Computer Arts Laboratory

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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 (**c**ollaborative **v**irtual **e**nvironments), groupware and CSCW (**c**omputer-**s**upported **c**ollaborative **w**ork); 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 $\overset{S}{c}ha_{i}r^{e}$ rotary motion platform), as well as speaker array systems in the **U**niversity-**B**usiness **I**nnovation **C**enter 3D Theater.[2] Lab faculty members Michael Cohen[3] and Julián Villegas[4] teach the "Intro. to Sound and Audio" graduate school course,[5], featuring extensive experiential learning featuring applications such as Audacity[6] and Pure Data,[7] including tablet-based courseware (an iPad is issued to each student). That course is a prerequisite for "Spatial Hearing and Virtual 3D Sound,"[8] taught jointly with Prof. Jie Huang; 黄 捷 in the Human Interface Lab.

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[9] focused on Computer Music,[10] studying basic music theory and DTM (**d**esk-**t**op **m**usic) software, including samplers and MIDI sequencers[11] to compose and perform student-authored songs. The last two years we have incorporated tablet-based music composition software, issuing an iPad to each member. This SCCP segues into a graduate level computer music course.[12]

Visual We promote creative applications of scientific visualization, encouraging the use of Mathematica[13] and stereoscopy,[14] including chromastereoscopy[15] (3D images with depth layers cued by color). We enjoy exploiting the unique

[2] http://www.ubic-u-aizu.jp/shisetsu/kengaku.html
[3] http://www.u-aizu.ac.jp/~mcohen
[4] http://www.u-aizu.ac.jp/~julian
[5] http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Sound+Audio/syllabus.html
[6] http://audacity.sourceforge.net
[7] http://puredata.info
[8] http://arts.u-aizu.ac.jp/courses/spatial-hearing-and-virtual-3d-sound/
[9] http://web-ext.u-aizu.ac.jp/official/curriculum/syllabus/2015_3_E_001.html#03-004
[10] http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/Computer_Music
[11] http://www.apple.com/ilife/garageband, http://www.pgmusic.com/band.htm
[12] http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Computer_Music/syllabus.html
[13] http://www.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/Mma.html
[14] http://www.u-aizu.ac.jp/~mcohen/spatial-media/stereograms.html
[15] http://www.chromatek.com

large-format immersive stereographic display in the UBIC 3D Theater. The "M-Project" student CAD and CG circle[16] 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, 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 "$\overset{\text{S}}{\text{c}}\text{ha}_{\text{i}}\text{r}^{\text{e}}$ [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, 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,[23] and synæsthetic (cross-sensory modality) visual and haptic music players (rendering songs as light shows[24] or dancing chairs[25]). Using visual sensing techniques, narrowcasting postures can be recognized, and used to control distributed chatspaces or virtual concerts. A student project deployed a mi-

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

[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-1_e.html

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

[21] http://web-ext.u-aizu.ac.jp/official/curriculum/syllabus/2_E_000.html

[22] http://http://geomagic.com/en/products-landing-pages/sensable

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

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

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

crophone 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,[26] 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.[27]

We are also exploring mobile (nomadic, portable) computing, working in conjunction with university spin-offs Aizu Lab,[28] 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.

Other activities:

[26] http://openwonderland.org
[27] http://www.u-aizu.ac.jp/~mcohen/spatial-media/VMPMyRide
[28] www.aizulab.com
[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

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" ('00–'01), "Magic in Math and Music" ('01–'02), "Advanced Multimedia and Virtual Reality" ('02–'03), "Spatial Sound" ('03–'04), "Hearing and Sound Installations" ('04–'05), "Sound, Audio, and Music" ('05–'06), "Interactive Media, Security, and Stereography" ('06–'07), "Internet Media" ('07–'08), "Computation and Music" ('08–'09), "Systems and Applications" ('09–'10) "Distributed, Mobile, and Ubiquitous Multimodal Interfaces" ('10–'11), "Social Multimedia" ('11–'12), "Visual Interfaces for Multimedia Systems" ('12–'13), "Multimodal Signs: Computer Enhancement of User Experience" ('13–'14), and "Audio and Music" ('14–'15). This past year our meeting was held in conjunction with the Health 2.0 Fukushima Chapter/Medical × Security Hackathon 2015[36] at Alts Hoshino Bandai Ski Resort.[37]

Our lab sponsors several student performance circles, including the Yasakoi 部 Dance Circle,[38] and **D**isco **M**ix **C**lub.We also sponsor the Dual Boot (Ultimate Frisbee) Flying Disc Club,[39].

