Computer Arts Laboratory

Michael Cohen
Professor

Satoshi Nishimura
Associate Professor

Most of the courses taken by engineers and computer science students emphasize scientific discipline and accumulation of "truth." The Computer Arts Lab. activities include such technically objective factors, but also encourage original expression, subjectively motivated by æsthetics rather than "correctness," sometimes "putting the art before the course!" Unlike many other labs' activities that try to converge on a "right answer" sharable by everyone else, artistic disciplines encourage originality, in which the best answer is one that is like no one else's.

The Computer Arts Lab., through its resident Spatial Media Group,[1] is researching projects including practical and creative applications of virtual reality and mixed (augmented, enhanced, hybrid, mediated) reality and virtuality; panoramic interfaces and spatially-immersive displays (especially stereotelephonics, spatial sound, and stereography); wearable and mobile applications, computing, and interfaces; and networked multimedia, with related interests in cves (collaborative virtual environments), groupware and cscw (computer-supported collaborative work); hypermedia; digital typography and electronic publishing; force-feedback displays; telecommunication semiotics (models of teleconferencing selection functions); information furniture; way-finding and navigation (including using a Segway personal transporter); entertainment computing; ubicomp (ubiquitous computing), calm (ambient), and pervasive technology. We are particularly interested in narrowcasting commands, conference selection functions for adjusting groupware situations in which users have multiple presence, virtually existing in more than one space simultaneously. We investigate realtime interactive multimedia interfaces— auditory, visual, haptic, and multimodal:

---

[1] http://www.u-aizu.ac.jp/~mcohen/spatial-media/welcome.html

Auditory We are exploring interfaces for multichannel sound, including stereo, quadraphonic, and nearphones (mounted on our $^{S}_{C}ha_{i}r^{e}$ rotary motion platform), as well as two separate speaker array systems in the **U**niversity-**B**usiness **I**nnovation **C**enter 3D Theater.[2] Lab faculty members Julián Villegas[3] and Michael Cohen[4] teach the "Intro. to Sound and Audio" graduate school course,[5], featuring extensive experiential learning featuring applications such as Audacity and Pure Data. That course is a prerequisite for "Spatial Hearing and Virtual 3D Sound,"[6] taught jointly with Prof. Jie Huang; 黄 捷 in the Human Interface Lab.

With Profs. Robert Fujii; ロバート フジイ and Satoshi Nishimura; 西村 憲 we host a Computer Music Studio, featuring keyboard synthesizers and computer music workstations complemented by assorted amplifiers, racks, mixers, and effects processors.

We annually conduct a **S**tudent **C**ooperative **C**lass **P**roject.[7] In the past we sponsored SCCPs on Digital Compositing (using Photoshop and the Gimp[8]), but in recent years the SCCP has been focused on Computer Music,[9] studying basic music theory and DTM (**d**esk-**t**op **m**usic) software, including samplers and MIDI sequencers[10] to compose and perform student-authored songs. This SCCP segues into a graduate level computer music course.[11]

Visual We promote creative applications of scientific visualization, encouraging the use of Mathematica[12] and stereoscopy,[13] including chromastereoscopy[14] (3D images with depth layers cued by color). We enjoy exploiting the unique large-format immersive stereographic display in the UBIC 3D Theater. The

---

[2]http://www.ubic-u-aizu.jp/shisetsu/kengaku.html

[3]http://www.u-aizu.ac.jp/~julian

[4]http://www.u-aizu.ac.jp/~mcohen

[5]http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Sound+Audio/syllabus.html

[6]http://web-int/~j-huang/Lecture/3DSound/3dsound.html

[7]http://www.u-aizu.ac.jp/official/curriculum/syllabus/3_E_000.html

[8]http://www.gimp.org

[9]http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/Computer_Music

[10]http://www.apple.com/ilife/garageband, http://www.pgmusic.com/band.htm

[11]http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Computer_Music/syllabus.html

[12]http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/Mma.html

[13]http://www.u-aizu.ac.jp/~mcohen/spatial-media/stereograms.html

[14]http://www.chromatek.com

"M-Project" student CAD and CG circle[15] is hosted in our lab, under the supervision of Profs. Satoshi Nishimura; 西村 憲 and Michael Cohen. We are experimenting with various CAD authoring tools, such as 3DStudioMax, Blender, Maya, and Sketch-Up, as well as Illustrator and PhotoShop. We are also exploring creative applications of panoramic imaging and object movies,[16] including a virtual tour of the university.[17]

Haptic We are also exploring the use of haptic interfaces, including force-display joysticks and a rotary motion platform (the "^S_Cha$_i$r^e [for 'shared chair'] Internet Chair"). A recent project deployed the Sudden Motion Sensor in a laptop for gyroscopic control of avatars in a virtual environment.[18] We also convene annual **C**reative **F**actory **S**eminars.[19] Past CFSs explored advanced audio interfaces and panoramic imaging, but in recent years, in conjunction with Prof. Rentaro Yoshioka; 吉岡 廉太郎 [20] of the Active Knowledge Engineering Lab., we conduct a workshop on Haptic Modeling and 3D Printing,[21] using force-feedback CAD workstations[22] to make models that are then rapid prototyped (as stereolithograms) with our personal fabricator,[23] closing the "idea (stored in brain neurons) – information (stored as bits) – matter (atoms)" pathway.

