

*Conceptualizing the **energyComposer**:
Interactive Choreography and
Performance Using Software and Motion Tracking Systems*

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“Of all the arts, dance would seem the least likely to accede to the vagaries of rapid change and the relentless advances of this modern technology. Dance, the art of human movement, on the surface appears nontechnologically inclined. It is the self-sufficient art.” Judith A. Gray

1. Evolution of the dance and technology relationship

Since the first attempts to computerize dance notation (such as Labanotation) in the 1970's, it was conceived that dance and technology were meant to be together. Just because dance seems to be the self-sufficient art, it doesn't mean that one couldn't 'accessorize', expand and experiment. Initial attempts to design computer-based dancers happened at Simon Fraser University with an ellipsoid body figure and at the Royal College of Art with a sphere-based model that could cast shadows. The pivotal moment for embracing such project may have been the New York Institutes's 1983 elegant dancer created for Twyla Tharp's video choreography "Catherine Wheel". The development of computerized notation systems for dance have since opened the door for endless choreography experiments. The use of motion detection systems was notably used first at Tufts University for cross-disciplinary purposes by Alice Trexler and Ronald Thornton.ⁱ

Labanotation was conceived by Rudolf Laban in 1928 but has come a long way since that. It has been developed so much that

any type of movement can be mapped using this system. The system involves a shorthand system that requires training for interpretation but it also allows for some room for improvisation by the dancer. It is possible to specify velocity, acceleration and quality of movement if an additional parallel notation system is used called the Effort-Shape. This is a tedious method because it involves breaking down the motion into very small pieces.ⁱⁱ

Giving the dancer freedom to interpret a given choreography is a method that allows for more interesting experimentation and it expands the possible use of a notation system. For one thing, it makes the notation more useful for dance that is not body-designed such as ballet and it allows for modern performance style. Moving away from classical ballet composition and embracing dance for dance's sake is a trend that many arts disciplines followed after the rise of the Avant-Garde movement and after deconstructivism. It seems that making the effort to break down the movement and map it gave rise to interests in isolation of movement, decentralisation and unconventional ways of reaching balance.

Perhaps the most famous dance and technology choreography is Merce Cunningham. His vision of making dance focuses on the motion itself, not an illustration of a particular concept. His innovation continues in the separation of music and dance. He

choreographs motion and his music composer works independent of that motion. Both music and dance come together for the show. His collaborations with John Cage for work such 'Points in Space' is also one of the first dance works designed for the camera view and not for the stage.

Cunningham improvises in order to find the movement phrases he is interested in. He experiments with their execution and their interpolation and then choreographs. After leaving Martha Graham and starting to develop his own style of choreography, his audience could not believe that the dancers were indeed following a set, strict choreography and were not improvising on stage during the performances. People failed to understand that the range of motion and on-stage positioning Cunningham used could not have worked but only with practice and perfection. Phrases originated in improvisation but were executed in the final performance in a strict schedule.

In the late 1990's, a new piece of software for dance notation started being developed called "Life Forms". It has become so popular that it is used extensively for human motion animation in combination with motion capture files from various motion capture technologies. Motion tracking systems have also affected the area of dance in a major way. Perhaps the most common way to track motion is by analyzing captured images. Computerized image processing technology has been possible since

the 1960's and the explosion of video in the last three decades after that has made yielded many memorable dance performances. The emphasis with image-based tracking systems seems to be real-time image processing and interpretation of the dance, oftentimes using color maps. This kind of work is still popular today especially since the affordability of digital video cameras. A very popular system that does just this is the VNS (Very Nervous System) created by David Rokeby and used by Todd Winkler.

Post-processing or performing real-time image processing of dance performances has expanded the possibilities of staging in current days. Such video projections are being used as background, filler and to supply the real dancers with more 'partnering' possibilities. Isadora created by TroikaTronix is a graphic programming environment for real-time manipulation of images, video, graphics and sound created for dance projects for Troika Ranch.

Motion capture data is commonly used in dance projects to produce 3D animations as additional partners. Such projects are abundant in the Dance and Technology shows organized by Georgia Tech that started in 1994. One of their projects in 1996 featured a choreography by David Parsons using animated dancers and virtual costumes through real-time optical motion tracking and projected animation of costumes onto the dancers.

Cunningham's 1999 project "Biped" was a stunning mix of choreography of real dancers and ethereal dance creatures choreographed using Life Forms and output on gauze screens. The virtual dancers merely contributed in the choreography as additional bodies coming in and out of the stage and added another dimension and depth to the show. It has been so far the most 'elegant' show produced using technology for choreography and no other such project has picked up as much publicity as this one. Specifically, in Ohio State's Interactive Performance Series 2002 Think Tank Report, Birringer his summarizing report notes the frustration expressed by people such as Dawn Stoppiello of Troika Ranch and Kent de Spain wondering where is the work that has gotten media attention and why it seems that all performances currently seemed to be in "beta-release aesthetically".

