Information Overload: A Collaborative Dance Performance

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ABSTRACT
The artistry of dance spans a multitude of professional fields encompassing projection, video, audio, and interactivity. Information Overload explored opportunities in which digital media could be incorporated into a modern dance performance. The piece examined how we relate to technology. Moreover, it brought together and drew expertise and knowledge from several programs of Drexel University including Performing Arts, Digital Media, Electrical and Computer Engineering, and Music Industry.

1. INTRODUCTION
Some choreographers explore ways to incorporate dance and digital technology. They experiment with the use of projection, video, audio, and interactive media. Because of the wide range of expertise needed to implement these technologies, many pieces are collaborations between different professionals. One issue collaborators face is how the art and science interact and inform each other. The digital technology used in a piece should not be solely showcased; instead, the art and science should work together to create a cohesive piece.

This work includes research and documentation on how digital media can be used as a part of dance. This research provides a background of what has been done in these fields and directly influences a performance piece, named Information Overload, designed, choreographed and produced by Lauren Mandilian [5]. The performance is a modern dance piece about how we as an American culture relate to the overwhelming nature of technology, and still demand more.

2. DANCE DESCRIPTION & RATIONALE
The piece began with a projection of rolling clouds, which represented all that is nature. The clouds transitioned to rain clouds, and it began to rain letters much like Text Rain by Camille Utterback [8]. A dancer emerged from the wings with an umbrella. The projected letters bounced like raindrops off her umbrella. A silhouetted dancer was projected on the screen. This dancer appeared small in the distance and grew larger and larger as she walked towards the audience. Two more digital dancers morphed out of the silhouetted and live dancer. Simultaneously, the live dancer and three digital dancers performed a choreographed dance piece as the raining letters continued to bounce off them. At the conclusion of the choreography, the digital dancers morphed back to the dancers from which they came and the live dancer exited the stage into the wings.

As the choreography was progressing, letters were replaced by individual words. Immediately following the dancers’ exodus from the stage, the words were replaced by a quote taken from “Techgnosis” by Erik Davis [2]. The quote broke up and the letters form the word “TECHNOLOGY”. The projected word “TECHNOLOGY” increased to create a bright metropolis and was then projected onto two Broadway flats, flown onto stage to enhance the three dimensionality of the projected cityscape that has grown. The ringing of a cell phone reverberated throughout the theater. The single cell phone sound grew to be a musical composition of vast varieties of technological sounds (such as fax machines and computers). The dancers emerged from the wings using various technological items such as mp3 players, PDAs, and cell phones. Totally focused on the world of technology, the dancers were oblivious to the other dancers on stage. The dancers walked by one another without the slightest indication that they saw one another. Like Edward Tenner in “Why Things Bite Back”, the piece depicted the dancers’ total involvement and dependency on technology [6].

After several minutes, the metropolis faded out and the dancers emerged back on stage. One dancer was stationed on the apron of the stage; she was filmed and projected as filtered video. Two other dancers performed around her projected image. This part of the piece represented society’s need for technology for the process of communication.

Modeling the Gertrude Stein Repertory Theater, the end of the piece featured animation projected onto the dancers holding pieces of fabric [3]. Moving with the fabric, the dancers used it to wrap it around themselves. The fabric represented the overpowering force of technology on society as discussed in detail by Davis. During the animation, boxes appeared to break through the screen to symbolize the various types of technology used on a daily basis. The animation became chaotic implying an overabundance of technology that society must deal with all at once. This chaos culminated in a Microsoft Windows styled critical system error or “Blue Screen of Death” and the dancers fell to the ground. This was intended to represent society’s frustration over the overwhelming amount of technology.

Untangling themselves from the fabrics, the dancers slowly recovered illustrating society’s desire to free itself from the daily constraints of technology. Using a full-circle dramatic technique, the projection transitioned back to the rolling clouds creating a literal and metaphorical loop. The conclusion of Information Overload symbolized the relationship of humans and technology, which is constantly failing and being reborn to make another attempt at cohesion.

3. EXECUTION
3.1 Silhouetted dancers
The beginning of the performance featured only one live dancer on stage. The other dancers, which appeared as silhouettes, were previously recorded. The animation featured falling letters, which simulated raindrops. Filming each dancer separately in Drexel University’s Mandell Theater created the silhouettes. Each dancer was instructed to wear all white and dancers with dark hair to wear an additional piece of fabric tied around their head. The dancers were then filmed in front of a black curtain making it easier to key out later. To create the illusion of the silhouettes morphing out of one another, the floor was measured and marked so that the dancers knew exactly where to stand at certain points in the piece.

