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The Synergists: An Exploration of Choreography, Media, and Science

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Abstract

This research project combined choreography, media, and science as a means to explore creative process. For this project, I created my own interpretation of mixing dance and multimedia elements through the use of video projection. I questioned how the use of video projection would affect my choreographic process and how the video and live performance would support each other to portray a cohesive idea. The scientific source of inspiration included neuron structure and synaptic function. Through my research, I discovered the work of The Blue Brain Project which allowed me to see the creativity and artistry present in scientific fields. *The Synergists*, a ten minute multimedia work, premiered on April 7, 2016 at Daum Theatre, Kolbe Hall on The University of Akron campus. The video of the work can be accessed on YouTube using this link: https://youtu.be/Z0gc3ZKXKeY. The results of this process allowed me to experience many different avenues of choreography. I developed a new choreographic process by using research as a basis for translating scientific ideas into a creative interpretation. The collaborative use of choreography created a strong dance work that was visually exciting and had a clear interpretation of the ideas I had researched.

Introduction

The great contemporary ballet choreographer Wayne McGregor said, “If you put yourself in a place where you’re having to work at understanding something then you keep yourself awake to all possible choices. Choreography and creativity – it’s my matrix, let’s see where we can move” (Robertson, 2008). One of the great things about dance and choreography is that there are infinite possibilities for experimentation and exploration. There are always new avenues that you can take to push yourself. In developing this honors research project, I wanted to challenge myself to create a work that incorporated a multimedia element in addition to the choreography. I have always been interested in technology and how it can be incorporated in creating a dance work. I questioned how the incorporation of video projection would affect my choreographic process including the outcome of the work and how choreography could be derived from research on a scientific topic. I was initially attracted to the idea of synapses in both their electrical structure and as a means for communication. After I had conducted research on this topic, I discovered the artistry in their structure and function and was able to create movement based on that inspiration.

I titled the piece “The Synergists” because the word “synergy” is a term that is often applied to neurons. Synergy is the combination of individual parts to produce a greater overall effect (Synergistic Effect, 2012). The title is also appropriate for the collective use of choreography, video projection, and concept to create a synergistic effect. The cast consisted of six dancers, one male and five female performers. The piece was divided into three sections and had an overall runtime of ten minutes. This piece premiered on April 7, 2016 at the Spring Into Dance concert at Daum Theatre in Kolbe Hall. Spring Into Dance is a student produced show run

by Terpsichore Dance Club. The event gives dance students the opportunity to choreograph as well as perform in pieces created by their peers. The lighting for the piece was designed by student Cole Schraitle and made use of specials to highlight important moments in the choreography. I designed the costumes which were black long sleeve tops, black shorts, and black socks. I wanted the costuming to be simple in order to highlight the movement and to not distract from the video projection. The music consisted of pieces by the artists Sohn and Olan Mills. The separate videos of the individual dancers were shot by Alex Logsdon and I edited all the footage into a single video that was projected onto the upstage cyclorama from my laptop during the performance.

Research

The physical structure of a neuron is seemingly very simple. It consists of three parts including the cell body, dendrites, and axon. The cell body contains the nucleus of the nerve cell which governs all cell activity including the production of proteins needed in regeneration of the axon and dendrites (Lodish, Berk, & Zipursky, 2000). The dendrites branch off of the cell body and are responsible for receiving signals sent from the axons of other neuron cells. The dendrite branches can be very long and numerous. This allows a single neuron to receive signals from many different neuron cells (Lodish, Berk, & Zipursky, 2000). Neurons are able to send signals to other cells through their one axon. The axon is a single, long fiber that extends in a series of swellings. In some neurons, the axon is covered by a membrane called a myelin sheath. Because of the structure of the axon, there are often gaps in the sheath which are referred to as nodes. When a signal is sent down the axon, the signal has to jump across the nodes which increase the

speed of the transmission (Miller & Levine, 2006). Because of the strong relationship between dendrites and axons, they often group together in bundles called nerves.

Neurons communicate with each other through the space between the dendrites of one neuron and the axon of another. The space where this transmission occurs is called a synapse. Before a neuron can send a signal, it has to develop an action potential (Lodish, Berk, & Zipursky, 2000). This occurs when the charges in and around the neuron are temporarily reversed. The membrane around the cell has channels that allow ions to enter and leave the cell. When at rest, the inside of the neuron is negatively charged and the outside is positively charged. When a neuron receives an impulse, it causes positive ions to enter the cell creating a positive charge inside and negative charge outside the cell. The release of the positive ions within the cell causes connecting neurons to activate, create action potential, and send the impulse to other neurons and thus creating a chain reaction (Miller & Levine, 2006).

