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." 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," artistic disciplines encourage originality, in which the best answer is one that is like no one else's.

The Computer Arts Lab., including through its resident Spatial Media Group,[1] is researching projects including practical and creative applications[2] 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; 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 multipresence, virtually existing in more than one space simultaneously. We investigate realtime interactive multimedia interfaces— auditory, visual, haptic, and multimodal:

[1] `http://u-aizu.ac.jp/~mcohen/spatial-media/welcome.html`
[2] `https://u-aizu.ac.jp/research/researchlist/enlist?searchActivity=5`

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.[3] Julián Villegas[4] leads a **S**tudent **C**ooperative **C**lass **P**roject on Pure Data ("Pd"),[5] and also teaches an advanced graduate level course on Music Technology.[6] Lab faculty members Michael Cohen[7] and Julián teach the ITC02: "Intro. to Sound and Audio" graduate school course,[8] featuring extensive experiential learning featuring applications such as Audacity[9] and Pure Data,[10] including tablet-based courseware (an iPad is issued to each student). That course is a prerequisite for "Spatial Hearing in Virtual Environment,"[11] which was started by Prof. Jie Huang in the Human Interface Lab.

We support a Computer Music Studio, featuring keyboard synthesizers and computer music workstations complemented by assorted amplifiers, racks, mixers, and effects processors.

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). The annual Chromastereoptic Picture Contest[15] exhibition is mounted[16] in the university library. We enjoy exploiting the unique large-format immersive stereographic display in the UBIC 3D Theater. The "M-Project" student CAD and CG circle[17] is hosted in our lab, under the supervision of Profs. Satoshi Nishimura[18] and Michael

[3] http://www.ubic-u-aizu.jp/shisetsu/kengaku.html
[4] http://u-aizu.ac.jp/~julian
[5] http://onkyo.u-aizu.ac.jp/index.php/classes/pd/
[6] http://u-aizu.ac.jp/official/curriculum/syllabus/2016_2_E_005.html#ITA01
[7] http://u-aizu.ac.jp/~mcohen
[8] http://u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Sound+Audio/syllabus.html
[9] http://audacity.sourceforge.net
[10] http://puredata.info
[11] http://onkyo.u-aizu.ac.jp/index.php/classes/3d-sound/
[12] http://u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/Mma.html
[13] http://u-aizu.ac.jp/~mcohen/spatial-media/stereograms.html
[14] http://www.chromatek.com
[15] http://web-ext.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/HI&VR/ChromadepthPictureContest
[16] http://u-aizu.ac.jp/en/intro/facilities/library/library5.html, http://u-aizu.ac.jp/intro/facilities/library/library5.html
[17] http://mpro-aizu.blogspot.com
[18] http://u-aizu.ac.jp/e-intro/e-faculty/e-undergraduate/e-undergraduate2/

Cohen. Students use various CAD authoring tools— such as 3DStudioMax, Blender, Maya, and Sketch-Up, as well as Illustrator and PhotoShop— to make digital contents such as videos. A photomosaic of our faculty was compiled, both hyperlinked[19] and flickering.[20] We are also exploring creative applications of panoramic imaging and object movies, including a virtual tour of the university[21] and photospheres of the university in Spring[22] and Winter[23].

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"). We deployed the sudden motion sensor in a laptop for gyroscopic control of avatars in virtual environments.[24] We also convene annual **C**reative **F**actory **S**eminars.[25] Iin conjunction with Prof. Rentaro Yoshioka[26] of the Active Knowledge Engineering Lab., we conduct a workshop on Haptic Modeling and 3D Printing,[27] using force-feedback CAD workstations[28] to make models that are then rapid prototyped (as stereolithograms) with a 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,[29] and synæsthetic (cross-sensory modality) visual and haptic music players (rendering songs as light shows[30] or dancing chairs[31]). Using visual sensing techniques, narrowcasting postures can be recognized, and used to control

e-nisim.html

[19] http://u-aizu.ac.jp/~mcohen/welcome/UoAmosaic/faculty2.html

[20] http://u-aizu.ac.jp/~mcohen/welcome/UoAmosaic/faculty.gif

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

[22] https://theta360.com/s/gdDcKZaDaa9PKL5F9eeJ4T47A

[23] https://theta360.com/s/3SiAETczscXILlKMb5CldF5RE

[24] http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/Videos/SMS-CVE.m4v

[25] http://web-int.u-aizu.ac.jp/official/faculty/sad/CFSlist.pdfl

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

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

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

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

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

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

distributed chatspaces or virtual concerts. We are interested in exploring using figurative interfaces to express emotion and to control narrowcasting privacy using a media mixing system for advanced conferencing features. We are also exploring extensions of Open Wonderland,[32] 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.[33] Lately we have been playing with the Unity[34] IDE, including deployment in HMDs, such as the HTC Vive.[35]

We are also exploring mobile (nomadic, portable) computing, working in conjunction with university spin-offs Aizu Lab,[36] The Designium,[37] Eyes, JAPAN,[38] and GClue.[39] We have developed and published the "Twhirleds" app[40] on Google Play for Android[41] and Apple iTunes App Store for iOS.[42] Such *keitai*-based interfaces can be used to control internet appliances, panoramic imaging, spatial sound, or motion platforms.

