and students information and resources regarding science and technology, including biology, psychophysics, history, and hardware and software issues.

**2007 – (ACI) NASA Ames Research Center – Senior Technology Strategist (contractor)** - Strategic Business Development Office (Office of the Center Director)

* Developed on highly leveraged technology partnerships between NASA and several major technology companies, matching capability and intents in terms of technology, people, and business strategies.
* Successes included a Memorandum of Understanding between Sun Microsystems and NASA for multi-million dollar value in five areas of collaboration covering supercomputing, Open Source development, and wireless sensor networks.
* Worked on two additional Space Act Agreements with other high tech companies.
* Visited Cape Canaveral and coordinated for deployment of beta commercially available advanced photogrammatic visualization software from Microsoft Research for Space Shuttle flight and in-orbit operations, and possible use for Mars rovers.

**2006-2007** **- Fonly Institute, Palo Alto, CA (contractor)**

* Image processing and device control - C programming under Microsoft Visual Studio & Windows XP to access and process raw color image data from two types of digital cameras.
* Image processing of raw Bayer mosaic color sensor data to achieve grayscale super resolution.
* Advised on lighting, lenses, and UI design for a handheld scanner for 2-D bar codes.
* Prepped image processing software for port to TI DSP for functional prototype of the handheld scanner.

**2004-2006 Sun Microsystems Laboratories, Menlo Park, CA - Senior Staff Engineer**

* Member of the Sun SPOT Project, developing wireless sensors and networks.
* Programmed in C, Java, on OS X and Linux, and nesC under TinyOS on the Crossbow Mote platform (Atmega128L AVR). Shell scripting and CGI-bin programming under Linux. Java on Sun SPOT wireless sensor network platform (ARM7 & ARM9).
* Presented numerous briefings to analysts and major Sun customers, and worked with Sun field sales representatives.
* Filed 6 patents on a new form of time-decay RFID tag, gesture-based UI for provisioning software, novel provisioning and communication schemes for mobile devices, swarm-intelligence based theft detection, and tamper-respondent crypto key distribution. All six have issued..
* Participated in a design study with NASA/JPL for the Deep Space Array Network.
* Co-invented a novel tamper-respondent crypto key device developed for US Navy SPAWAR. Managed subcontractors and suppliers to implement the device. Presented to U.S. Navy.
* Sun’s representative to the working group of the National Technology Roadmap for Productive Nanosystems.
* Member of the Sun Labs committee on Open Source licensing, the Sun Digital Rights Management task force (derived a novel strategic matrix based on identity, sources of data emission, and licensing for Sun’s new DRM strategy), and the Sun CTO patent review committee.
* Championed and contributed to a funded educational project for Sun SPOTS with the Graduate Media Design Program at the Art Center College of Design.
* Invited speaker at the AMIGRO 2006 Ambient Intelligence Conference, Groningen, Netherlands.

**2002-2006 Art Center College of Design, Pasadena, CA - Adjunct Faculty**

* Graduate studies thesis advisor, guest lecturer for the Art Center College of Design graduate Media Studies and graduate Industrial Design departments.

**2003 VIPMobile, Inc. Menlo Park, CA - Head of Research and Development**

* Principal Investigator for the Phase I design and development of the VIPMobile video compression system for SOF Reconnaissance Missions for the U.S. Special Operations Command (SOCOM).
* Brought together the winning team of subcontractors including Droplet Technologies for video compression and Set Engineering (the designers of the original Palm Pilot) for hardware.
* Submitted four SIBR responses to RFP for DOD and DARPA, for U.S. Navy video compression, OSD "smart dog tag" (incorporating UWB radio technology), SOCOM team transportable computer and threat warning system, and DARPA "My Day" personal video archiving system.

**2002-2004 Consultant**

*Intuit, Mountain View, CA*

* Java and C programming for graphics processing under Linux and Windows 2000 for custom processing of customer graphics uploaded via the Web for integration into business forms. Implemented using Java and Open Source software including Ghostscript and ImageMagick.
* Delivered a tutorial on strategy and tactics to Intuit's human factors and marketing teams.

*Mobile Persuasion Laboratory, Stanford University, Stanford, CA*

* Program management for a Palm Pilot application.
* User testing of web based UI.
* Psychological measurement and coding of user testing regarding a web-site "believability" study.

## *Oregon Public Radio*

## Consulted on the design of a simulated high school for web based interactive game aimed at students.

## *Private Clients*

* Video editing and DVD design and production.