Multimodal Using such multimodal interfaces, our students have crafted driving simulators, location-based games featuring the rotary motion platform,[24] and synæsthetic (cross-sensory modality) visual and haptic music players (rendering songs as light shows[25] or dancing chairs[26]). Using visual sensing techniques, narrowcasting postures can be recognized, and used to control

---

[15]http://mpro-aizu.blogspot.com

[16]http://sonic.u-aizu.ac.jp/spatial-media/QTVR/

[17]http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/HI&VR/VirtualTour/

[18]http://www.u-aizu.ac.jp/~mcohen/welcome/publications/SMS-CVE.mov

[19]http://www.u-aizu.ac.jp/official/curriculum/syllabusCFS/curr04-cfs_e.html

[20]http://www.u-aizu.ac.jp/~rentaro

[21]http://www.u-aizu.ac.jp/official/curriculum/syllabus/2013_2_E_004_000.html#MC05

[22]http://www.sensable.com/products-freeform-systems.htm

[23]http://www.zcorp.com/Products/3D-Printers/spage.aspx

[24]http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips/KuruKuru-pitcher-long.mov

[25]http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips/CITMixedReality_Demo.wmv

[26]http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips/keitai+Schaire2.mov

distributed chatspaces or virtual concerts. A student project deployed a microphone vector to track a moving sound source, using its network interface to trigger internet appliances (like lights that follow the source). We are also developing a driving simulator using collision-detection modulation of the force-feedback steering wheel and the rotary motion platform. A recent version of the project features a dual-steering (front and back) fire truck, racing through a 3D model of our campus to reach a fire, piloted by two drivers, and featuring spatial sound effects. We are interested in exploring using figurative interfaces to express emotion and to control narrowcasting privacy using a media mixing system based on the **S**ession **I**nitiation **P**rotocol for advanced conferencing features. We are also exploring extensions of Open Wonderland,[27] an open-source framework for developing virtual reality environments. Group members developed windshield wipers that dance, featuring beat detection, a digital phase-locked loop, and articulated wiper gestures.[28]

We are also exploring mobile (nomadic, portable) computing, working in conjunction with university spin-offs The Designium,[29] Eyes, JAPAN,[30] and GClue.[31] Such *keitai*-based interfaces can be used to design kaleidoscopic "wallpaper" screen savers, or to control internet appliances, panoramic imaging, spatial sound, or motion platforms. In the past we combined spatial sound with way-finding, using GPS tracking, our Segway personal transporter,[32] and directional transfer functions.

A advanced undergraduate course on "Human Interface and Virtual Reality"[33] surveys many of these topics, contextualized by "machinema" (machine cinema) using "Alice,"[34] featuring student-designed and -programmed, computer-generated interactive stories with 3D animation— including texture maps, photographic compositing, audio effects, speech synthesis, background music— and segments on panoramic and turnoramic imagery, stereopsis, and groupware.

---

[27]http://openwonderland.org
[28]http://www.u-aizu.ac.jp/~mcohen/spatial-media/VMPMyRide
[29]http://www.thedesignium.com
[30]http://www.aizu.com
[31]http://www.gclue.com
[32]http://www.segway.com
[33]http://web-int.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/
HI&VR
[34]http://www.alice.org

Other activities:

We host an annual symposium, the Int. Symposium on Spatial Media,[35] inviting experts to share their knowledge and passion regarding such themes as "Spatial Sound and Spatial Telepresence" ('01), "Magic in Math and Music" ('02), "Advanced Multimedia and Virtual Reality" ('03), "Spatial Sound" ('04), "Hearing and Sound Installations" ('05), "Sound, Audio, and Music" ('06), "Interactive Media, Security, and Stereography" ('06), "Music XML and the Structure of Swing, Understanding Color Media, Media Grid, and Visualization Tools" ('07), "Multimedia Computing" ('08), "Systems and Applications" ('09–'10) "Distributed, Mobile, and Ubiquitous Multimodal Interfaces" ('10–'11), "Social Multimedia" ('11–'12), and "Online Engineering" ('11–'12). This past year our meeting was held in conjunction with the Health 2.0 Fukushima Chapter/Medical × Security Hackathon 2013[36] at Alts Hoshino Bandai Ski Resort.