A advanced undergraduate course on "Human Interface and Virtual Reality"[43] and a parallel graduate course "Multimedia Machinima"[44] surveys many of these topics, contextualized by "machinima" (machine cinema) using "Alice,"[45] 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:

We host an annual symposium, the Int. Symposium on Spatial Media,[46] invit-

[32] http://openwonderland.org
[33] http://u-aizu.ac.jp/~mcohen/spatial-media/VMPMyRide
[34] https://unity3d.com/
[35] https://www.vive.com/
[36] http://www.aizulab.com
[37] http://www.thedesignium.com
[38] http://www.aizu.com
[39] http://www.gclue.com
[40] http://u-aizu.ac.jp/~mcohen/spatial-media/Twhirleds/
[41] https://play.google.com/store/apps/details?id=jp.ac.u_aizu.Twhirleds
[42] https://itunes.apple.com/us/app/twhirleds/id962674836
[43] http://web-int.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/HI&VR/
[44] http://web-int.u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/graduate/Multimedia_Machinima/
[45] http://www.alice.org
[46] http://u-aizu.ac.jp/~mcohen/welcome/ISSM/16-17/

ing 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), "Audio and Music" ('14–'15), "Cybersound" ('15–'16), and "Math and Multimedia" ('16–'17). This past year our meeting in conjunction with the Fukushima Hackathon at Alts Hoshino Bandai Ski Resort.[47]

Our lab sponsors several student performance circles, including the Yosakoi Dance Circle,[48] and DMC, the **D**isco **M**ix **C**lub.We also sponsor the Dual Boot (Ultimate Frisbee) Flying Disc Club.[49]

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

[47] `http://www.alts.co.jp`
[48] `http://u-aizu.ac.jp/circles/yosakoi`
[49] `http://u-aizu.ac.jp/circles/dualboot`

"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/Videos/

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

Audio Narrowcasting for Multipresent Avatars on Workstations and Mobile Phones http://sonic.u-aizu.ac.jp/spatial-media/mixedreality/Videos/00612_00000.mpg

Sudden Motion Sensor Control of Collaborative Virtual Environment http://sonic.u-aizu.ac.jp/spatial-media/Videos/SMS-CVE.m4v

"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/Videos/Tworlds2.mp4

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

Spatial Media Group YouTube Channel https://www.youtube.com/channel/UCJrpDTHGCuNvdW_vdDkFB6g

"Twhirleds" for iOS and Android https://www.youtube.com/watch?v=XF2pGPDrr7s

"CVE": Collaborative Virtual Environment https://www.youtube.com/watch?v=4jauDFbTxgg

Padiddle and Poi rigs: spinning and whirling control of photospherical browsing href="https://www.youtube.com/watch?v=Fpgj6nNb6ns

Motorized turn-table for automatic panning capture https://www.youtube.com/watch?v=XvMFTTOM9_U

"Schaire" Rotary Motion Platform https://www.youtube.com/watch?v=ttK4yGpBkw0

"Lights, Camera, Action!": Ambient lighting extending photospherical display https://www.youtube.com/watch?v=Y7uIvOCgxpE

"Exocentric Rendering of 'Reality Distortion' User Interface Illustrating Egoce https://www.youtube.com/watch?v=lC7cNSB1ZWE

Panoramic and Photospherical Imagery 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

Spring https://theta360.com/s/gdDcKZaDaa9PKL5F9eeJ4T47A

Winter https://theta360.com/s/3SiAETczscXILlKMb5CldF5RE

Virtual tour of the U. of Aizu http://u-aizu.ac.jp/~mcohen/welcome/courses/AizuDai/undergraduate/HI&VR/VirtualTour/

Press and Mass Media Coverage Gokujo-no-Aizu Project Council https://www.facebook.com/gokujounoaizu.iti

UoA Student Teams Win Grand Prize and Other Awards at SPAJAM 2016 Sendai http://u-aizu.ac.jp/en/information/spajam-sendai2016.html

Team with UoA Student Win Awards at the Tokyo Round of Japan VR Hackathon http://u-aizu.ac.jp/en/information/vr-hack2016.html

"Best Paper Award," Electromagnetics and Control Systems Track, at IEEE IEMC http://u-aizu.ac.jp/en/information/ieee-iemcon-2016.html

Refereed academic journal

[julian-302-016-01:2016] Jorge González-Alonso, Julián Villegas, and M.P. García-Mayo. English compound processing in bilingual and multilingual speakers: The role of dominance. *Second Language Research*, 2016.