Through my initial research of neuron and synaptic structure, I came across the work and research of the Blue Brain Project. The goal of the project is to create a biologically based digital reconstruction of the human brain. With these super-computer based digital simulations, they can study the interdependencies and interactions of every layer of brain organization (The Blue Brain Project, In Brief, 2015). They work in a specific process in order to acquire data and apply that data to their understanding of the brain.

Neuroscience is the first step in the process in which the researchers collect data on the varying levels of structural and functional organization of the brain. This allows researchers to be able to define each level of structure including "the genome, the transcriptome, proteins, metabolites, organelles, neurons and glia cells, synapses, extracellular space, microcircuits, mesocircuits, macrocircuits, the vasculature, blood, the blood brain barrier, ventricles,

cerebrospinal fluid, and large-scale organization of the whole brain" (The Blue Brain Project, Neuroscience, 2015). The functional organization levels include "gene transcription, protein translation, cell biology processes, signaling, receptor functions, biochemical, biophysical and electrochemical processes and properties, neuronal and synaptic information processing, information processing at the micro- meso- and macro-circuit level and at the level of the whole brain , metabolism, development, adaptation, learning, perception, cognition, and behavior" (The Blue Brain Project, Neuroscience, 2015). Defining each level of organization allows for the accurate recreation when it comes to the modeling process. The next step in the series is neuroinformatics which processes the data acquired in the previous step and accounts for the unknown variables and interdependencies in the data (The Blue Brain Project, Workflows, 2015).

Once all the levels and interaction of those levels are defined, equations are created in order to simulate the processes in the computer based model. Geometry is especially important because the function of the brain is directly related to the shape and positioning of all the varying structures and levels (The Blue Brain Project, Mathematical Abstraction, 2015). After setting the parameters and mathematical equations, the digital model can be constructed. Researchers use a software program called Builder in order to create these digital representations. The Cell Builder creates the individual nerve cells in all of their varying structural shapes. The Microcircuit and Mesocircut Builders determine the circuitry of the brain and how the individual nerve cells are layered and how collections of nerves interact with each other (The Blue Brain Project, Modelling, 2015).

The final step in the process is the actual experimentation using the constructed digital models. The working models allow researchers to test hypotheses, diagnostic tools, and

treatments for brain diseases (The Blue Brain Project, In Silico Experiments, 2015). In using these digital models, researchers acquire data on how the variable they are testing affects the entire unit of the brain. This provides the opportunity for researchers to gain knowledge of the human brain in ways that was never before possible.

The research was conducted in order to obtain an understanding of the structure and function of neurons and synapses. The knowledge gained was to serve as a base from which to create the choreographic structure and theme for the work. However, the ideas found proved to be a great source of inspiration for not only the structure but the actual movement of the piece. After reading or viewing the images of the Blue Brain Project, I was always eager to process the information and translate it into the work.

Choreographic Process- Making Connections

The first section of the piece was primarily inspired by synapses in terms of their physical structure and their ability to transmit information. In this section, I wanted to create the feeling of electricity through bold, fast, and powerful movement. I also chose an instrumental version of the song "Lessons" by the artist Sohn for the musical selection of this piece. The elements of the music help to create the feeling of electricity through the driving beats and quickness. This section began with the video projection of a solo dancer and a dark stage. I wanted the beginning to create an immediate interest and start to build a sense of tension. The tension was inspired by the action potential of a neuron right before it fires its message through the synapse. The movement of the dancer incorporated elongated and entwining motions of the limbs in order to simulate the axon and dendrite braches of a neuron ready to fire. This became more apparent as the lights on stage began to fade up and revealed the same dancer in live performance. The

addition of the live dancer served to create an artificial synapse between the video projection and the live performance which symbolized the dueling aspect between the axon on one end of the synapse and the dendrites on the other end. Both the video projection and the live dancer performed the same movement to show each side preparing for the firing of the synapse.

