In the fall of 1988, Brad Waller became a Reader at the Folger Shakespeare Library. After 30 years of working as a choreographer for the Folger Theatre, the Shakespeare Theatre, the Kennedy Center, the Washington National Opera, Arena Stage, and the Washington Ballet—as well as teaching Historical Martial Arts and Stage Combat at the Shakespeare Theatre, the Academy for Classical Acting, and many years as an adjunct professor at George Mason University—Brad wanted to make his retirement a research endeavor that would give back to the cultural and educational institutions that had given him so very much over the years.

Using AI to Recreate and Visit the Past Is the Future

An Interview with Brad Waller. Director of the Historical Movement Archive

Q: How did this research idea begin?

A: The origins of this research project began with a meeting in 2015 at the Folger Shakespeare Library with Dr. Michael Witmore and Rick Davis, now Dean of the College of Visual and Performing Arts at George Mason University. I presented the idea of using emerging motion capture technologies to research, preserve, and archive historical martial arts and historical dance. We decided to create a test research project using a historical movement work: Giacomo de Grassi's treatise of 1570, titled *Ragione di adoprar sicuramente l'Arme*. Englished by I. G. Gentleman in 1594. And so my journey began.

Q: What is historical movement research?

A: Hundreds of antiquarian movement works have been left to us in the form of books, treatises, and manuscripts. It is the work of historical movement scholars and researchers who endeavor to unlock the knowledge contained within these words and images. It is an arduous task to research and understand these historical movement techniques and systems of movement. It takes an uncommon dedication to the rigorous physical development of skill through training and building an understanding in the body.

Q: How were you able to recreate and capture historical movement?

A: In 2016, we devoted seven months of movement research and training to motion capture a series of historical movement sequences from Giacomo de Grassi's treatise. This video shows one of those sequences—a routine of 16th century longsword techniques performed by Jonathan Purvis.

https://historicalmovementarchive.org/longsword-sequence/

By this point, we had accomplished our first mandate or proof from our meeting in 2015. We had taken words and images from a historical work, and through research and reconstruction, digitized that historical movement and preserved it in a three dimensional digital form.

Q: What do you do with the digitized historical movement?

A: This is where we engage an entirely different set of skills, where the technical research and development begins.

I had the honor of serving as a Visiting Scholar in Residence at George Mason University, and set up shop at the Virginia Serious Game Institute on the university's Manassas campus. I was provided with the tools to interact and work with programmers and digital artists who helped me to implement these research ideas and develop them into a digital reality.

Q: What kind of research tools did you develop as a Visiting Scholar in Residence?

A: We laid the technical foundation for a downloadable application that would contain a series of research tools created for my international colleagues.

We designed, built, and implemented a studio avatar that could inhabit the historical movement sequences we were capturing and preserving with wireless motion capture suits.

We created our own HMA 3D viewer, a web application that allows a user to display historical and cultural movement in 3D on the web, to be viewed on any mobile browser, desktop browser, and on VR headsets, AR headsets and smart glasses.

Here is an example of our 3D viewer that has preserved a movement sequence researched, reconstructed, and motion captured from some of the earliest known Chinese orchesography symbols. These historical movements are later found in panathenaic dance of the fourth century BC; and historical martial arts of the sixteenth century. They are regarded as universal movement principles or elements, air, fire, water, and earth.

https://historicalmovementarchive.org/historical-movement-archive-3d-player/

At this point we had accomplished our second mandate or proof. We had taken digitized historical and cultural movement and created the research tools to preserve this movement knowledge in 3D, archive it, and make it accessible online.

Q: What did you hope to accomplish while you were a Visiting Scholar in Residence?

The purpose of my work as a Visiting Scholar in Residence was to provide the proof that we can create a process and methodology for this research and to demonstrate how we can build digital tools that utilize these emerging technologies.

When the Covid pandemic hit, any thoughts of establishing a research program that would serve this new field of movement research were put on hold.