This article reports a study which investigated the relative influence of the first and dominant language on L2 and L3 morpho-lexical processing. A lexical decision task compared the responses to English NV-er compounds (e.g. taxi driver) and non-compounds provided by a group of native speakers and three groups of learners at various levels of proficiency in English: L1 English-L2 Spanish sequential bilinguals and two groups of early Spanish-Basque bilinguals with English as their L3. Crucially, the two trilingual groups differed in their first and dominant language (i.e. L1 Spanish-L2 Basque vs. L1 Basque-L2 Spanish). Our materials exploit an (a)symmetry between these languages: while Basque and English pattern together in the basic structure of NV-er compounds, Spanish presents a very different construction. Results show differences in response times that may be ascribable to two factors beyond proficiency: the number of languages spoken by a given participant and the nature of their L1. An exploration of response bias reveals an influence of the participants' L1 on the processing of NV-er compounds. Our data suggest that morphological information in the nonnative lexicon may extend beyond morphemic structure, that there are costs to additive multilingualism in lexical retrieval, and that most of these effects are attenuated by proficiency.

[mcohen-302-016-01:2016] Rasika Ranaweera and Michael Cohen. Gestural Interface for Conducting Virtual Concerts. *IEEJ Trans. on Electronics, Information and Systems (C)*, 136(11):1567–1573, 2016.

We have created a mixed reality concert application using Alice, a 3D rapid prototyping programming environment, in which musical instruments are arranged around a virtual conductor (in this case the user) located at their center. A user-conductor can use a smartphone as a simplified baton, pointing at a preferred instrument and tapping a button to start playing. The volume and panning of a selected instrument can be adjusted by simply tilting and steering the smartphone. When selected, an instrument is jiggled or its components dilated and contracted, and a spotlight illuminates it until the instrument is muted, providing conductor and audience with visual cues about the ensemble. Unlike other systems, ours does not re-

quire user or equipment to be placed at specific locations (contrasted with Kinect, Wii sensors, or camera-based tracking systems), there is no issue regarding room lighting (such as digital camera-based tracking systems or Kinect), nor interference with other players or obstacles. The goal of using different equipment as a conductor's baton is to allow nonexpert users to lead a realtime concert within a cyberworld. The synchronization of gestures with music and animation has been one of the biggest challenges in many systems we have surveyed, although ours had only minimal delays. We had compared user experience with a contemporary commercial game, receiving acceptable ratings from the participants.

[mcohen-302-016-02:2016] Michael Cohen, Blanca Mancilla, and John Plaice. Zebrackets: A Score of Years and Delimiters. *TUGboat: Communications of the TeX Users Group*, 37(2):214–221, 2016.

In this paper, we present the resurrection of the Zebrackets project, originally initiated by the first author 20 years ago, with which parentheses and brackets are zebra-striped with context information. There are two reasons for this innovation: first, to improve the visual presentation of the necessary linearization of hierarchical structures in text, and second, to make a first step away from the assumption that documents must be built up from a set of unchanging atoms called characters.

[mcohen-302-016-03:2016] Michael Frishkopf, Michael Cohen, and Rasika Ranaweera. Curating Ethnomusicology in Cyberworlds for Ethnomusicological Research: 'World Music in Wonderland'. *Ethnologies (Exhibiting Soundscapes; Exposer les paysages sonores)*, 37(1):119–132, 2015.

Cyberworlds open new avenues for ethnomusicological research. A cyberworld is an online social space, with implications for real-world social interaction and culture-formation. Cyberworlds can model the real world, but are also embedded within it. Cyberworlds are thus of tremendous interest to many scholars working in the social sciences and the humanities. As cyberworlds incorporating music become increasingly prominent (especially in multiuser videogames), the task of studying them falls to ethnomusicology. The ethnomusicologist seeks to comprehend social dimensions of musical cyberworlds, to enhance their musical functions, and to further understand music in social-cultural contexts more generally, since cyberworlds are closely related to the real world, and impact it strongly.

Unrefereed academic journal

[julian-302-016-02:2016] Julián Villegas. Improving singing experience for people with tuning difficulties. *Sound*, 32:10–14, 2017.