2. The energyComposer concept

DeLahunta and Spain's concern has been a personal concern of mine while developing a solid concept for **energyComposer**, my thesis project so I have opted to develop the concept visually in my mind before I even decide which technology to use, rather than experiment with the technology which I have done and has proven a constant frustration.

I have set myself the following goals:

- to increase my awareness of how tracking systems function and how they can be useful to me creatively
- to create a relationship between data collected from the tracking system and choreography in an indirect manner
- to experiment in the medium of performance art by creating a space and a reason to improvise motion

a. concept

Motion requires energy. Dance requires energy. Choreography requires composition, analysis, translation of that energy into motion and back out into energy. Choreography interprets and dictates different types of energy. By means of a tracking system that energy can be collected as data, interpreted and used for composition. The user shall be positioned into a virtual space and 'forced' to move physically into that space. Navigation in the traditional sense will be disabled. The user shall be forced to move in order for the virtual space to respond instead of the opposite.

energyComposer will remap that energy onto a given choreography. For example, the aerial level in which the user is motioning in will decide which part of the body the remapping will happen.

b.choreographic glossary

motif: A dominant, usually recurring idea or element in a dance or sequence. Motif development as a choreographic device involves using a single movement or short movement phrase that is manipulated (e.g., by varying the elements of movement, by repetition, by fragmentation, using different body parts) to develop movement sequences for a dance.

theme: The underlying idea/motif or intent used to create movement

phrase: theme with a beginning, middle, and end; a sentence.

c. Technical And Aesthetics Conflicts/Ideas

i. tangible vs. intangible interface

Two possible ways of collecting data: a. A visible or invisible grid of trigger will turn on and off data collection. When the user motions from point A to point B, the system will calculate DISTANCE and VELOCITY from point A to point B. VELOCITY will affect length of execution of a phrase. DISTANCE will affect speed of interpolation from one phrase and/or theme to the next. b. data collection will be turned on and off based on a delay system. When the user is immobile data collection stops. Data collection starts again when the user exceeds the 'immobility' threshold and stops when he exceeds the 'speed

limit'. DISTANCE and VELOCITY will act same as above. (currently favoring (a))

ii. visible vs. invisible interface

Depending on the previous debate, there are two options for exploring space. Some immediate feedback from user interactivity should be expected. If option (a) from previous argument is picked, an intensive visual and aural response would be desired to motivate the user to motion via the principle of instant gratification and to clue them in perhaps aurally when they toggle data collection on and off. With option (b) I would prefer visuals that are created in real time, rather than a visual that is there that responds with user motion, to enforce the 'creating something with nothing' concept. (currently favoring a visible interface)

c. bvh technology and issues

Bvh files are motion capture (mocap) files standardized by Biovision and used across many animation programs for complex skeletal animation. They are text files that consist of a skeleton of joints, joint offsets and channels of motion. They include number of frames and frame duration and a series of sampled data points. The programs that parse the file distribute the data points over the joints and the choice of what that skeleton looks like is decided in the animation program, NOT the bvh file.

There are syntax conflicts with different versions of programs that compose the bvh files differently mainly with using world vs. local coordinates (origin for human is 'hip') and also with joint names and joint mapping. The current parsing application we have at EVL written by Shalini Venkatamaran seems to favor bvh files from a particular version of the program Poser rather than standard bvh files.

d. modern vs. classical piece and piece-meal vs. one file

If one mocap file is used and 'marked' for themes, phrases and motifs, the genre of dance is of no importance besides personal preference. If however, the system has to string together different mocap files then classical or modern ballet will be preferred because it is body-designed and it is easy to create a series of small phrases that for example all start and end in one position, therefore there are no interpolation issues.

e. public vs. private user experience

To expect that anyone placed in this environment will move and even perform in any level is too much to ask. My experience with past CAVE shoes is that two out of eight people actually want to navigate. Being forced to perform in public in any way is not expected in this case. I would much rather have the user be alone in their experience and take advantage of the space. A

clone of the application could be a public experience if a performer explores the space.

f. making the energy-mapping connection

An additional prop should be a way for the users waiting to see what the user in the space is doing. An idea would be to translate the data into a visual color graph being affected with the data collection.

3. Final Thoughts

My vision of the energyComposer is to have an interesting private space for any person to move in. I don't want the user to worry about what that means and how what they do will affect something constantly. I want them to just interact with the physical and the virtual space which is something that doesn't happen in your typical VR experience where people stand still and navigate. The data I collect from the user will be reinterpreted and affect a given choreography that will be available for people to see in the waiting area. The stage of the choreography outputs will get populated as more people experience the space. This way they can enjoy two experiences: affecting a virtual space by moving in the physical space and contributing to the virtual dance stage by affecting the given choreography.

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