After filming, the raw footage of the dancers were brought into Autodesk Combustion. The goal was to key out the black curtain behind the dancers so all that remained were the individual dancers. The dancers were placed in front of the background cloud footage, taken from the Adobe Image Library. Due to the fact that each dancer was filmed separately, it was difficult to align the figures. In some cases a dancer
appeared too far to the right or left and was not in time with their digital counterparts. This problem was rectified by carefully adjusting the individual dancer’s footage. It was transformed, where needed, while the dancers moved across the stage to reduce the appearance of sliding. It was also sped up or slowed down so that the dancers appeared in time. A difference key was then applied to each individual dancer creating a silhouette. The silhouettes were then brought into Adobe Flash as individual frames and traced into native Flash vectors (see Figure 1 below). The vectors were programmed to interact with the raining letters.

3.2 Metropolis
The metropolis was animated and textured using Autodesk 3D Studio Max. In post-production, 2D fog was added using Combustion. This small detail made the city appear more realistic. The metropolis alone was a static image however, by adding the fog, it created a small amount of movement so that the audience did not lose interest. Originally, the city was designed to appear more two-dimensional (see Figure 2 below). However, after the creation of the pre-viz and feedback, it was determined that the city animation would be stronger if it incorporated a 3D camera pan.
3.3 Incorporating DICE
The dancer that had a video filter applied to her projected image was created using John Henry Thompson’s DICE program [7]. DICE takes real time video footage and transforms it using one of twenty-two different filters (see Figure 3 below).

3.4 Finale Animation
The end of the piece featured animation projected onto the dancers holding pieces of fabric. The animation appeared very rigid and rectilinear; however, it became more curvilinear when it was projected into organic forms. The final product was 3D modeled and animated in 3D Studio Max. (see Figure 4 below)

Experimentation with perspective was explored by creating different angles and shapes with the fabric. The choreography was not created in advance and the dancers were challenged to create their own movement with the fabric through structured improvisation. They explored many different possibilities all attempting to trick the viewers’ real sense of perspective.

4. COLLABORATIONS
The complexity involved with this project spanned many fields and required significant collaboration from several programs at Drexel University including Performing Arts, Digital Media, Electrical and Computer Engineering, and Music Industry. In addition to the academic collaboration, several professionals were brought in to assist with the costume design, lighting design and technical assistance in the theatre. These academic and professional liaisons are experts in their field and provided support throughout the process. They were able to integrate aspects of the performance that would not have been possible without a profound knowledge of their respective fields; for example composing an original score and motion tracking a live dancer. By involving specialists from multiple disciplines everyone was able to learn from each other and gain knowledge of an unfamiliar field. We all worked together as a combination of many disparate pieces creatively combined into a final performance.

4.1 Computer & Electrical Engineering
A team of electrical and computer engineering students, as part of their senior design project, was engaged to design the complex technology interaction between the live dancer and digital letters [1]. The goal of their project was to wirelessly track a performer at a rate of 30Hz (standard video frame rate) with approximately 5cm precision and communicate the information in real-time to a video animation system.

The final tracking system employs two modalities for visual tracking: infrared light and color histograms. Infrared LED clusters were incorporated into a vinyl raincoat designed by the professional costume designer. Using conductive thread, she was able to sew the LED clusters onto the raincoat so there were no loose wires impeding the dancer’s movements. The clusters were powered with several nine-volt batteries hidden in a microphone pack and positioned on the raincoat at ten key spots: two on the front of the coat, two on the back, two on
each arm, and one on each side. The positions were chosen to mark the dancer’s upper body covering the widest range of viewing angles. LEDs were not incorporated into the dancer’s lower body costume because the piece involved a significant amount of floor movement. The risk of damage to the LEDs and the dancer was determined to be too great compared to the relatively small amount of data provided by lower body LEDs.

A secondary tracking system was also developed to determine the position of the umbrella by its color. It was necessary to use color tracking because of the difficulty in supplying power to the umbrella, as required by the infrared LEDs. Compared to the LED system the color tracking system required more precise calibration. Every night before each performance, the color model used for the umbrella was initialized by manually sampling a specific area under performance lighting conditions from the camera video feed.