Based on the association of psychoacoustic roughness and musical pitch, and inspired by the common tuning technique of eliminating aural beats between the strings of an instrument, we hypothesize that users of our system could adjust their intonation in order to minimize the interference between their current and desired pitch (a modulated version of his or her current voice). It is our hope that this process could lead to long-term singing improvements, as well. This work-in-progress report discusses implementation issues, expression possibilities, and future evaluations of this tool as an alternative for improving singing skills in self-refrained singers.

Refereed proceedings of an academic conference

[julian-302-016-03:2016] Julián Villegas and Takaya Ninagawa. Pure-data-based transaural filter with range control. In *Proc. 5th Int. Pure Data Convention*, Nov 2016.

We present an extension to Pure-data by which users can truly spatialize sound via a pair of loudspeakers, i.e., spatialize monaural sound sources at an arbitrary azimuth, elevation, and distance. Although transaural techniques have been long explored, our system takes advantage of a recently collected Head-Related Impulse Response (hrir) dataset measured in the near field (20–160 cm from the center of a mannequin's head) to allow a more accurate distance control, a missing feature in other implementations.

[julian-302-016-04:2016] Julián Villegas, Tore Stegenborg-Andersen, Nick Zacharov, and Jesper Ramsgaard. A comparison of stimulus presentation methods for listening tests. In *Proc. 141 Audio Eng. Soc. Int. Conv.*, Sep. 2016.

This study investigates the impact of relaxing presentation methods on listening tests by comparing results from two identical listening experiments carried out on two countries and comprising two presentation methods: the ITU-T P.800 Absolute Category Rating (ACR) recommendation and a modified version of it where assessors had more control on the reproduction of

the samples. Compared with the standard method, test duration was reduced on average 37% in the modified version. No significant effects of the method used on the ratings of codecs were found, but a significant effect of site on ratings and duration were found. We hypothesize that in the latter case, cultural differences and instructions to the assessors could explain these effects.

[julian-302-016-05:2016] Jeremy Perkins, Seunghun Lee, and Julián Villegas. The roles of phonation and f0 in Wuming Zhuang tone. In *Proc. 22nd Himalayan Languages symp.*, Jun. 2016.

This study reports phonetic measurements of the tonal system of Wuming Zhuang. While previous analyses have described Wuming Zhuang's tone contrasts using F0 only, this study finds that that creaky phonation can distinguish pairs of tones that have similar F0 contours, suggesting that creakiness, in addition to F0, may play a role in distinguishing tones. A composite acoustic algorithm is applied as a way to compute creaky phonation and is offered as an alternative method for linguists interested in measuring phonation from the acoustic signal.

[julian-302-016-06:2016] Jeremy Perkins, Seunghun Lee, and Julián Villegas. An interplay between F0 and phonation in Du'an Zhuang tone. In *TAL: Proc. 5 Int. Symp. on Tonal Aspects of Languages*, Buffalo, May 2016.

This paper undertook an acoustic study of the tone system of Du'an Zhuang, finding that unlike the standard dialect, Wuming Zhuang, its tone system involved phonation differences in addition to F0 and duration differences. It was found that two of the six tones in unchecked syllables in Du'an Zhuang involved significant creakiness near the midpoint of the vowel. In checked syllables, a three-way tonal contrast was observed based on F0 contours, but not creakiness. These results suggest a phonological tone contrast that involves both F0 and creakiness. Among pairs of tones that differed in their phonation, significant differences in the timing of F0 fall were discovered. Additionally, the two creaky tones differed in the timing of the maximum creakiness. Future research on the perception side could establish whether and to what extent Du'an Zhuang speakers utilize creakiness and F0, and their relative timing, in discerning between tonal categories.

[julian-302-016-07:2016] Donna Erickson, Julián Villegas, Ian Wilson, Yuki Iguro, Jeff Moore, and Daniel Erker. Some acoustic and articulatory corre-

lates of phrasal stress in Spanish. In *Proc. 8 Speech Prosody*, Boston, MA, May 2016.

All spoken languages show rhythmic patterns. Recent work with a number of different languages (English, Japanese, Mandarin Chinese, French) suggest that metrically assigned stress levels of the utterance show strong correlations with the amount of jaw displacement, and corresponding F1 values. This paper examines some articulatory and acoustic correlates of Spanish rhythm; specifically, we ask if there is a correlation between phrasal stress values metrically assigned to each syllable with acoustic and articulatory values. We used video recordings of 3 Salvadoran Spanish speakers to measure for each vowel maximum jaw displacement, mean F0, mean intensity, mean duration, and mid vowel F1 of two Spanish sentences. The results show weak but significant correlations between jaw displacement and F1/ intensity, but no correlation between jaw displacement and F0. We also found strong correlations between stress, duration, and F1, and weaker, but significant correlations between stress and mean intensity /maximum jaw displacement.

