

## Haptic Research

This project draws on my background in computer programming and experimental music.

I started programming in 1969, when I was 13, and received a BA in Computer Science coordinated with English from Trinity College, Hartford in 1980. I've worked for nearly four decades at startups, corporate businesses, dot-coms, and my own consulting, using diverse architectures and languages. In the early days of the Internet, I built gopher sites and websites for many arts institutions.

I have a parallel interest in music as a performer, composer, and theoretician. I've been associated with the American Festival of Microtonal Music since 1984, performing and creating tuning software for their pieces. I've adapted musical instruments to play with this group and for my own purposes. I'm currently a member of two bands: Mamalama, an all-acoustic group in which I sing and play hammered dulcimer, glockenspiel, melodica, and tenor recorder, and the Catskill Mountain Gamelan, where I play gambang, panerus, suling, jenglong, bonang, and gong.

I combining these two disciplines by writing music software. In the early 1970s I wrote hybrid synthesizers on custom-built microcomputers and PDP/8s. In the 1980s I wrote nontraditional synthesis and effects programs for Amiga computers. In the Internet era, I developed the first Internet-based synthesizer, and since 2008, I have written dozen music apps for iOS devices [1].

There is a lot more background information at my website, <https://jhhl.net>.

In 2012, I started working as a developer on the Adaptive Use Musical Instrument (AUMI) project. Established by Dr. Pauline Oliveros [2], AUMI uses motion tracking of live video to play sounds. This allows people, even those capable of only the slightest voluntary movement, to participate in improvisation-based music ensembles, and to experience interaction with others. AUMI is used for music and physical therapy, in music programs at schools for disabled children, and in mixed-abilities public performances. I reconceived and wrote the iOS version of this instrument in 2012. AUMI marked its 10th anniversary in October 2017 with a symposium at Rensselaer Polytechnic Institute [3][4].

In 2015, I was invited by Dr. Oliveros to join her at RPI for a seminar she was leading in exploring ways that hearing-impaired people could experience music [5]. I thought of a number of approaches to "music" that is not perceived

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primarily by hearing, which I refer to as "haptic"; those practicing haptic I refer to as "hapticians". It was an exciting class for the students, because they had to question and examine what we think of as music from the perspective of composer, performer, and audience. These students designed and built devices that tested ideas that came from that research. I set up a website, (<http://haptician.org>), so I could write and share my haptic ideas [6] .

In 2016, Dr. Oliveros included some of my ideas in a workshop in Bergen, Norway, which concluded in a concert by and for the enjoyment of the hearing impaired. Tarek Atoui was a collaborator on that project; I would invite him to collaborate with the students, as he's been working on similar projects [7].

Regrettably, Dr. Oliveros's unexpected death in November 2016, slowed research on this topic. I'm excited by this opportunity to continue research and practice in this embryonic discipline in a context where people, tools, and resources are available.

I think the model of brainstorming-and-project-development we employed at RPI would work well for your students. I propose my residency culminate in a concert of pieces demonstrating the techniques found through its research. In the spirit of Dr. Oliveros, I'd hope that the audience, hearing impaired or not, would participate in the pieces.

The goals of the residency would be to conceive of non-audio "music", create haptic compositions, develop tools for realizing and perceiving that experience, and finally rehearsing and presenting a concert using these new techniques.

I would begin by meeting with the students and faculty on campus, to see how to coordinate my work with theirs. At the same time, meetings can be set up with local hearing-disabled organizations that might want to collaborate on this project, and encourage their input and engagement. Over the residency, and in coordination with other courses, we would research existing solutions, and test prototype instruments and techniques, perhaps with the participation of people from the aforementioned organizations. During this phase, there may be some early previews of the research as performances or podcasts. This would then lead to the creation of new haptic pieces, further refinements and a transition to coordinating a more public demonstration and performance.

The students involved with this project would work with light, heat, haptic, and other non-sound-based, musical-like expressions to create an audio-free experience analogous to music. The students would research different

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approaches to the problem, such as making haptic analogies of existing musical forms, exploring haptic equivalents of the psychoacoustic phenomena, doing research to find existing analogies to music in other cultures, and then the engineering side: designing sketch models to enable hapticians to play and audiences to perceive and enjoy "haptic".

My role would be to create some of the pieces, guide students in composing their own pieces and realizing them, and to direct research and development of the tools to enable these performances.

Students would be working on conceptual design, user experience, manufacturing techniques, structural design and materials testing, project management and materials/services procurement. These are the skills identical to those used for modern manufacturing. I would envision working remotely, for scheduling and running meetings, with periodic trips residency for hands-on advice, critique, and direction, delegating R&D tasks, overseeing the performance, and performing myself.

In contrast to my tendency to solve everything in software, my approach would be to experiment with non-electronic means for encountering this new kind of music-like experience.

Devices for translating sound to haptics, or broadcasting touch, or modulating light, or coordinating various other non-audio-based senses could be adapted for general use. The residency would make possible proposing and testing new devices, using them in performance, and hearing them – or, rather seeing and feeling them – by an inclusive test audience.

These devices would either convert existing sound, or create haptic and light "haptic music" directly. Developing them, refining them, and playing them would be the students' main assignment. For solutions involving interpretation of audio signals haptically, there would be opportunity for the students to solve engineering challenges in the course of research into acoustics and non-electronic means of amplification, modulation, and generation of haptic signals.

**How do you imagine the “in-reference” aspect of the work in your proposed project?**

The basis of my project is to bring music to those who are unable to enjoy it in its normative form. Community coordination would be a seminal part of the project, facilitating real-world feedback on ideas. Encouraging participation of hearing impaired students, and exploring existing relationships with deaf

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organizations or schools would be ideal first steps. As noted above, I plan to ask groups such as DEAF, Inc. [8] to partner with the project and encourage their members to participate in the concert.

I imagine a diverse range of composition styles will be performed at the final project concert. They might range from classically inspired ensemble pieces, to variations on pre-existing world music, and might also be inclusive, intimate, and improvisatory pieces. Singly or together, the performance pieces will also be good starting points for a literature of a new kind of expression, one that combines dance, music, audience participation, and lighting, and that could have a life outside this project.

[1] A list of iOS apps I have written: <http://www.jhhl.net/iPhone/>

[2] For information on Pauline Oliveros: <http://www.arts.rpi.edu/pl/faculty-staff/pauline-oliveros>, or <http://paulineoliveros.us>

[3] International Symposium on Assistive Technology for Music and Art (ISTAMA) 2017, held at Rensselaer Polytechnic Institute (RPI): <http://www.isatma.org>

[4] AUMI website: <http://aumiapp.com> .

[5] Dr. Oliveros's seminar at RPI, ARTS 4963 CRN 88643/ CRN 88644 6963-01 Seminar in New Performance: [http://www.rpi.edu/dept/srfs/topics\\_courses/fall2015topicscourse.pdf](http://www.rpi.edu/dept/srfs/topics_courses/fall2015topicscourse.pdf)

[6] Haptician website: <http://haptician.org>

[7] For Tarek Atoui's work in Bergen Norway, 2016, see: <http://bergenassembly.no/en/tarek-atoui/infinite-ear/>

[8] DEAF, Inc: <http://www.deafinonline.org>; there are approximately six umbrella community groups that serve the Boston area and deaf community.