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/`

[35] `http://www.u-aizu.ac.jp/~mcohen/welcome/ISSM/13-14/`

[36] `http://health2con.jp/2015/01/14/medical-x-security-hackathon-2015\%E3\%81\%AE\%E9\%96\%8B\%E5\%82\%AC\%E3\%81\%8C\%E6\%B1\%BA\%E5\%AE\%9A\%E3\%81\%97\%E3\%81\%BE\%E3\%81\%97\%E3\%81\%9F/`

[37] `http://www.alts.co.jp`

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

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

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

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/TwinSpin.m4v

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

"Whirled Worlds": Pointing and Spinning Smartphones and Tables to Control Mult http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/VideoClips/Whirled_Worlds.mov

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」, Televiewe Fukushima; テレビュ福島, 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/

Japan Woche: Interviews mit Michael Cohen und Jun Yamadera, May 25, 2011 https://www.youtube.com/watch?v=ZziK_nueBpI

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

Twirling interface developed for mobile ambient communication, Jan. 25, 2013 http://www.diginfo.tv/v/12-0195-d-en.php

「グローバル化に挑戦する大学」; “Universities challenge to globalization” No. 02, 2014, 「会津大学 コンピュータ理工学部: 最先端の教育で会津から世界へ」, http://www.u-aizu.ac.jp/~mcohen/scrapbook/p11_kiji2_131014.pdf”

Refereed Proceeding Papers

[julian-01:2014] Julián Villegas. Movement perception of Risset tones with and without artificial spatialization. In *Proc. 137 Audio Eng. Soc. Conv.*, page NA, Oct 2014.

The apparent radial movement (approaching or receding) of Risset tones was studied for sources in front, above, and to the right of listeners. Besides regular Risset tones, two kinds of spatialization were included: global (regarding the tone as a whole) and individual (spatializing each of its spectral components). The results suggest that regardless of the direction of the glissando, subjects tend to judge them as approaching. The effect of spatialization type was complex: For upward Risset tones, judgements were, in general, aligned with the direction of the spatialization, but this was not observed in the downward Risset tones. Furthermore, individual spatialization yielded judgements comparable to those of non-spatialized stimuli, whereas spatializing the stimuli as a whole yielded judgments more aligned with the treatment.

[julian-02:2014] Tomomi Sugasawa, Jie Huang, , and Julián Villegas. Relative influence of spectral bands in horizontal-front localization of white noise. In *Proc. 137 Audio Eng. Soc. Conv.*, page NA, Oct 2014.

The relationship between horizontal-front localization and energy in different spectral bands is investigated in this research. Specifically, we tried to identify which spectral regions produced changes in the judgments of the position of a white noise when each band was removed from a front loudspeaker and presented via side loudspeakers. These loudspeakers were set at left and right from the front-midsagittal plane of the listener. Participants were asked to assess whether the noise was coming from the front loudspeaker as bands were moved from front to side loudspeakers. Results from a pilot study suggested differences in the relative importance of spectral bands for horizontal-front localization.

[mcohen-01:2014] Michael Cohen, Rasika Ranaweera, Bektur Ryskeldiev, Tomohiro Oyama, Aya Hashimoto, Naoki Tsukida, and Miyaji Toshimune. Mixed virtuality transducer: virtual camera relative location displayed as ambient light. In *SIGGRAPH Asia Symp. on Mobile Graphics and Interactive Applications*, page Poster demonstration, Shenzhen, China, December 2014.