[julian-302-016-08:2016] Julián Villegas. An online benchmarking platform for visualizing ionizing radiation doses in different cities. In *Proc. of* EATIS: 8th Euro-American Conf. on Telematics and Information Systems, April 2016.

A working prototype for alternative visualizations of environmental data (currently, ionizing radiation) measured with bGeigie nano Safecast sensors is presented. Contrary to previous interfaces, in this visualization users have finer control of the displayed data (i.e., can determine date ranges, compare locations, decide the averaging areas, etc.) and more detailed information of the resulting visualization (size of the samples per day and per region, etc.). With this new data visualization, it is easier to compare local environment figures with those of other regions of the planet.

[mcohen-302-016-04:2016] Michael Cohen. Demo: Smartphone Rigging with GUI Control Emulation for Freeware Rapid Prototyping of Mixed Virtuality Scenes. In *SIGGRAPH Asia Symp. on Mobile Graphics and Interactive Applications*, Macao, dec 2016.

We have developed a networked phantom GUI control emulator that can click and type into otherwise stand-alone applications. In conjunction with rapid prototyping "Alice" desktop VR system, and previously developed "Twhirleds" smartphone applications and network interfaces, all of which

are freely available, anyone with a contemporary smartphone can rig scene parameters to affordance orientation so that manipulative position controls virtual scene elements.

[mcohen-302-016-05:2016] Michael Cohen, Yousuke Nagayama, and Bektur Ryskeldiev. Metering "Black Holes": Networking Stand-Alone Applications for Distributed Multimodal Synchronization. In *Proc. ICMI: ACM Int. Conf. on Multimodal Interaction*, Tokyo, nov 2016.

We have developed a phantom GUI emulator that can read from otherwise stand-alone applications, complementing a separate parallel program that can write to such applications. In conjunction with the "Alice" desktop VR system and previously developed "Collaborative Virtual Environment," both of which are freely available, virtual scene exploration can synchronize with multimodal peers, including panoramic browsers, spatial sound renderers, and smartphone and tablet interfaces.

[mcohen-302-016-06:2016] Isuru Jayarathne, Michael Cohen, and Senaka Amarakeerthi. BrainID: Development of a Biometric EEG-Based Authentication System. In *IEMCON: Proc. 7th Annual Information Technology, Electronics and Mobile Communication Conf.*, pages 1–6, Vancouver, oct 2016. IEEE.

Authentication is a crucial consideration when securing data or any kind of information system. Though the existing approaches for authentication are user-friendly which are vulnerable in cases such as threatening the user. In this paper, we propose a novel approach which uses Electroencephalogram (EEG) brain signals for the authentication process. The unique features of EEG data for distinguishing brain activities can be potentially used to authenticate a user. Compared to other biometric systems, this approach is very robust and more secure because the response is significantly changed according to the instantaneous mental condition. In the proposed approach, the system user is asked to visualize a number while capturing the corresponding EEG signals. First, captured signals are used to train the system and the same method was followed in the authentication process. This approach mainly focuses on the 8 to 30 Hz frequency band across all EEG channels, since it is the most appropriate and faultless band for EEG signals in Brain Computer Interfaces (BCI). Common Spatial Patterns (CSP) values are used as main features to train the model. Linear discriminant analysis (LDA) is used in the proposed model as a classification algorithm for a given

set of user data. A trained set of models for each user is embedded in the system as a parameter database. Each user should select the profile attached to their trained model before the authentication session. Eventually, a trained model can authenticate a user after the memorization or deliberation of predefined four digits which the user is asked to imagine in his mind in the very first stage of the process. The maximum accuracy recorded with the existing data was 96.97 percent.

[mcohen-302-016-07:2016] Michael Cohen, Blanca Mancilla, and John Plaice. Zebrackets: A Score of Years and Delimiters. In Karl Berry, editor, *TUG: TeX Users Group Meeting*, volume 37, Toronto, jul 2016.

In this paper, we present the resurrection of the Zebrackets project, initiated by the first author 20 years ago, with which parentheses and brackets are zebra-striped with context information. There are two reasons for this innovation: first, to improve the visual presentation of the necessary linearization of hierarchical structures in text, and second, to make a first step away from the assumption that documents must be built up from a set of unchanging atoms called characters.

Unrefeered proceedings of an academic conference

[julian-302-016-09:2016] Yuki Iguro, Ian Wilson, and Julián Villegas. Articulatory settings of English-French bilinguals reanalyzed by SS-ANOVA. In *J. Acoust. Soc. Am.*, volume 140, pages 3222–3222, 2016.