**2000-2002 AT&T Labs’ "Menlo Studio", Menlo Park, CA - Technology Consultant (a "Band C" management position)**

* Menlo Studio was an advanced design and prototyping "studio", focusing on small Internet devices and on messaging services.
* Created the concept design for a small wearable digital video cellular network escrow recording device - "Fair Witness".
* Directed a contract with Studio Red of Redwood City to do the mockups, and managed discussions with AT&T Wireless to explore 3G services based on Fair Witness.
* Directed (system architect and group leader) the creation of a very powerful very compact wearable Linux computer system as a prototyping tool for exploring networked rich media services, including Fair Witness - the "Kava Project. Kava was delivered in December 2001 as a Palm III sized wearable Linux computer using a 700MHz Intel XScale processor, a dual CPU AMD DSP, 250M RAM, and 500M Flash, with CD quality digital audio IO, 802.11, Ethernet, and V90 on daughter cards. It was an Open Source hardware & software platform - the first such approved by AT&T legal.
* Program management included developing and managing vendor relationships with Intel, Analog Devices, Studio Red, and Set Engineering.
* Traveled to Europe as AT&T’s representative to the Star Labs sponsored I-Wear Consortium for smart clothing and wearable computers.

**1992-2000 Interval Research Corporation, Palo Alto, CA - Member of the Research Staff, Computation and Perception**

* Interval was founded by Paul Allen (co-founder of Microsoft) and David Liddle (former CEO of Metaphor and vice president of IBM) to explore new models for computing and to develop new technology and interfaces.
* After joining as employee #9, focused on immersive technologies (Virtual Reality), robotics, and interface design.
* Participated in the creation of a large-scale multi-participant virtual environment installation, "Placeholder", which focused on natural landscapes and narrative play. The project was co-sponsored by Interval and the Banff Centre for the Arts in Alberta, Canada. Acted as Interval's technical lead for the project, performing audio field capture and massive amounts of C programming for audio and gestural UI.
* Created and managed a project exploring the use of emotional communication between robots and people, which resulted in a prototype robotic system, and in the granting of a two very broad patents covering emotional communication, where the major prior art cited was Charles Darwin’s "The Expression of the Emotions in Man and Animals".
* Participated in a project designing new interfaces for video browsing and filed a patent application, based on the use of MPEG motion vectors for video search (granted 2007).
* Acted as a technical advisor to an Interval spin-off company producing computer games, Purple Moon, on subjects ranging from primate social behavior to audio field capture, online communities, software standards and tools.
* Public speaking included invited lectures at Stanford University, The Royal College of the Arts (London), and several other campuses and conferences.

**1991-1992 Consultant**

#### Sun Microsystems Labs

* Developed a new methodology for judging image quality (initially applied to JPEG and MPEG compression) based on the visual contrast sensitivity function.
* Lectured lab staff in Mountain View, CA and at Billerica, MA on human and non-human visual perception.
* Evaluated third party technologies for Sun at Reflection Technologies, Inc. (head mounted displays) and Aware, Inc. (wavelet compression).
* Developed algorithms for improved digital halftoning.
* Wrote a white paper analyzing strategy and tactics for technology development of multimedia, virtual/augmented reality, high definition television, and image and video compression, including detailed proposals for developing scalable video compression aimed at computer networked teleconferencing.

#### Prime Arithmetics

* Designed, implemented, and documented a Macintosh application and object-oriented developer's tool kit for the programming, editing, and iconic display of arithmetic strings representing finite multisets and trees.

#### Silicon Beach, Inc. of San Diego

* Developed a C algorithm for fast bi-level error diffusion halftoning that was used in their flagship image processing program "Digital Darkroom".

**1988-1991 XEROX Palo Alto Research Center (PARC) Electronic Document Laboratory, Palo Alto, CA - Member Research Staff**

* Received a Xerox CRG/PARC Inventor's Recognition award for patent work - filed 4 patents (3 of which issued) in the area of embedded digital data in documents, covering two new technologies for invisibly embedding digital data in pixelmaps and documents at much higher bit densities than previous technologies such as bar-codes.
* Received a patent for the design of an amorphous silicon document scanner that was inherently perceptually color-correct.
* Responsible for technology transfer of color rendering/correction, image processing, halftoning, and display software to Xerox business units from EDL.
* Developed image processing, display, printing, and halftoning algorithms and software, and integrated software and hardware systems for a color measurement laboratory.
* Public speaking included lectures at the Bay Area ACM SIGGRAPH on color perception and reproduction and at SiliCon '90 on visual perception in humans and non-humans.