`http://dl.acm.org/citation.cfm?doid=2669062.`

2684185, http://sa2014.siggraph.org/en/attendees/symposium-on-mobile-graphics-and-interactive-applications.html?view=event&type=soa&event=222. We have built haptic interfaces featuring smartphones and tablets that use compass-derived orientation sensing to animate virtual displays and ambient media. "Tworlds" is a mixed reality multimodal toy using twirled juggling-style affordances crafted with mobile devices to modulate various displays, including 3D models and, now, environmental lighting. A player whirling a "poi"-style weight monitors virtual projection in a graphic display with a displaced, "2nd-person" perspective, able to see the body of the puppet, including orientation of the twirled toy. Correspondence is preserved even as the camera moves continuously around the avatar between frontal and dorsal views in a spin-around "inspection gesture," phase-locked rotation and revolution. To elucidate the relationship between the real and virtual spaces, we use networked lighting: Philips Hue wirelessly networked LED bulbs and original middleware are deployed to indicate the relative position of the virtual camera in user space. Even though the toy itself might be twirled too fast for such lights to follow in the real world, the speed of turning of the virtual camera can be adjusted to accommodate even sluggish lighting switching. The roomware light system takes about a second to adjust the distributed bulbs, but virtual camera position and invocation of tethered or mirrored perspective mode has the luxury of separate timing: even though a user might be whirling an affordance with a typical angular tempo of perhaps 1 Hz, the virtual camera can accommodate lumbering distributed lighting, leisurely swinging around in synchrony. "Mobile-ambient" describes integration of personal control and public display, such as Tworld's mobile affordances projected onto social screens and back-projection of virtual camera position. This mixed reality environment, using playfully fluid perspective to blur the distinction between sampled and synthesized data, is literally illuminated by networked lighting.

[mcohen-02:2014] Wataru Sanuki, Julián Villegas, and Michael Cohen. Spatial Sound for Mobile Navigation. In *Audio Engineering Society (136rd Conv.*, page Engineering Brief, Berlin, April 2014.

[mcohen-03:2014] Bektur Ryskeldiev, Aya Hashimoto, Toshimune Miyaji, and Michael Cohen. Twirling Gestural Musical Sequencing and Synthesizing. In *Proc. HC: Int. Conf. on Humans and Computers*, page http://http://ktm11.eng.shizuoka.ac.jp/HC2014/, Aizu-Wakamatsu, Hamamatsu, and Düsseldorf, December 2014.

We have built interfaces featuring smartphones and tablets that use magnetometer-derived orientation sensing to control spatial sound, motion platforms, panoramic and turnoramic image-based renderings, virtual displays, and other programs.

[mcohen-04:2014] Michael Cohen, Rasika Ranaweera, Bektur Ryskeldiev, Tomohiro Oyama, Aya Hashimoto, Naoki Tsukida, and Miyaji Toshimune. Multimodal mobile-ambient transmedial twirling with environmental lighting to complement fluid perspective with phase-perturbed affordance projection. In *SIGGRAPH Asia Symp. on Mobile Graphics and Interactive Applications*, pages `http://dl.acm.org/citation.cfm?doid=2669062.2669080`, `http://sa2014.siggraph.org/en/attendees/symposium--on--mobile--graphics--and--interactive--applications.html?view=event&type=soa&event=210`, Shenzhen, China, December 2014.

[mcohen-05:2014] Michael Cohen. From Killing Trees to Executing Bits: A Survey of Computer-Enabled Reading Enhancements for Evolving Literacy. In *VSMM: Proc. Int. Conf. on Virtual Systems and Multimedia*, page `www.vsmm2014.org`, Hong Kong, December 2014.

[nisim-01:2014] Satoshi Nishimura. Takt: A read-eval-play-loop interpreter for a structural/procedural score language. In *Proc. of the 40th International Computer Music Conference*, pages 1736–1741. ICMA, September 2014.

A new language for describing musical scores as well as its interpreter is developed. The language allows a concise description of note and chord sequences, and at the same time, it provides rich programming functionalities with C-like syntax, which are useful for algorithmic composition. Representing structures in music such as repetitive occurrences of a common phrase or its variation is supported with macros and phrase transformation modules. The interpreter enables us to execute its program code interactively with a read-eval-play loop. The interpreter can also be used for the real-time processing of MIDI events coming from input devices. The language is extensible in that C functions can be called from its program code.

Grants

[julian-03:2014] Julián Villegas and Michael Cohen. Perceptual tests for next generation of speech codec for mobile phones (3GPP SA4 EVS codec), 2014.

Academic Activities

[julian-04:2014] Julián Villegas, 2014.

Reviewer, 9th Design and Emotion Conf.