My residency had ended, but I was fortunate to be allowed to retain the office space where all of our work was stored on our processing computers and our archive computer.

As the VSGI office was to be closed, we quickly shifted our research and development team to the bare minimum of hours working online from home and accessing our data work files at the HMA office using Amazon Web Services (AWS).

The HMA team (slowly but surely) developed a process and methodology applied to historical and cultural movement. We have applied this process to integrate the historical record in text and images with archaeological excavation evidence, in order to recreate a digital reconstruction of a sixteenth century playhouse called the Hope Bear Garden.

Q: What was the purpose behind building a digital replica of a sixteenth century playhouse?

A: Imagine the digital Hope Bear Garden playhouse being the digital host destination for movement professionals to get together as HMA studio avatars or volumetric generated avatars using simple volumetric capture research studio setups and holoportation. Researchers meet online within the Hope Bear Garden 3D interactive virtual research environment and exchange high-end movement research and performance information from different parts of the world.

https://historicalmovementarchive.org/digital-host-destination/

Volumetric Generated Avatars
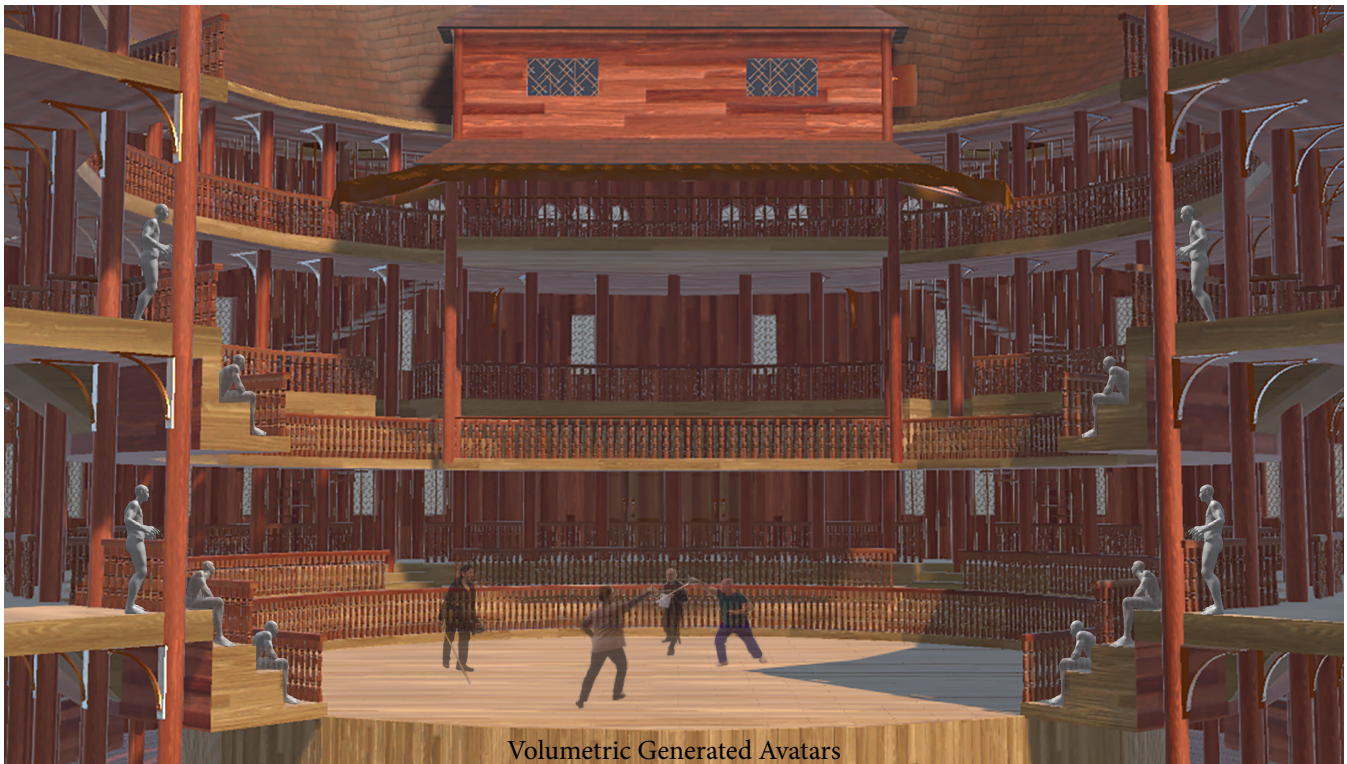
Q: How do you plan to turn this playhouse into a kind of metaverse for research?

