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SOSA proposal narrative: *iMaestra* – a custom conducting experience

Concise Description of the Proposed Scholarly Activity

Some projects, thankfully, seem to generate their own external momentum. That has been the case for a line of work that has significantly occupied my scholarly/creative attention for the past fifteen years. During this period, I have been building interactive, computer-based conducting simulations that allow people to experience the feeling of orchestral conducting. Thousands of participants have engaged with these public exhibits in museums and cultural institutions since 2003. In order to realize these projects, I founded Immersion Music, Inc., a not-for-profit music technology production company, which provides substantial logistical support. I also recruited a small team of collaborators; over the years, I have worked with four professional software engineers, two graphics designers (including TCNJ colleague Chris Ault), and members of the staff at the host institutions with whom I coordinate the production details. I serve as lead designer, musical consultant, programmer, and coordinator. In this manner, I have produced nine different systems that have been exhibited at venues including the Boston Children's Museum, the Kohl Children's Museum of Greater Chicago, Lincoln Center, the Kimmel Center, Boston's Symphony Hall, the Ravinia Music Festival, and ABC's Extreme Makeover Home Edition.

These exhibits have been variously named *You're the Conductor*, *Virtual Maestro*, *Be the Conductor*, etc., and have featured both custom sensors and Nintendo game interfaces for hand-held baton controls. They have shared some similarities with video games, with the exception that experiencing and shaping the music itself is the primary goal. Gameplay is limited to specific musical actions, without any competitive scoring or ranking system. Although my systems are sometimes informally called *Conductor Hero*, they bear scant resemblance to the titles produced by the *Guitar Hero* video game franchise.

'Under the hood,' the software powering these systems requires several basic structural components: video time-stretching algorithms, audio time-stretching algorithms, an interaction loop for users (including on-screen instructions, if desired), and hand-gesture controls for musical features such as tempo (speed) and dynamics (volume). In addition, high-quality video and audio recordings are required, preferably from an excellent orchestra in a hall with good acoustics. The length of the recorded selections is also a design decision: one challenge is to choose short excerpts of music that engage users continuously throughout the entire duration of the experience. Finally, in order to work reasonably well for the largest number of participants (young, old, tall, short, those with musical training and those without), these systems must have additional features that minimize the impact of physical and perceptual differences.

Now that I have designed, built, delivered, and serviced these nine exhibits over many years, I am slowly coming the realization that my software and hardware systems have become out-of-date. In order to keep this work relevant to new generations of users and expand its potential reach, I propose to revitalize and expand the possibilities afforded by this line of work and push it in a new direction that strengthens its public outcomes. The system that I hope to develop would be a customizable, *individual* conducting experience. The details of my plan are described below.

Proposed objectives and purpose of the scholarly activities
I propose to undertake a project to identify the weaknesses and shortcomings of my current interactive conducting system, brainstorm new features, update the codebase in two phases (one for public release; one for educational purposes), conduct systematic user testing, and write up the results in a journal paper or conference proceedings. The purpose of this work will be to modernize the technology, increase the number of users, and expand the potential uses for this system.

I will begin by gathering my team of long-time collaborators (including the Board of Directors of Immersion Music) to reflect on our years of work on this system and identify ways in which we might revise the development process and redefine our outcomes. When this work began back in 2002, our original goal was to provide children with some access and insight into the way that classical music works by experiencing an immersive, physical simulation of orchestral conducting. In the intervening time, the invention of the smartphone has revolutionized the ways in which the public interacts with music and software. In consultation with my team of experts, I would like to radically rethink the ways in which we make this kind of work more accessible and powerful for the average person.

Here are some of the goals, features, and requirements that I would like to consider during the reflection and brainstorming process:

- How might we optimize our design process and make it more efficient?
- How can our system be more general-purpose (plug-and-play)?
- Might we move away from contracting these systems for large organizations and instead create a version that is customizable for individuals?
- As classical music becomes more remote and inaccessible for the average person to understand, how might we bridge its important cultural content for future generations?
- How can we allow users to swap out and customize their content?
- How might we incorporate AI and machine learning algorithms to improve the experience?
- How might we develop this system as a platform for teaching and learning music?
- How might it be more affordable while preserving high-quality software development?
- How might we determine return on investment and create a system that has wider utility?
- How might we leverage the huge historical catalog of classical music recordings?
- How might we encourage skills transference and bridge to further music education?

3. Detailed plan of scholarly activity with proposed timeline
After brainstorming with my collaborators, I plan to make some decisions about priorities and features. (This is sometimes called a ‘requirements document,’ detailing the elements that the proposed system must have.) I will then begin implementing software revisions in two phases: phase 1 will be for public release, and phase 2 will be for teaching and learning. Each phase will undergo a user testing process, to be determined. (I plan to undertake an IRB approval process for this testing protocol.) During my SOSA release semesters, I will finalize the code revisions and complete user testing; in the Spring 2020 semester I will also submit at least one conference paper or journal article for publication. (Promising venues for this work could include the International Computer Music Conference, the New Interfaces for Musical Expression conference, or perhaps Computer Music Journal.) Here is the timetable that I have developed for this project:

Summer 2018	reflect and brainstorm with Immersion Music team collaborators
	finalize goals, prioritize features, specify requirements
Fall 2018	begin building phase 1 software revisions, submit IRB for approval
Spring 2019 (SOSA)	phase 1 user testing
	finalize phase 1 revisions
Summer 2019	begin public distribution of phase 1
	define phase 2 revisions (teaching and learning platform)
Fall 2019	begin implementing phase 2 revisions
Spring 2020 (SOSA)	phase 2 user testing
	finalize phase 2 revisions
	write and submit conference/journal article on project

4. Expected scholarly outcomes

As a result of this project, I hope to realize a new, customizable version of my software for public distribution (phase 1), a new teaching and learning software platform (phase 2), and one scholarly publication. Depending upon what we decide to build, the phase 1 outcome could be made available for free download on code distribution sites such as Github or the AppStore; phase 2 could result in a computer system that could be used in my classes as a platform for students to develop and modify musical code (as in MUS336/IMM350 Interactive Music Programming or MUS335/IMM351 Audio Signal Processing).

5. Importance and significance of proposed scholarly activities to the applicant's discipline

The Guitar Hero and Rock Band video game franchise was game-changing for my discipline; its success proved that music-related games could engage the public and generate strong sales. However, classical music games and interactive experiences have not had anywhere near the same exposure; it seems that this genre has failed to launch in the commercial market. Perhaps with the continuing success of music streaming and recommendation services such as Spotify and Pandora, new avenues might emerge for the modification and sharing of personalized music made on a system such as mine. In recent years, the number of scholarly publications on the topic of *audio time stretching* has increased markedly, and there will be some scholarly interest in computer music publication venues for work such as the project described in this proposal.

I hope that by continuing to iteratively revise and update this long-term scholarly/creative project, I will encourage the success of interactive music systems and expand their uses for learning and entertainment. In so doing, I hope to continue to bridge the worlds of classical music and new technology with enriching and engaging experiences for future generations to come.