The firing of the synapse occurred in a surge of the music and three other dancers entered the stage while the projection of the dancer faded. The other dancers represented other neurons which had been activated by the synapse and began to entwine with the original neuron. Two more dancers entered the stage and began to break up the entwined structure to show how connections can be formed and then broken in order to translate a new message. Once broken free from the entwined pose, the dancers ran to the corner and created a ripple effect showing how the message sent from one neuron could activate many other adjacent neurons in order to carry the signal to the desired destination. It then returned to the idea of dueling sides between two neuron endings which was represented by two dancers that faced each other and began a duet. However, instead of building the action potential as was represented at the start of the piece, these two neurons constantly fired signals between one another.

The electrical representation was enhanced by the video projection of the duet and created another active connection. The rapid firing of the two dancers caused the other dancers to enter one by one and became active neurons. This again translated to the transmission of messages through synapses and the positioning of the dancers also created a mirroring effect which again highlighted the active ends of neurons when transmitting and receiving signals.

The next video portion featured a solo dancer who performed an entire movement phrase while the live performers joined individually at certain specified points. The interactivity between the video projection and the live performers again created a symbolic synapse between

the two realms. The video projection directly affected what occurred in the live performance. It also showed how the fired signal of one neuron may affect the receiving neurons at different times and in different ways. This section ended with all of the dancers performing in unison and showed how neurons work cohesively to produce a single effect.

The second section of the piece was inspired by the actual structure of the neurons themselves and how they physically entwine with other neurons in order to form synapses. This section in particular was created through my research of the digital representations of neuron created by the Blue Brain Project. I was very struck by the artistic structure of neurons and how they were able to grow and express themselves individually (See Appendix, Images 1-3). The beginning of the second section served to represent the idea of each neuron having its own means of self-expression. In order to highlight each individual, the dancers all appeared on stage one at a time with their own movement phrase. The dancers did come together in the center of the stage but they continued to perform their unique phrases and represented the individual expression of each neuron structure before it physically connected with other neurons. Once the individuality and uniqueness of each dancer or neuron was established, the inspiration shifted to visually represent the beautiful entwining that occurs when two fully expressed neurons come in contact. This is represented through a duet which utilized the filling of negative space and fluid motions in order to produce the entwined effect. The dancers also performed their individual phrases in close proximity and to discover the connections that could be formed. This idea then flowed to the other couples as they performed their own movement phrases and discovered their own connections. Once these connections were formed, there was a shift of attention to the group as a whole unit.

The lyrics of the music talked about receiving “the light” which I interpreted to be the signal of activation for each neuron. This idea started with a solo dancer who began the transmission of a movement phrase that was passed to each dancer. Once all the dancers had joined into the group, there was a strong surge of music which caused all of the dancers or neurons to become electrically active at one time. Once they were all active, they returned to their original partners and performed their phrases in order to reestablish the connections that were discovered earlier in this section. This section ended with one last transmission through each of the dancers to solidify them as a functional unit.

The video projection aspect is quite different in this section than it was in the previous movement. Through my research, I was so inspired by the beautiful work that the Blue Brain Project has done in making digital representations of neurons and how they are able to function together. Because this was such a large source of inspiration for the movement that was created, I wanted to be able to share those images with the audience as part of the performance. I made a collection of images and videos that most intrigued me and then put them all together into one cohesive video. I placed the videos accordingly to what occurred on stage choreographically. The beginning of the video projection started with models of individual neurons in order to highlight the self expression of each of the dancers. It then continued with models of how the neurons entwined with one another and how the activation of one neuron affected the rest that were present. The effect of the choreography with the video created a great deal of visual interest and also gave the audience clues into the process of how this piece was choreographed and conceived (See Appendix, Images 4-5).

The third and last section of this piece highlighted the brain and how the collections of neurons work together to make us who we are. The dancers started walking in a slow circle in

order to create a moment of breath and relaxation for the audience after the previous fast paced sections. The music was also very calm and atmospheric in order to enhance this trance like effect. Then, one dancer entered the middle of the circle and began to move fluidly. The other dancers then joined the middle of the circle one by one and added to the group movement. As the last dancer entered the middle of the circle, all of the dancers weaved in and out of each other which created a morphing shape of entwined dancers. This section and the piece ended when the dancers took hands and passed movement throughout the morphed shape. One dancer began with a twitch which traveled through the physical shape which represented how different parts of the brain react when one section receives a message.