**1987-1988 XEROX Palo Alto Research Center (PARC) Systems Concepts Laboratory, Palo Alto, CA - Contributing Engineer**

* Member of the Smalltak-80 programming group at SCL as it prepared for a spin-out from PARC.
* Designed and implemented graphics, imaging, and printing software for Smalltalk-80.
* Designed and created the logo, disc labels business cards, brochures, promotional materials, etc., for the commercial Xerox rollout of Smalltalk-80.

**1985-1987 Schlumberger Palo Alto Research Computer-Aided Systems Laboratory, Palo Alto, CA - Member Technical Staff**

* Transferred from a business unit into the SPAR research lab to pursue experimental work in color reproduction, based on the spectroradiometry of inks and toners, human visual system color responses, image transducer response curves, and source and target lighting.
* Developed spectroradiometric data presentation and analysis software, used to characterize the psychophysics of color computer graphics hardcopy.
* Developed image processing software - Haar transform (used to synthesize deep depth of focus images from collections of shallow depth of focus images), smoothing, edge enhancement, gamma correction, and color correction.
* Originated the concept of and participated in the system design of the Schlumberger Benson Prism (TM) color controller for Benson’s single-pass color electrostatic plotter.
* Modified black and white UNIX typesetting and rasterization software and device drivers to typeset and print in color, with embedded halftoned color images.

**1983-1985 Benson, Inc. (a Schlumberger company), San Jose, CA - Senior Systems Analyst**

* Designed and implemented a wide variety of graphics software, in C and Fortran, including a portable GKS/VDM interpreter, color halftoning algorithms for a four-color ink-jet plotter, an interactive screen editor for vector text font design, and diagnostic software for Benson controllers and plotters.
* Led corporate C language training.
* Served as liaison with the Fairchild Laboratory for Artificial Intelligence Research, which later became Schlumberger Palo Alto Research (SPAR).

**1981-1983 Compression Labs, Inc., San Jose CA - Senior Software Engineer**

* Group leader of four programmers for 68000 development.
* Designed and implemented a multi-user real-time operating system micro-kernel, written in C and 68000 assembler, for the 68000 based executive processor of CLI's T1 video codec.
* Developed a portable command line interpreter, written in C, for the codec.
* Designed and implemented memory and systems diagnostics for Z80 and 68000 computers.

**1980-1981 Fairchild Test Systems, San Jose, CA - Test Engineer**

* Group leader of five programmers for automatic test equipment programming.
* Invented and implemented an automatic programming system for Nova-3 based bed-of-nails automatic test equipment, and designed and implemented an interactive project database, programming in BASIC and FORTRAN.

**1979-1980 Northrop Defense Systems - Advanced Systems Group, Rolling Meadows, IL - Engineer**

* This position required a DOD "Secret" level clearance.
* Designed and implemented radar signal processing and electronic warfare algorithms, including Walsh transforms, in BASIC, FORTRAN and assembler, and wrote instruction set micro-code for 2901 bitslice.

**1978-1979 Interstate Assurance, Des Moines, IA - Programmer Associate**

* Database programming in FORTRAN, COBOL and 8080 assembler.

**PATENTS (ISSUED)**

Tow, R. "Methods and Means for Embedding Machine Readable Digital Data in Halftone Images" - U.S. Patent no. 5,315,098, May 1994. This is the basic "Smart Paper" (TM) / DataGlyph (TM) patent)

The following three patents describe the technology - a simplified case of the hHalftone case above - used in DataGlyph (TM), as incorporated in Xerox's Paperworks(TM).

Bloomberg, D., Tow, R. - "Adaptive Scaling for Decoding Spatially Periodic Self-clocking Glyph Shape Codes" - U.S. Patent no. 5,091,966, February 1992. *This was the first "Smart Paper" (TM) patent to issue.*

Bloomberg, D., Hect, D., Flores, P., Tow, R. - "Self-clocking Glyph Shape Codes " - U.S. Patent no. 6076738, June, 2000.

Smith, Z, Street, R., Tow, R. - "Spectral Resolving and Sensing Apparatus" - U.S. Patent No. 5,037,201, August 1991. *This the first design for a page scanner that scans spectra, and emits CIE triplets - it is inherently perceptually correct*.