To improve the skill of speaking a second language (L2), one good way may be to be aware of the underlying tongue position for a language. We focused on such underlying position differences between English and French, particularly when pausing for a short time between speaking; something called inter-speech posture (ISP). In past research, Wilson and Gick investigated ISP between English and French spoken by bilinguals. In that research, bilinguals had distinct articulatory settings for each language, mostly in the lips. However, their tongue data was for only 4 points of articulatory settings: distance from the ultrasound probe to tongue root, tongue dorsum, tongue body, and tongue tip, but not overall shape. Furthermore, to measure tongue tip position, past research relied on the alveolar ridge, which is unclear to see: possibly making the results inaccurate for tongue tip. In this study, we analyzed the whole shape of the tongue and made models of them using SS-ANOVA in R so that we could compare

the difference from past research using a different measurement method. Our results showed that bilinguals who are perceived as native in both languages have a different ISP in the posterior half of the tongue.

[julian-302-016-10:2016] Julián Villegas, Jeremy Perkins, and Seunghun J. Lee. Psychoacoustic roughness as creaky voice predictor. In *J. Acoust. Soc. Am.*, volume 140, pages 3394–3394, 2016.

The use of psychoacoustic roughness as a predictor of creaky voice is reported. Roughness, a prothetic sensation elicited by rapid changes in the temporal envelop of a sound (15-300 Hz), shares qualitative similarities with a kind of phonation known as vocal fry or creakiness. When a creakiness classification made by trained linguists was used as a reference, a classifier based on an objective temporal roughness model yielded results similar to an artificial neural network-based predictor of creakiness, but the former classifier tended to produce more type I errors. We also compare the results of the roughness-based prediction with those predicted by samples of three populations who use creakiness contrastively in different degrees: Japanese (where creakiness is not systematically used for phonetic contrast), Mandarin (where creakiness is used as a secondary cue), and Vietnamese (where creakiness is used as a phonetic contrast between tones). The roughness-based classification seems to better agree with classifications made by the untrained listeners. Our findings suggest that extreme roughness values (¿4 asper) in combination with local prominences on the roughness temporal profile of vocalic segments could be used for classification of creaky intervals in running speech.

[julian-302-016-11:2016] Julián Villegas. Measuring acoustic feature from audio and EGG recordings. In *Proc. Int. Electroglottography Workshop*, 2016.

[mcohen-302-016-08:2016] Akihito Suzuki and Michael Cohen. Musical Audio Stream Beat Detection to Conduct Dance of UAV. In *HC 2016: 5th Int. Conf. on Human and Computer*, Aizu-Wakamatsu and Hamamatsu, Japan and Duesseldorf, Germany, dec 2016.

The aim of this study is to develop processes that enable dancing of a drone animated by music. Drones are exceptionally agile vehicles. However, commercial release quadcopter is a manually teleoperated drone. That is why it difficult for us to operate to the fast beat of music. We used commercial-release quadcopter "Parrot Rolling Spider." Software drivers for drone are released as an SDK in GitHub and anyone can extend it. In this study, we used it and programmed by

JavaScript. We analyze audio by Traktor Pro 2 as DAW (Digital Audio Workstation) and beat detection is used to conduct a drone for dance. A Terminal command line gets MIDI-encoded beat of music and determines downbeat as a trigger. Then we send action signals to drone. Results indicate that drone movement can be choreographed to the rhythm of music.

[mcohen-302-016-09:2016] Hiromasa Kojima and Michael Cohen. Unity-developed interface for spatial sound conferencing featuring narrowcasting and multipresence with network control. In Kazuyoshi Mori and Shunsuke Yamaki, editors, *Proc. 305th SICE (Society of Instrument and Control Engineers) Tohoku Branch Workshop*, Aizu-Wakamatsu, nov 2016.

305-1, http://www.topic.ad.jp/sice/2016/program305.html

[mcohen-302-016-10:2016] Akari Osugi and Michael Cohen. Adaptive Speed Control for Panoramic Browsing. In Kazuyoshi Mori and Shunsuke Yamaki, editors, *Proc. 305th SICE (Society of Instrument and Control Engineers) Tohoku Branch Workshop*, Aizu-Wakamatsu, nov 2016.

305-2

[mcohen-302-016-11:2016] Satoshi Kaji and Michael Cohen. HMD-presented Virtual Reality with personal and social spatial sound. In Kazuyoshi Mori and Shunsuke Yamaki, editors, *Proc. 305th SICE (Society of Instrument and Control Engineers) Tohoku Branch Workshop*, Aizu-Wakamatsu, nov 2016.