The video projection for this piece combined the elements from the two previous sections. It started with an image of brain mapping produced by the Blue Brain Project which used different colors to show how different areas of the brain work together. Videos of individual dancers overlaid the image when each dancer entered the middle of the circle. It created a ghost like effect and represented a memory and the addition of that dancer or neuron to the brain collective.

Reflection

The creation of this piece has really stretched me as a choreographer and it will be an experience that I will carry with me through the rest of my career. The incorporation of all these separate elements into one piece made me think about choreographic structure and inspiration in very different ways. The use of the video projection proved to be the most challenging aspect of the process. It was difficult to visualize choreographically what would happen in both the video projection and what would occur on stage. There were times that I became so inspired for the

actual choreography that I became lost when it came to the video portion. I discovered that incorporating multimedia and dance performance requires a great deal of finesse, thought, and time for experimentation. Although I was happy with the final product, I wish that I would have had more time to experiment with different ways to use the video projection. My initial goal in creating this piece was to find a way to seamlessly integrate the multimedia element with the live performance. While I was able to achieve some interactive elements, I think that I was only able to scratch the surface of possibilities and I hope that I will be able to dive further into this conceptual exercise in the future.

In the process of my research, I was struck by how much of what I was reading translated so well to movement and choreography. Everything from the structure, functional processes, and layering of neurons and synapses sparked inspiration in terms of choreographic structure and movement. The outcome was a piece that was structured based off of the scientific research I had conducted. I found that I was able to comprehend what I had researched much more deeply through the process of translating what I had just read into a creative interpretation. Through the use of the video projection, I also learned how to take inspiration from various sources and combine them all into one piece. The creation of this piece has given me a whole new perspective of what can be used to inspire choreography.

In the past, my choreography had always been sourced from a place of emotion or personal experience and I tended to keep my more emotional, artistic side separate from my logical, scientific side. Because I had polarized these two sides of myself, I wasn't sure exactly how I would be able to create a piece choreographically sourced through something so academic and logically based. However, through my research I was astounded by how much beauty, creativity, and artistry was present in the structure of neurons and how they are able to work

together through a seemingly infinite number of connections. I had an epiphany that art and creativity are really present in everything.

Creativity can be defined as “the ability to come up with ideas or artifacts that are new, surprising, and valuable" (Bowden 2004). It is not exclusive to artistic fields but in fact it is inclusive of all fields. Creativity and scientific processes stimulate brain functions involved in higher-order thinking (Andreasen & Ramchandran, 2012). Before there was advanced technology to conduct research, Plato, Aristotle, and Leonardo da Vinci all gained inspiration from the natural world around them and used creative ways of thinking in order to make scientific and philosophical theories. Leonardo da Vinci is a prime example of someone who combined the two worlds of artistic creativity and science. Not only was he an extraordinary painter and sculptor; he was also an engineer and inventor (Andreasen & Ramchandran, 2012).

The distinction between art and science has become more defined over the years because of our focus on specialization. We are encouraged to pick one field of study that best suits our strengths and ways of thinking. Because of this, art and science are believed to require different skill sets and different thought patterns (Andreasen & Ramchandran, 2012). Artists constantly make observations about the world and human emotion, and from those observations they ask questions. The questions help to create a process for experimentation using their medium of art and through the conducting of their experiments they reach conclusions about their initial observation. Finally, they share their conclusions with the world through the presentation of their artistic piece. This process is strikingly similar to the scientific method which involves the process of observation, inquiry, and experimentation, and shows that artists and scientists engage in similar inquiry patterns.

Conclusion

Through the process of creating this piece, I have gained many insights into myself as a choreographer and into my field of dance. Through the use of video projection, I was able to add another dimension to my choreography, and I became aware of the infinite possibilities when it comes to combining dance with multimedia elements. I would like to continue to work with these elements in my choreography in order to gain more knowledge on how dance and multimedia can be even more interactive.

The amount of inspiration that I found through my research of neurons and synapses took my project to a place that I did not foresee when beginning this project. Art and science can work cohesively with each other and elements from both fields can be used to inspire and help the other. I no longer have to separate my logical and artistic side. Instead, I can combine them to create my own unique choreographic style.