[mcohen-06:2014] Michael Cohen, March 2014–15.

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

[mcohen-07:2014] Michael Cohen, 2014–15.

IEEE MMTC (Multimedia Communications Technical Committee) Voting Member, `http://community.comsoc.org/groups/ieee-mmtc`

Ph.D and Others Theses

[julian-05:2014] Tomomi Sugasawa. Relative influence of spectral bands in horizontal-front localization of white noise, University of Aizu, Mar 2014.

Thesis Advisor: Julián Villegas

[julian-06:2014] Seiya Hoshi. Steganography in stereo signals using phase changes, University of Aizu, Mar 2014.

Thesis Advisor: Julián Villegas

[mcohen-08:2014] Hashimoto Aya; 橋本 彩 (s1180020). Graduation Thesis: "MIDI sequencing for Twirling Interface in Collaborative Virtual Environment Groupware", University of Aizu, 2014–15.

Thesis Advisor: Michael Cohen

[mcohen-09:2014] Komatsubara Yuki; 小松原 由紀 (s1190100). Graduation Thesis: "Graphical Affect-Based Animation of Facial Expression Based on Mined Twitter Stream", University of Aizu, 2014–15.

Thesis Advisor: Michael Cohen

[mcohen-10:2014] Yokokoji Takeshi; 横小路 健 (s1190081). Graduation Thesis: “Duplex Communication for Android-based Client in Collaborative Virtual Environment”, University of Aizu, 2014–15.

Thesis Advisor: Michael Cohen

[mcohen-11:2014] Takuya; 岡本　拓也 (s1180170) Okamoto. Graduation Thesis: “Panoramic Browsing Client for Collaborative Virtual Environment Groupware”, University of Aizu, 2014–15.

Thesis Advisor: Michael Cohen

[mcohen-12:2014] Ryskeldiev Bektur; リスケリヂィエフ ベクトウル (m5171140). Masters Thesis: “Sound Spatialization for Mobile Devices”, University of Aizu, 2014–15.

Masters Thesis Supervisor: Michael Cohen

[mcohen-13:2014] Shiratori Shun; 白鳥 峻 (m5151148). Masters Thesis: “Semi-automatic 3D model creation and animation using Kinect, Skanect, and Maya”, University of Aizu, 2014–15.

Masters Thesis Supervisor: Michael Cohen

[mcohen-14:2014] Gu Lin; 顧 琳 (d8142102). Doctoral Dissertation: “Cost Efficient Resource Management in Geo-distributed DataCenters”;「地理的に分散するデータセンターのコスト効率的な資源管理」, University of Aizu, 2014–15.

Doctoral Dissertation Referee: Michael Cohen

[nisim-02:2014] Masatoshi Seki. Graduation thesis: Music Classification by rhythm using Template Matching, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

[nisim-03:2014] Nobuyuki Kosuga. Graduation thesis: Automatic equalization for emphasizing vocal sound, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

[nisim-04:2014] Kazuhiro Tasaki. Graduation thesis: Simulating sound reflection in 3D virtual space by ray tracing, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

[nisim-05:2014] Kazuya Kishimoto. Master thesis: Acceleration of Photon Mapping by Applying Special Hardware, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

[nisim-06:2014] Yuya Naito. Graduation thesis: Efficient rendering of free-form surfaces with FPGAs, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

[nisim-07:2014] Tasuku Sagara. Graduation thesis: Web-based cooperative rendering with a server and a client, University of Aizu, 2015.

Thesis Advisor: S. Nishimura

Others

[mcohen-15:2014] Sanuki Wataru; 讃岐 航. "Machi-Beacon";「町ビーコン」. "Aizu Industry IT Technology";「会津産ＩＴ技術認定証授与式兼産学連携フォーラム」contest, January 2014.

Aizu IT Forum Encouragement Prize. Supervised by Julián Villegas and Michael Cohen.

[mcohen-16:2014] Michael Cohen. From Killing Trees to Executing Bits: A Survey of Computer-Enabled Reading Enhancements for Evolving Literacy. VSMM: 20th Int. Conf. on Virtual Systems and Multimedia, December 2014.

"Best Paper" Award, Information Visualization track, and "Best Paper" Award Overall, `http://www.vsmm2014.org/#!awards/c1x35`