Our lab sponsors several student performance circles, including the Yasakoi 部 Dance Circle,[37] and **D**isco **M**ix **C**lub.We also sponsor a couple of other student circles, the Dual Boot (Ultimate Frisbee) Flying Disc Club,[38].

Through the research & development, the deployment & integration, of stereographic, spatial sound, haptic, and mobile applications, including virtual and mixed reality, we nurture scientific and artistic interest in advanced computer–human and human–human communication. Our ultimate domain is the exploration of interfaces and artifacts that are literally sensational.

Some relevant links:

Audio Courseware `http://sonic.u-aizu.ac.jp`

Spatial Media `http://sonic.u-aizu.ac.jp/spatial-media/Videos/cohea.html`

> **English** `http://sonic.u-aizu.ac.jp/spatial-media/Videos/coheen.mpg`
>
> **Japanese** `http://sonic.u-aizu.ac.jp/spatial-media/Videos/cohejp.mpg`

Multimedia and Virtual Reality Videos: `http://sonic.u-aizu.ac.jp/spatial-media/Videos/`

> **Mobile control of rotary motion platform** `http://sonic.u-aizu.ac.jp/spatial-media/Videos/keitai+Schaire2.mov`

---

[35] `http://www.u-aizu.ac.jp/~mcohen/welcome/ISSM/12-13/`

[36] `https://www.facebook.com/events/294148637380329/`

[37] `http://www.u-aizu.ac.jp/circles/yosakoi`

[38] `http://www.u-aizu.ac.jp/circles/dualboot`

Dual Driving Simulator `http://sonic.u-aizu.ac.jp/spatial-media/Videos/DualDrivingSimulator.mov`

"VMP My Ride" `http://sonic.u-aizu.ac.jp/spatial-media/Videos/VMPMyRide.mp4`

Mixed Reality Videos `http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips`

Cluspi Control of Rotary Motion Platform `http://sonic.u-aizu.ac.jp/spatial-media/Videos/CLUSPI_demo-QT.mov`

Sudden Motion Sensor Control of Collaborative Virtual Environment `http://sonic.u-aizu.ac.jp/spatial-media/Videos/SMS-CVE.mov`

"Twin Spin" iOS and Android CVE Interface `http://sonic.u-aizu.ac.jp/spatial-media/Videos/Twin_Spin.m4v`

"Whirled Worlds" iOS and Android CVE Interface `http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips/Tworlds2.mp4`

QuickTime Virtual Reality `http://sonic.u-aizu.ac.jp/spatial-media/QTVR/`

U. of Aizu Panorama `http://sonic.u-aizu.ac.jp/spatial-media/QTVR/Aizu_Daigaku.mov`

Object Movie `http://sonic.u-aizu.ac.jp/spatial-media/QTVR/shoe.mov`

Hideo Noguchi + Akabeko `http://sonic.u-aizu.ac.jp/spatial-media/QTVR/Noguchi+Akabeko.mov`

Rotational Degrees of Freedom `http://sonic.u-aizu.ac.jp/spatial-media/QTVR/Rotational-DsoF.mov`

Press and Mass Media Coverage: Fukushima Minpo, June 10, 2010 `http://www.u-aizu.ac.jp/~mcohen/scrapbook/FukushimaMinpo-10.6.10.jpg`

"Nikkei": Nihon Keizai Shimbun; 日本経済新聞, Nov. 5, 2010 (p. 35) `http://www.u-aizu.ac.jp/~mcohen/scrapbook/NihonKeizaiShimbun-2010-11-5-p.35.png`

「スイッチ」, Teleview Fukushima; テレビユー福島, Jan. 4, 2011 `http://www.u-aizu.ac.jp/~mcohen/scrapbook/MAH04434-edited.mov`

Fukushima Minpo, February 18, 2011 (p. 9) `http://www.u-aizu.ac.jp/~mcohen/scrapbook/Fukushima_Minpo_18.2.2011.tiff`

University Newspaper; 大學新聞, Apr. 8, 2011 `http://www.u-aizu.ac.jp/~mcohen/scrapbook/UniversityNewspaper-8.4.11.pdf`

FutureGov Asia Pacific, 20 May 2011 `http://www.futuregov.asia/articles/2011/may/20/japan-university-helps-special-education-school-ic/`

AERA English, October 2011 `http://www.u-aizu.ac.jp/~mcohen/scrapbook/AERAEnglish004.pdf`

Summary of Achievement

Refereed Journal Papers

[mcohen-03:2012] Wai-Man Pang and Jing Qin and Michael Cohen and Pheng-Ann Heng and Kup-Sze Choi. Fast Rendering of Diffusion Curves with Triangles. IEEE *Computer Graphics and Applications*, 32(4):68–78, July/August 2012.

