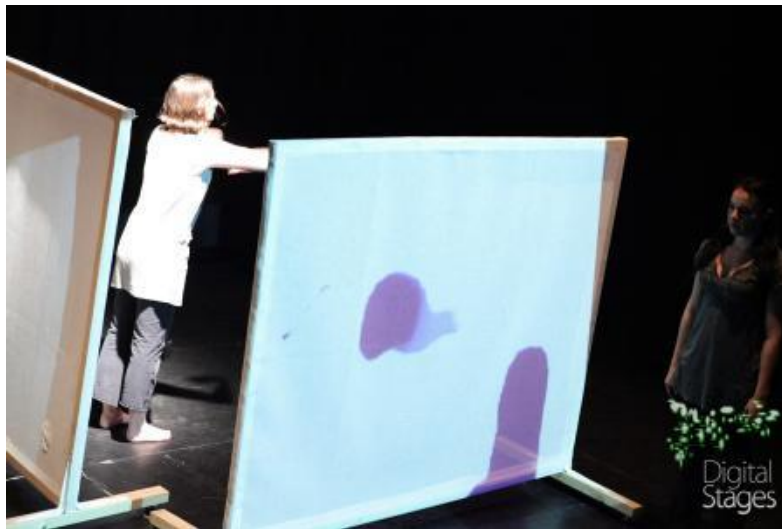


# CHOREOGRAPHING TOPOLOGICAL SPACES WITHIN DANCE PERFORMANCE WITH REAL-TIME VIDEO

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This paper will explore how the use of real-time video projection in live dance performance creates multiple spaces for choreography and how these spaces result in a topological approach to dance-tech work. Within the research, the types of space identified within choreography with real-time video projections include physical space, camera space, projection space, and compositional space.



*Fig 1. Nayra mara at Digital Stages Festival, London. (c) 2011 Piotr Erdman [www.otof.lt](http://www.otof.lt)*



*Fig 2. Nayra mara at Digital Stages Festival, London. (c) 2011 Piotr Erdman [www.otof.lt](http://www.otof.lt)*



*Fig 3. Nayra mara at Digital Stages Festival, London. (c) 2011 Piotr Erdman [www.otof.it](http://www.otof.it)*

This paper will explore the use of space within choreography with real-time video and will discuss spaces that have been identified through a practice-as-research approach. By creating a dialogue between performance works by the author and topological definitions of space, further considerations of composition of space within dance may be considered as well as means to achieve this, such as the use of qualitative rhythm.

To begin this consider of space, a definition of choreography must be considered. In this research choreography is the nexus between space, performer, movement and sound (Sanchez-Colberg, 1992). More specifically in this research, dance works created for black box theatre spaces will be considered. This paper also considers real-time video technology. Real-time video refers to the processing of video by a computer, so it has as little latency as possible when pixels are captured. This then may be utilised by software to transform pixels using a range of techniques such as background subtraction or visual effects. Real-time video may be live footage or footage used within video tracking systems, but it has as little delay as possible (to the point where it may not be recognisable by the human eye). In this work, the real-time video creates projections, which are then incorporated into a black box performance space during a live dance performance.

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## TYPES OF SPACE IN CHOREOGRAPHY WITH REAL-TIME VIDEO

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With choreography for the stage that utilizes real-time video projections, multiple spaces for movement must be considered. These include the physical space of the performance as well as camera space, projection space and the compositional space. These spaces form frames for movement and have interrelationships that create the composition.

To create a definition for a frame for movement, one can adapt Deleuze's cinematic concept of the frame. He discusses the frame as creating a space that maybe transformed and creates an open set. "The frame therefore forms a set which has a great number of parts, that is of elements, which themselves form sub-sets... Obviously these parts are themselves in image [en image]" (Deleuze, 1986, p12). By creating spaces that are sets of elements or movement, the frames and their relationships create a composition. "Framing becomes the means by which the plane of composition composes" (Grosz, 2008, p18). The composition of these frames will be discussed later in this paper, by examining the topological properties of these frames and the emerging choreotopology.

The physical space is the black box theatre and creates the first frame for movement. "The typical proscenium stage creates a theatre of illusion whereas smaller, more informal spaces lend themselves to performances in which events are to be seen as happening in a quotidian time and place...non-proscenium spaces communicate the proximity of life to art" (Foster, 1986, p60). The physical frame is where the dancers perform and the movement is first generated.