305-3. Recently, HMD (Head Mounted Display)-presented virtual reality can be experienced. But HMD-presented virtual reality can not share 3d audio via network. Our Spatial Media Group as the University of Aizu has locally developed CVE (Collaborative Virtual Environment). Using a CVE server I connect to HMD and speaker array with audio interface. In order to realize, my research uses HTC VIVE and TASCAM US-4x4.

[mcohen-302-016-12:2016] Isuru Jayarathne, Michael Cohen, and Senaka Amarakeerthi. Low Cost Line-Following and Load-Picking Robot. In Incheon Paik, editor, *IEICE Service Computing Branch Research Presentation Meeting and WEIE Workshop: Services Computing (SC)*, volume 116, pages 35–38, Aizu-Wakamatsu, jun 2016.

IEICE Technical Report. Navigation is a basic feature of mobile robots. Self-navigating robots can be used in industry for moving loads from one place to another without human interaction. In this paper, we propose a novel approach

to move a payload placed along a given path with minimum number of motors and sensors. The navigation is based on lines on the floor, and the robot is capable of finding and picking up the load. This robot is capable of navigating straight lines, 90 degree junctions, T junctions and crossed junctions, which functionality engineers have found. difficult to implement with inexpensive equipment. This paper presents a low-cost approach with minimal and high accuracy.

Writing a part of textbook or technical book

[mcohen-302-016-13:2016] Michael Cohen and Julián Villegas. *Applications of Audio Augmented Reality: Wearware, Everyware, Anyware, and Awareware*, chapter 13, pages 309–330. CRC Press: Lawrence Erlbaum Associates, Mahwah, NJ; USA, second edition, 2016.

ISBN-13 978-750-4822-4350-5, eBookISBN 978-1-4822-4351-2, `http://dx.doi.org/10.1201/b18703`, `http://www.crcnetbase.com/doi/book/10.1201/b18703`, `http://www.crcnetbase.com/doi/abs/10.1201/b18703-17`

[mcohen-302-016-14:2016] Michael Cohen. *Dimensions of Spatial Sound and Interface Styles of Audio Augmented Reality: Whereware, Wearware, and Everyware*. 2016.

Time is the core of mul**time**dia, Modern applications are synchronous:dynamic (interactive),realtime (changes reflected immediately),and on-line (networked). Hypermedia is conceptual dimensionality. An introduction to spatial sound in the context of hypermedia, interactive multimedia, and virtual reality is presented. Review theory and practice of spatial sound for entertainment computing, including psychophysical (psychoacoustic) basis of spatial hearing; outlines the mechanism for creating and displaying spatial sound the hardware and software used to realize such systems and display configurations. Basic principals of relevant physics and psychophysics are reviewed (ITDs: interaural time differences, IIDs: interaural intensity differences, and frequency-dependent attenuation capturable by transfer functions). intensity, spatial hearing, Doppler Shift, and HRTFs. Modeling of sources and sinks (listeners) elaborates such models to include such as intensity, radiation, filtering, and reflections & reverberation. obstacles. Position can be defined as the combination of location and orientation information. Location-based or location-aware services do not generally require orientation information, but position-based services are explicitly parameterized by angular

bearing as well as place. we discuss the challenges and current progress of 3D-based new interfaces. "Whereware" suggests using hyperlocal georeferences to allow applications location-awareness; "whence- and whitherware" suggests the potential of position-awareness to enhance navigation and situation awareness, especially in realtime high-definition communication interfaces, such as spatial sound augmented reality applications. Combining literal direction effects and metaphorical (remapped) distance effects in whence- and whitherware position-aware applications invites over-saturation of interface channels, encouraging interface strategies such as audio windowing, narrowcasting, and multipresence.

Research grants from scientific research funds and public organizations

[julian-302-016-12:2016] Julián Villegas and Jie Huang. Simulation of Auditory Near-field Distance, 2016-2019.

[mcohen-302-016-15:2016] Anh Tuan Pham, Julian Villegas, and Michael Cohen. JSPS Kakenhi "Smart Supermarket", 2015-2017.

Advisor for undergraduate research and graduate research

[julian-302-016-13:2016] Takaya Ninagawa. Implementation of a transaural system in Pure-data, University of Aizu, Mar 2017.

[mcohen-302-016-16:2016] Nagayama Yosuke (s1200180). Graduation Thesis: "Extending a Stand-Alone or Shut-in Application for Distributed Multimodal Synchronization", University of Aizu, 2016–17.