A: We have built and tested a prototype digital host game environment and portal that my colleagues call the Bardaverse. We have tested the build with the help of my international colleagues by entering the online digital portal and interacting from ten different countries at once. This is just the beginning stage of a remarkable interactive research tool.

Here is a link to the prototype non-download digital portal where you can enter the Bardaverse and explore the prototype we are developing.

https://historicalmovementarchive.org/digital-portal/

Q: Where are you now with the development of these research tools?

A: At this point (by the end of June 2023) we will have accomplished the last mandate or proof of concept. We have a process and methodology for historical and cultural movement research and can demonstrate how to build digital tools that use these emerging technologies.

The historical movement community will be able to download and install the Historical Movement Archive's research application that contains these research tools. Research participants can log on and enter the digital Hope Bear Garden research game environment as HMA studio generated avatars using any computer, smart phone, tablet, or augmented reality and virtual reality device. They can interact within the Hope Bear Garden in three dimensions as if they were in a movement studio, a classroom, or witnessing a live performance.

Motion capture and volumetric capture technologies allow us to take historical and cultural movement and preserve it in a three-dimensional digital form. For the first time in history, modern technology offers the ability to preserve historical movement depicted in antiquarian books and manuscripts. Using motion capture and volumetric capture technologies, we can recreate and interpret this historical and cultural movement in digital form, so that it can be preserved, studied, archived, and shared all over the world.

All the digital tools that were ideas and concepts presented a little more than seven years ago, are now ready to be implemented into a research program.

Q: What do you see in the future for this research program?

That is the most exciting part of it all! Consider the opportunities presented by recent advances in artificial intelligence. There is a whole AI or artificial intelligence aspect to all of this. Let's say for a moment that a motion capture or volumetric capture studio can be put together that is dedicated to capturing and archiving these historical movement systems. Let's say we take (as an example) Giacomo de Grassi's footwork system and digitize that movement research in all its complexity. Hundreds of thousands of possible footwork sequences. We then engage this vast amount of movement data into the reconstruction process that we have developed for historical movement.

To understand this research process, we need to look at the historical structure of movement. The best comparison is the structure of language, and how language is structured, categorized and analyzed. Cultural and historical systems of movement can be looked at in a very similar structural manner.

Imagine the history of human movement being analyzed using the highest standards of research, integrating the innovations of artificial intelligence applied to the digitized historical and cultural language of movement. By engaging these emerging technologies with artificial intelligence, we have the opportunity to significantly contribute to the advancement of our understanding of biomechanics, kinesthetics, proprioception, and the science of historical and cultural movement. This work will create new fields of research, such as Kinesthetic Anthropology and Kinesthetic Relativity.

It is a "Gutenberg moment" for historical movement and movement research.

My work as a Visiting Scholar in Residence at George Mason University enabled me to transform ideas and concepts into digital research tools for movement scholars around the world. These tools will be invaluable to establishing a research program dedicated to the preservation of historical and cultural movement. With these tools in hand, we can begin this work.

I am grateful to have the opportunity to give back to the University that I have taught for, the cultural institutions that I have served, and the community that has been my home.

I invite you to explore our website, in fact I double-dog dare you: historicalmovementarchive.org