Camera space frames movement not only in the lens of the camera but also within the programming of computer vision utilized in dance with real-time video. Within the camera space the location and position of the camera not only effect the framing, but also transform movement into a digital space. "The distance between the camera and its subject matter, the angle, the focus, the use of lighting and the style of editing all contribute to this modification" (Dodds, 2001, p30). Camera space also involves computer vision that manipulates the movement of pixels. "Multimedia computers have become fast enough to manipulate video on a pixel-by-pixel level rather than frame-by-frame" (O'Sullivan and Igoe, 2004, p234). This manipulation of movement via programming is integral to the choreographic process.

Projection space involves the surface of the projection (such as a screen, cyclorama, etc), as well as the content of the video being projected. The projection space is a physical construct, whether it is a wall, cyclorama or custom screen, which provides a surface for video to be shown. Another component of projection space is that it is not simply the geometry of the screen or projection surface, but there is also a digital space to be considered. This aspect of projection space is where the movement captured in the camera space re-emerges as part of the choreography transformed in real-time. This frame looks to transform the movement captured in the camera space and present it back into the physical space.

Compositional space is the most topological of the spaces as it has continuous interrelationships with other spaces and it is these relationships that are choreographed into a composition. Compositional space does not act as a container for the other frames of the composition (physical, camera and projection), nor does it react with space outside those identified in the performance. While it is the territory for the dance piece, it has constantly changing relationships with the other frames that can be choreographed by exploring rhythms within the movement.

## **Topology and Dance Composition**

Topology in its mathematical definition includes sets and subsets that are open and when sets intersect the union creates a collection of open sets. It also can be applied to choreography. "Topology characterizes dance as a precisely choreographable pattern in space and time" (Portanova and Piccirillo, 2009, p2). If each space for movement (physical, camera, projection) is considered an open set of movement, then the compositional space created by their interrelation is a combination of open sets of continuous movement (Rotman, 2009). This causes qualitative space as the continuous movement is outside of measurement and Euclidean geometry. Topology is "the process of arriving at a form through continuous deformation" (Massumi, 2002, p184).

Deleuze and Guatarri (1988) discuss the plane of consistency or composition as "not a plan(e) of organization, development, or formation, but of nonvoluntary transmutation" (Deleuze and Guatarri, 1988, p269). This idea of composition as "only relations of movement" (Deleuze and Guatarri, 1988, p266) reflects the topological nature of the compositional space within dance with real-time video systems. The measurement of the space does not determine the relationship of the live dance with the projected dance, but instead it is choreography of movement across these spaces. Examining the plane of composition as transmutation and relationships of movement, the topological design of the space becomes apparent as the composition is created through movement.

Within dance composition of space, rhythm emerges as a critical part of choreography in topological spaces as rhythm is found in movement and in time. Rhythm becomes the action, distribution and energy between the frames of space in a topological choreography without becoming a metric organizer of movement. Rhythm does not have to be quantitative to be part of movement composition, but instead rhythm creates space and time with energy in a qualitative manner, as "it is well known that rhythm is not meter or cadence, even irregular meter or cadence" (Deleuze and Guattari, 1988, p313). Qualitative rhythm is creates this composition of space by providing the temporal means for movement throughout the composition in a qualitative distribution, rather than require a measurable increment of movement, space or time.

### ***Nayra mara* - Performance at Digital Stages 2011**

During January 2011 a new piece entitled *Nayra mara* was formed exploring the composition of live dance with real-time video projection. The real-time video system was comprised of a CCTV camera, the software package Isadora, a MacBook running the software and a video projector. This piece began as a solo performance and was later developed into a duet with performances at the Digital Stages Festival in London in April 2011.

An important addition to the compositional landscape of this piece was the making of moveable screens out of sharkstooth mesh, a semi-transparent fabric that allows for front projections to be seen, as well as the fabric to be seen through when back lit. This means that the choreography is not only movement of bodies and pixels, but now screens as well. It also allowed for projections to be in front of the dancers within the physical space, rather than always placed behind them. These movements considered in relation to each space create a dance composition.

Because of the movement and possible semi-transparency of the screens, there were a lot of spatial relationships based upon the location of the screens that had not been possible in previous work in this research project. This new movement and new relationships of spaces because of the new movement, contributed significantly to the creation of topological compositions of physical, camera and projection spaces. Because of this, the movement creates compositions that are not plotable configurations in

physical space but deformations and distributions of movement across spaces. Continuous change in location of the frames of movement means that the use of space in the piece can be described as topological.