Thesis Advisor: Michael Cohen

[mcohen-302-016-17:2016] Kaji Satoshi (s1210006). Graduation Thesis: "HMD-presented virtual reality with personal and social spatial sound", University of Aizu, 2015–16.

Thesis Advisor: Michael Cohen

[mcohen-302-016-18:2016] Suzuki Akihito (s1210115). Graduation Thesis: "Musical Audio Stream Beat Detection to Conduct Dance of UAV", University of Aizu, 2015–16.

Thesis Advisor: Michael Cohen

[mcohen-302-016-19:2016] Kojima Hiromasa (s1210235). Graduation Thesis: "Unity-developed interface for spatial sound conferencing featuring narrowcasting and multipresence with network control", University of Aizu, 2015–16.

Thesis Advisor: Michael Cohen

[nisim-302-016-01:2016] Hiroaki Yui. Doctoral dissertation: Efficient Algorithms for Graph Partitioning and Back Propagation in Numerical Applications, University of Aizu, 2016.

Thesis Sub-Advisor: S. Nishimura

[nisim-302-016-02:2016] Tasuku Sagara. Master's thesis: Efficient Web-based cooperative rendering using environment mapping, University of Aizu, 2017.

Thesis Advisor: S. Nishimura

[nisim-302-016-03:2016] Nanae Osawa. Graduation thesis: Generating musical score for Shinobue beginners, University of Aizu, 2017.

Thesis Advisor: S. Nishimura

[nisim-302-016-04:2016] Takahiro Tashiro. Graduation thesis: Acceleration of Photon Mapping Using an FPGA, University of Aizu, 2017.

Thesis Advisor: S. Nishimura

[nisim-302-016-05:2016] Reo Kuribara. Graduation thesis: Musical position detection using neural network, University of Aizu, 2017.

Thesis Advisor: S. Nishimura

[nisim-302-016-06:2016] Ryota Hayakawa. Graduation thesis: Enhancing Shadow Quality of Screen-space Ambient Occlusion, University of Aizu, 2017.

Thesis Advisor: S. Nishimura

Others

[mcohen-302-016-20:2016] Michael Cohen. Software Engineering Workshop: "Desktop Virtual Reality", October 2015.

AUST: African University of Science and Technology, Abuja, Nigeria

[nisim-302-016-07:2016] Satoshi Nishimura. The Takt music description language and generative music. Fukushima-no-Shinro, Toho Area Research Institute, June 2016.

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Advisor of a student club or circle

[mcohen-302-016-21:2016] Michael Cohen: Advisor, DMC (Disco Mix Club), http://dmconline.co.cc

[mcohen-302-016-22:2016] Michael Cohen: Advisor, Yosakoi Dance Circle, http://www.u-aizu.ac.jp/circles/yosakoi

[mcohen-302-016-23:2016] Michael Cohen: Advisor, Dual Boot Flying Disc Club, http://www.u-aizu.ac.jp/circles/dualboot

[mcohen-302-016-24:2016] Michael Cohen: Co-Advisor (with Satoshi Nishimura), M-Project, http://mpro-aizu.blogspot.com

Contribution related to faculty personnel (outside scouting, etc.)

[mcohen-302-016-25:2016] Chairperson, Information Systems Division Faculty Selection Committee

Contribution related to on-campus/off-campus publicity work

[mcohen-302-016-26:2016] Member, PR/Web-site Working Group

[mcohen-302-016-27:2016] Member, Super Global University (SGU) Group II Committee

Contribution related to educational planning management

[julian-302-016-14:2016] Served as member of the Community Affairs Planning Committee

Contribution related to planning administration for research, research conferences, or international research

[mcohen-302-016-28:2016]

Other significant contribution toward university planning, management, or administration

[julian-302-016-15:2016] Served as president of SAISUA: the Support Association for Int. Students of the University of Aizu

[mcohen-302-016-29:2016] Competitive Research Funding Evaluation Committee

[mcohen-302-016-30:2016] Graduate School Curriculum Coordinator, Graduate School Virtual Reality & Human Interface Track

[mcohen-302-016-31:2016] Director, Information Systems Division

Did you participate in students recruitment, support the alumni, and/or contact with student's parent? (Yes or No) If yes, please describe what you did.

[julian-302-016-16:2016] Created one problem of the PC-Koshien 2015 problem set

[julian-302-016-17:2016] Proctor for the General Entrance Examination AY 2016

[julian-302-016-18:2016] CS Field examiner for the Graduate School Entrance Exam AY 2016

Did you participate in Public Lectures, and/or Open Campus? (Yes or No) If yes, please describe what you did.

[julian-302-016-19:2016] Participated in both 2016 Open Campus events

[mcohen-302-016-32:2016]