Two Firewire cameras utilizing IIDC, an uncompressed video transmission format, were used; one with an infrared filter to track the LEDs and one without any filters to color track the umbrella via color. The cameras were positioned behind the audience in order to capture the entire stage. Each camera was connected to a dedicated tracking computer running Linux and a customized version of Open CV (a library of functions for real-time computer vision applications [4]. Custom software based on Open CV was developed to observe the video, track the LED clusters and umbrella, and assign each a unique ID and position. The position data is sent every 1/30 second through an Ethernet-based network to a third display computer, located in a projection booth, tasked with executing the animation script authored using Adobe Flash. Another custom application written in C#, conveyed the received coordinate information to the animation script via the Flash External API to control a rough figure of the dancer in Flash (see Figure 5 below).

5. OBSTACLES

During the process of creating Information Overload, many obstacles were overcome. To begin, the raining letters morph into the city animation and cannot be split between multiple media types. This means that the city animation must be included in the Flash animation despite the fact that Flash was not necessary for that part. Another constraint of using Flash video is only one video can be displayed at a time. Therefore, all video assets were imported into Flash as one composite video. The score during the DICE filters and finale animation were also combined. While not inherently compatible, the two were merged into one QuickTime file to create a seamless transition. This left us with two media types, a Flash and QuickTime file, and no way to seamlessly transition between the two. To get around this limitation, choreography was developed to transition from the metropolis into the next scene. The dancers perform in silence with no visuals, allowing the stage crew time to swap the Flash and QuickTime files.

After the footage was silhouetted for the beginning of the piece, it was brought into Flash so that it can be programmed to interact with the raining letters. Because the silhouettes were in High Definition format, it caused Flash to crash. To solve this problem, the High Definition silhouettes were incorporated into the composite video, which is much less resource intensive for Flash. Next, quarter sized silhouettes were brought into Flash and traced into native Flash vectors. The vectors were scaled up and programmed to interact with the letters. Because the High Definition silhouettes are in the background video, the quarter-sized silhouettes can be made transparent causing it to appear as if the letters are interacting with the High Definition silhouettes. Silhouetting the footage could have been easier and cleaner looking if all dancers wore a piece of white fabric around their head and a white umbrella was used.

One of the toughest obstacles of this project was working with the engineers. In case the engineers were not able to create a functional motion capture system in time for the performance, a back up plan was devised. Because the live dancer was filmed in the same time as the silhouetted dancers, her footage could be treated the same way. This meant that her footage could be brought into the Flash animation as a transparent object and programmed to interact with the falling letters. Therefore, the live dancer must perform exactly as she was filmed. To the audience it appears as if the live dancer is interacting with the letters when in reality it is her prerecorded footage.
6. CONCLUSION
The piece, *Information Overload*, examined how we relate to technology. Ironically, the very production of this piece mandated the integral use of the technology it attempted to explore. In order to create the complex visuals required by *Information Overload*, it was necessary to integrate several separate technologies. The vision of the piece demanded this and would not have been possible without the tight integration.

Many conscious decisions were made to help achieve the interaction between the performance and the technology, such as the mix between the projected visual elements and the live performers. The use of digital media was balanced throughout *Information Overload*. The dance and digital media were of equal importance and did not overpower each other. During the finale animation, the tight integration of the dance and digital media made it easy to experience both simultaneously. The dancers themselves were used as a projection surface and became a physical part of the animation. Their body movement drew from the animation thus making them an extension of the animation.

If one aspect, either the dance or the digital media, was more important, the other was downplayed so as to remove the possibility of splitting the audience’s attention. In the beginning of the piece a quote rained into the scene and the dancer left the stage; this allowed the audience to focus their attention solely on reading the quote. Similarly, at the end of the piece, the “Blue Screen of Death” began with all the dancers lying on the ground. After the audience had enough time to process the screen, it repeated and the dancers began to untangle themselves from their fabric. The repetition of the visuals allowed the audience to focus their full attention on the dancers. By creating a balance between the dance and digital media, *Information Overload* was able to direct the viewers’ eye. It is the author's view that unless carefully designed and balanced, technology can easily "overload" the performance.

*Information Overload* premiered in May 2007 and was very successful. The audience reacted to the piece much like the concept had hoped for. Additionally, everyone involved in the creation process learned a lot from the project. This project demonstrated that the integration of live dance and digital media could create a performance piece that conveyed a message about technology's impact on our lives that neither dance nor digital media could alone achieve.

7. REFERENCES