`www.computer.org/portal/web/csdl/doi/10.1109/MCG.2011.86`

Refereed Proceeding Papers

[mcohen-04:2012] Michael Cohen, Rasika Ranaweera, Kensuke Nishimura, Yuya Sasamoto, Tomohiro Oyama, Yukihiro Nishikawa, Tetunobu Ohashi, Ryo Kanno, Anzu Nakada, Jun Yamadera, Sascha Holesch, Yong Ping Chen, Akira Sasaki, and Hayato Ito. "Whirled Worlds": twirling interface for "mobile ambient," "practically panoramic" whole-body entertainment. In *DCE: Digital Contents Expo*, page (none), Tokyo, oct 2012. Digital Content Association of Japan.

`www.dcexpo.jp/2012/en/program/exhibition/detail.php#IT201222`

[mcohen-05:2012] Rasika Ranaweera, Michael Cohen, Kensuke Nishimura, Yuya Sasamoto, Yukihiro Nishikawa, Tetunobu Ohashi, Ryo Kanno, Tomohiro Oyama, Nakada Anzu, and Julián Villegas. Whirled Sequencing of Spatial Music. In *Audio Enginering Society (Japan Section Conf.): The Future of Multichannel Audio*, page (none), Sendai, Japan, oct 2012.

`http://aes-japan.org/wordpress/?p=414`

[mcohen-06:2012] Michael Cohen. Poi *Poi*: Point-of-Interest *Poi* for Multimodal Tethered Whirling. In *MobileHCI: Proc. 14th Int. Conf. on Human-Computer Interaction with Mobile Devices and Services*, pages 199–202, San Francisco, sep 2012. ACM SIGCHI.

`www.mobilehci2012.org`; Honorable Mention, Demonstrations

Academic Activities

[mcohen-07:2012] Michael Cohen, 2012–13.

Voting Member

[mcohen-08:2012] Michael Cohen, March 2012–13.

> Executive Committee, IEEE Computer Society Technical Committee on Computer-Generated Music

Ph.D and Others Theses

[mcohen-09:2012] Oyama Tomohiro; 小山 朋浩 (s1170010). Graduation Thesis: "'Augmented Reality Scenes in Alice Rigged with Whirling Affordance", University of Aizu, 2012–13.

> Thesis Advisor: Michael Cohen

[mcohen-10:2012] Kanno Ryo; 菅野 諒 (s1170144). Graduation Thesis: "Virtual Environment Control with Monotouch iOS Interface", University of Aizu, 2012–13.

> Thesis Advisor: Michael Cohen

[mcohen-11:2012] Dohi Kazuma; 土肥 一馬 (s1170160). Graduation Thesis: "Narrowcasting Alice Privacy Attributes Controlled by Kinect-Deployed Computer Vision Pose Recognition", University of Aizu, 2012–13.

> Thesis Advisor: Michael Cohen

[mcohen-12:2012] Shirakura Juniti; 白倉 潤一 (s1170264). Graduation Thesis: "Development of an Automated Tracing Tool", University of Aizu, 2012–13.

> Thesis Advisor: Michael Cohen

[mcohen-13:2012] Isamu; 田之上 勇武 (s1170201) Tanoue. Graduation Thesis: "Stitching UAV-captured Photos into Panoramic Images", University of Aizu, 2012–13.

> Thesis Advisor: Michael Cohen

[mcohen-14:2012] Senaka Amarakeerthi; セナカ アマラキールテイ (d8111101). Doctoral Disseration: "Voice-Based Emotion Excitation of Collaborative Virtual Environments", University of Aizu, 2012–13.

> Advisor: Michael Cohen

[mcohen-15:2012] Nishikawa Yukihiro; 西川 幸博 (s1170119). Graduation Thesis: "Musical Sequencing Controlled by Whirling Affordance", University of Aizu (didn't graduate), 2012–13.

Thesis Advisor: Michael Cohen

[mcohen-16:2012] Ohashi Tetunobu; 大橋 哲恒 (s1170052). Graduation Thesis: "Collaborative Virtual Environment Event Simulator", University of Aizu, 2012–13.

Thesis Advisor: Michael Cohen

[nisim-01:2012] Hayato Izumi. Graduation thesis: A GPU implementation of an acoustic simulator using path tracing, University of Aizu, 2013.

Thesis Advisor: S. Nishimura

[nisim-02:2012] Kazuho Okuyama. Graduation thesis: Music Classification by Analyzing Harmony Structure, University of Aizu, 2013.

Thesis Advisor: S. Nishimura

[nisim-03:2012] Fumiya Tochigi. Graduation thesis: Hand Shape Estimation using Inverse Kinematics, University of Aizu, 2013.

Thesis Advisor: S. Nishimura

[nisim-04:2012] Masashi Suzuki. Graduation thesis: Frequency modulation synthesis by a GPU, University of Aizu, 2013.

Thesis Advisor: S. Nishimura