Collin County Community College District
APPLICATION FOR SABBATICAL LEAVE

Instructions

Please complete this application by responding to **all** items. Attach requested documentation (in the order requested) and secure the appropriate signatures prior to submitting the application to the chair of the Sabbatical Leave Committee. **Please submit the original and 10 copies.**

Name Christopher R. Morgan **CWID** 110 48 59 86

Title Professor, Audio Engineering **Division** Fine Arts - Music

Have you ever been granted a sabbatical? YES If yes: Dates of Prior Sabbatical(s): Fall 2004

Please provide a brief description of your *previous* sabbatical project:

During the Fall 2004 semester I received a sabbatical leave to complete a prototype for a real-time computer music gestural control system. I had previously designed the hardware following research that I conducted as part of a study grant awarded in the Summer of 2003. I was able to complete two prototypes of the gloves during my sabbatical and I was able to make use of these prototypes for several concert performances as well as one new composition. I wrote a paper based on this research that was submitted and accepted to the national computer music conference run by the Society for Electro-Acoustic Music in the United States (SEAMUS).

Sabbatical Leave Period Being Requested

Dates: **Beginning Date** January 2018 **Ending Date** May 2018

Length: [√] One semester [ ] Two semesters [ ] Other _____

Applicant's Agreement

ABSTRACT

This proposal focuses on bringing emerging wearable technologies to Collin College dance and music students in order to increase student learning, recruitment and retention, as well as to position Collin College Dance and Music Departments as leaders in the digital arts revolution.

In the emerging field of music and interactive dance technology, there are three dominant approaches: touch-sensitive floors, video-based motion tracking systems, and wearable technology. Of these three, wearable technologies present transformative student-success opportunities including bringing students from different disciplines together in new ways, delivering innovative, multi-disciplinary learning experiences and offering students a long-term competitive advantage based on early experience with these groundbreaking technologies.

This research is inspired by my current work in which I've adapted smartphones to send their accelerometer data to a computer running audio synthesis software I programmed for creating sound based on that motion data. In this work, I outfit dancers with these smart phones so that their movement and choreography create and shape a live soundscape. I premiered an initial version at Collin College in May, 2016 with a dance department student. At the core of this work, there are two important technologies that can be leveraged by Collin students: programming languages developed for non-programmers and inexpensive wireless and accelerometer technologies. This research will allow Collin students to further develop these technologies as they are emerging and will thereby position Collin College students as innovators in the field. These unique experiences will inspire Collin students across several disciplines with excitement and enthusiasm to continue at Collin towards finishing their degrees as well as sharing their innovative work outside of Collin College, thus aiding recruitment.

Title: Wearable Technology for Interactive Dance and Music Composition

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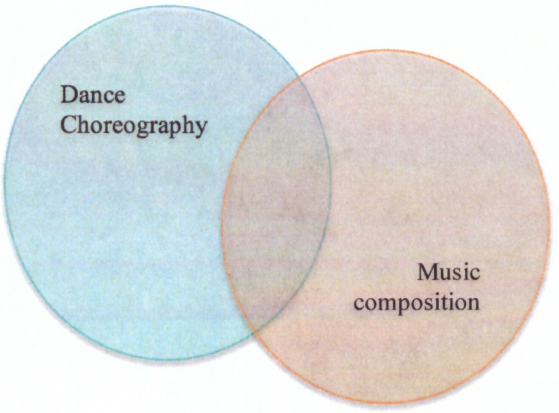
[End of Abstract]

I Research Plan, Rationale and Importance



The common area in the music composition and wearable interactive dance technology paradigm lies in the wireless hardware and software technology and how the different musical parameters (such as pitch, rhythm, etc.) are "mapped" onto the various movements of the dancer as well as which parts of

the dancers body are tracked for motion. This decision-making process is by nature collaborative: the dancer demonstrates their repertoire of movements and works with the composer to adapt the sound repertoire to those movements. The end result is not a "fixed" composition, but rather a type of hybrid musical instrument "played" by the dancer as they move. The dancer has control over the structure of the composition as well as the sequencing of sounds and sound manipulation.