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Appendix

Image 1

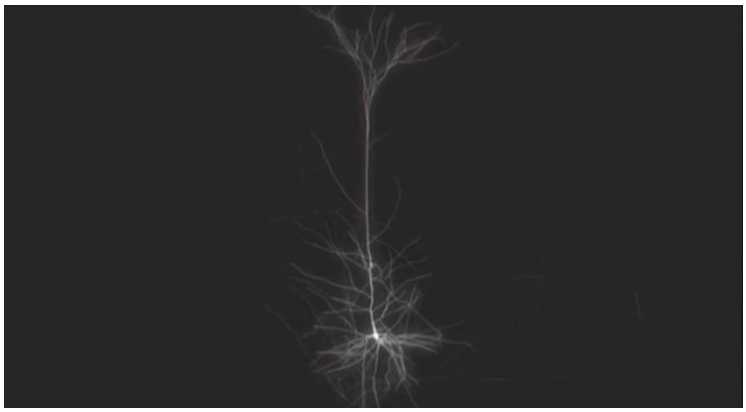

Image 2

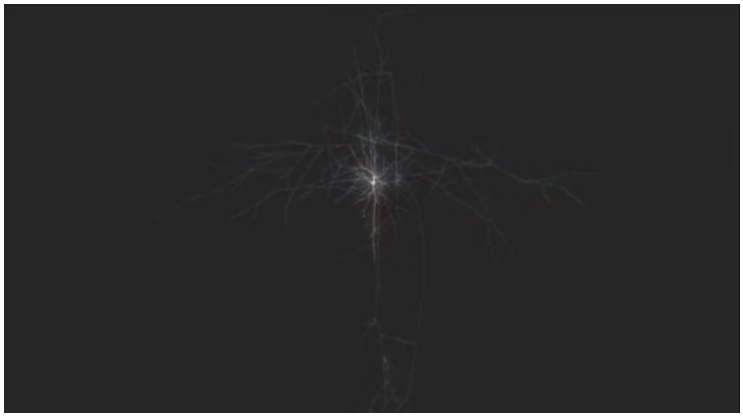

Image 3

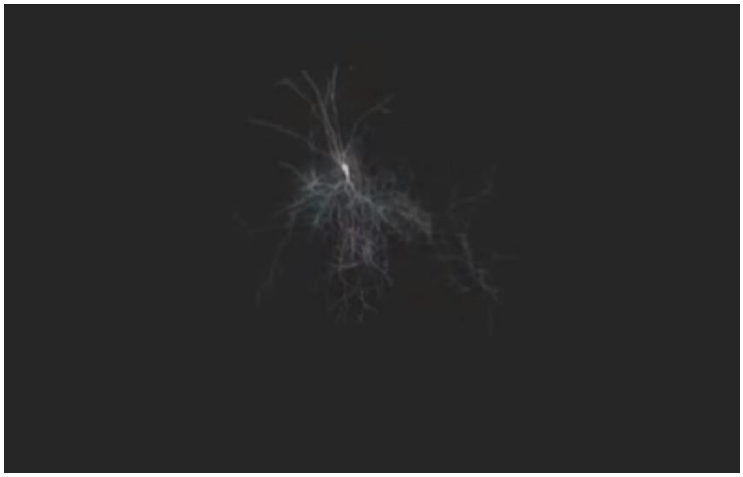

Image 4

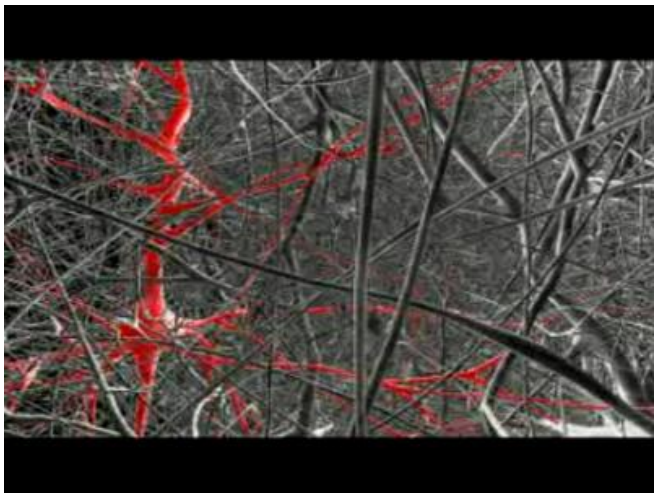

Image 5