The piece begins with the two screens in parallel diagonal lines on the stage in the black box space. One performer begins to move in the physical space and travels in between the two screens. This is the first time that the movement is seen behind the projection space, however, at this moment due to the lighting, the camera does not see the performer behind the screen. As the performer travels, the movement becomes visible to the camera and is simultaneously in the camera space and physical space. The camera space is programmed to look for the difference in pixels caused by the movement and this movement of pixels is then projected on the screen. The movement continuously flows from physical to camera to projection space and the arrangement of the movement in these frames forms the composition. As Grosz (2008) discusses in regards to architecture, the choreography negotiates the spaces existing in continuous relations to each other and the movement is present in the physical space of the blackbox, the camera space, and in the projection space of the screens simultaneously and the use of real-time technology permits a topological relationship. The performers walking around the screens follow the traveling, which is repeated several times with an increase in the speed of the walking each time. This can be seen as an increase in the energy flow and the resulting qualitative rhythm, which constructs the composition.

During the Digital Stages performance this section was not as successful in demonstrating the topological spaces because the lighting effected the projection as the dancers entered the stage. The lighting hit the screens and prevented the movement on screen to be seen clearly. There were many reasons for the lighting design interfering in this section, including the locations of the light in the rig and the lack of side lighting options. Despite this not working as well in this opening section, later in the piece a similar effect was used and was more visible to the audience, so the continuous movement was apparent and the topology was formed.

Following this section, one performer moves one screen to the back of the black box. The second performer circles the second screen around the centre of the space. The other performer begins to then circle that screen in the space. This movement of the projection space adds a new movement that is also in a continuous relationship with the other spaces in the composition. As the frame moves, the camera picks up its movement and creates a difference image that is then projected. However, the projection space is now moving in a circle and the movement from the camera space is only visible when the projection space is moving through a position in which one of its wide sides is in front of the projector. When this happens, the movement of the performer and the screen are visible briefly and then they continue to move and the image is lost from the projection space, until it is repeated moments later. The projection space now depends on time and movement to be part of the composition. This moment in the piece creates a dynamic space and illustrates Massumi's topology as a system for understanding spaces where movement is continuous. If one were to make this moment of the piece static, the movement would not be seen transforming into projection space.

In the middle of the piece the movement in the physical space begins with a gesture forward with the right arm and repeats this several times, gaining speed and momentum and allowing the left arm to join the gesture and the body to bounce as a result of the force of the movement. The movement is stopped abruptly and both arms are "caught" behind the live performer, where they struggle to release the hands from behind the body by leaning forward. Eventually they release the arms from this position and rebound and settle back to the original neutral standing position, to begin the sequence again. The

movement is transformed from the physical space by the camera space and then the projection space to then join the compositional space. The result is a projection that is reflecting the gesture but has been transformed into a blurred form, which slowly increases and decreases in size based on the amount of movement in physical space.

In this section, one performer is located in front of one screen and the second performer is behind the screen. The second screen has been placed perpendicular in the physical space. After the movement sequence is repeated twice by the performer in front of the screen it is then repeated by the dancer behind the screen. The semi-transparency of the screen allows for the camera to see the movement behind the projection space. This is the first time throughout this research that the movement being performed is located behind the projection being generated. The performer then walks around to the front of the screen where the movement that was just performed has been captured and is projected as the performers watch.

Two important aspects of choreotopology are occurring in this section of the piece. The gesture creates the interrelationships as it happens across space and the choreography of these interrelationships utilizes qualitative rhythms. Because the movement can be seen through the screens, the possibility of performers being located behind the projection space is possible and creates new relationships of the physical space, projection space and camera space within the composition.

The rhythms of the movement in this section of the piece are qualitative and contribute to the choreography of topology through non-metered intensions for the timing of the movement and through the use of energies. On different planes (projection, camera and physical) and with no pre-determined meter as the timing of the movement is based upon improvisation of the live performer, this section demonstrates rhythm as qualitative. Meter, as well as how the movement “ties itself together in passing from one milieu to another” (Deleuze and Guattari, 1988, p.313) across spaces. It also explores different energies to produce these qualities of rhythm, with an increasing intensity of the force of the gesture developing and then ending abruptly.

## **Summary**

Within choreography with real-time video projections, space becomes complex. Four frames for movement emerge, including physical space, camera space, projection space and compositional space. The relationship between these spaces can be considered topological as they rely on continuous transformation of movement. This interrelation creates a dance composition with consideration of all the frames. Another choreographic element to creating dance work with multiple frames for movement is the consideration of rhythm.

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