Furthermore, the sound source material is essentially infinite since it can include multiple modalities of sound and music itself including the following:

1. Initiating pre-recorded sounds, music and sound effects
2. Pre-recorded music shaped with motion-controlled filters, reverberation, echoes, etc.
3. Direct control over music synthesis engines (such as FM, physical modeling, etc.) This approach was utilized at the May, 2016 Collin College performance.

In addition, the dancer has an infinite number of unique gestures and movements, whose uniqueness is further enhanced based on the positioning of the wearable accelerometers themselves. The May 2016 premier featured two iPhones worn on the back of the dancer's wrists. However, input from dance students and faculty indicated they would also like similar tracking on the ankles and would actually prefer tracking of the upper torso. Their insightful comments demonstrated the cross-discipline divide between dance choreography and music composition. In essence, the torso position and orientation were more critical to the dancer, while the non-dancer music composer instinctively focused on the hands as "controllers" in the paradigm of the sliders and knobs found on a standard music mixing console.

Since it is a stream of information representing the movements in three dimensions (XYZ axis), the number of mappings is unlimited but the follow example represents a mapping based on the aforementioned 3-axis accelerometers worn on the back of each wrist:

Sample Mapping of two 3-Axis Accelerometers	
Left Hand	Right Hand
X – Reverberation Mix Level **Y** – FM synthesis harmonicity ratio **Z** – Lowpass filter cutoff frequency	**X** – Reverberation time **Y** – FM synthesis index of modulation **Z** – Lowpass filter resonance

II Benefits to the College and Students

This research will focus on further exploring and developing these wearable technologies and sound synthesis software. The net benefits will be three-fold:

1. Students, both dance, choreography, and music composition, will have an enriched, cross-discipline learning experience with a first-hand exploration of their counterpoint art forms.
2. Students will learn to work collaboratively with other disciplines.
3. Collin College will further position itself as a leader in emerging technologies such as the rapidly expanding "Internet of Things" (IOT).

The first two benefits have been shown to increase student retention and success while the third benefit will help with recruitment. Essentially, this research will focus on bringing disciplines together in new ways. This proposal will include a lecture recital and performance as well as demonstration of the interactive dance-sound synthesis interface.

April 2018

Testing
Working with dancers to composers to evaluate effectiveness by creating multiple compositions.

May 2018

Results
Planning performances and writing report.

VI. Resources

I will use the following software hardware and software resources:

1. Max/MSP programming environment
2. Arduino-based micro-controllers and peripherals (wireless transmitters and accelerometers).
3. Raspberry Pi or other Single-Board Computer (SBC)
4. Apple Xcode development environment with the Swift programming language for iOS development.

Bibliography

Apple Inc. "The Swift Programming Language. Swift 3.0.1", Apple Inc, 2016.

J. J. Arango and D. M. Giraldo, "The smartphone ensemble. exploring mobile computer mediation in collaborative musical performance," in *Proceedings of the international conference on new interfaces for musical expression*, Brisbane, Australia, 2016, pp. 61-64.

D. Becking, C. Steinmeier, and P. Kroos, "Drum-dance-music-machine: construction of a technical toolset for low-threshold access to collaborative musical performance," in *Proceedings of the international conference on new interfaces for musical expression*, Brisbane, Australia, 2016, pp. 112-117.

H. Berg, "Tango: software for computer-human improvisation," in *Proceedings of the international conference on new interfaces for musical expression*, Brisbane, Australia, 2016, pp. 7-8.

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M. Margolis, "Arduino Cookbook", 2nd Edition, O'Reilly Media; 2011.

C. Reas and B. Fry, "Processing: A Programming Handbook for Visual Designers and Artists", MIT Press, 2007.