Tow, R. "Affect-based Robot Communication Methods and Systems" - U.S. Patent No 5,832,189, November, 1998. *The major prior art cited was Charles Darwin's "The Expression of the Emotions in Man and Animals"!*

Tow, R. "Affect-based Robot Communication Methods and Systems" - U.S. Patent No 6038493, March, 2000. *This was a continuation of the first robot patent above, citing claims related to actual bodies in space as opposed to simulated bodies.*

Tow, R., Rahimi, A., SaundersS., Charnley, D., Kotik, G- "Video Stream Representation and Navigation Using Inherent Data", U.S. Patent No 7,266,771, September, 2007. *A method of presenting navigation info through stored video taking advantage of pre-computed MPEG motion vectors displayed in a perceptually tuned fashion (e.g., a browse bar of hue/saturation/lightness values).*

Tow, R., Smith, R., Scott, G., Meike, R - "Chemical Modification of An Object", U.S. Patent No 7,321,307, January, 2008*. A new method of providing time coursed activation/deactivation of RFID and other mechanisms.*

Goldman, R., Tow, R., Smith, R. – "Organizing Communications in a Network", U.S. patent No 7697488, April 2010. *A decentralized swarm intelligence method for emergent timing of sparse communication windows in wireless networks.*

Nolan, J., Smith, R., Tow, R. - "Method and Apparatus for Spatially Stationary Software on Mobile Devices", U.S. patent No 7761906, July 2010. *Software as a ghost-like presence of place - locus genii!*

Smith, R., Tow, R. - "Method for Detecting Objects Separated from a Group", U.S. patent No 7538670, May 2009. *A swarm intelligence approach to theft detection, using sensor network "motes".*

Smith, R, Tow, R. - "Method and Apparatus for Transferring Digital Content", U.S. patent No 8659546, January 2014. *A gesture based UI method for provisioning digital content.*

Hughes, J., Tow, R. – "Method and Apparatus for Secure Information Distribution", U.S. patent No 9015075. *A wireless tamper respondent crypto key device using MEMS accelerometers for a gesture interface.*

# PUBLIC VIRTUAL REALITY PROJECT

# "Placeholder: Landscape and Narrative in Virtual Environments". Produced by Brenda Laurel and Rachel Strickland; Interval Research Corporation and The Banff Centre for the Performing Arts, Banff, Alberta, Canada.

**PAPERS (journals, book chapters, and conference proceedings)**

Laurel, B, Tow, R. "Computers: A Classic Reconfigured", *Science* 21 September 2007:

Vol. 317. no. 5845, pp. 1684 – 1685.

Tow, R. "Clockwork and Steam Engines; Apollo and Rain Forests; Ubiquity and Ambience",

AMIGRO 2006 Ambient Intelligence Conference, Groningen, Netherlands.

"Strategy and Tactics for Research and Design", *Design Research: Methods and Perspectives*, Brenda Laurel Ed., M.I.T. Press, October 2003.

Mark Scheeff, John Pinto, Kris Rahardja, Scott Snibbe, Rob Tow. "Experiences with Sparky, a Social Robot". *Proceedings of the Workshop on Interactive Robotics and Entertainment* (WIRE-2000).

Greg Garvey, Brenda Laurel, Rob Tow, Joan Staveley, Allucquere Rosanne Stone. "Grids, Guys and Gals: Are You Oppressed by the Cartesian Coordinate System? " (panel session). SIGGRAPH 1995: 503-505.

Brenda Laurel and Rob Tow, "Placeholder: Real Bodies in Virtual Worlds”. 8th Computer Game Developers Conference, April 1994.

Brenda Laurel, Rachel Strickland, and Rob Tow, "Placeholder: Landscape and Narrative in Virtual Environments." *ACM Computer Graphics Quarterly*, May 1994.

"Placeholder: Technology and the Senses". ACM Computer Graphics Multimedia Conference, October 1994.

"Painting the Future". 1st International Symposium, National Security and National Competitiveness: Open Source Solutions, December 1992.

"An Improved Error Diffusion Algorithm", *Proceedings of the Society for Imaging Science and Technology 43rd Annual Conference*, May 1990.

# PUBLISHED AUDIO AND MUSICAL RECORDINGS

Binaural audio field recording for the “Placeholder” virtual reality project, 1993.

Binaural audio field recording for Purple Moon's "Secret Paths to the Sea", an interactive CD-ROM, 1997.

Guest artist on Tibetan bowls, "Locus Voci", on the album "The Sirius Expeditions" by Dogon (available from New Dog Records, 1998). Recording engineer for binaural digital recording.

"Kelp Scum", ambient field recordings, Rob Tow and Brenda Laurel, 2006.

# EDUCATION

**Grinnell College. University of Iowa, B.Sc.**