Making Connections
Through the Fifth Wall: A New Creative Place for Performing Arts and Pedagogy in Higher Education

Final Report
for JISC (previously JANET)
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1.0   Project Summary

"Making Connections Through the Fifth Wall: A New Creative Place for Performing Arts and Pedagogy in Higher Education" was a JANET funded Arts and Humanities network project, which ran from January 2014-May 2015. During the funding year, JANET (the network provider for UK education and research) became reorganised as part of the larger company, JISC. The Project was a three-way collaboration between staff and students at Edinburgh Napier University Music Department (UK) and staff and students in the Dance Departments at Liverpool John Moores University (UK) and Nova Southeastern University, Fort Lauderdale, Florida, (US). It involved the use of VisiMeet software videoconferencing system to link all three sites. The Project Directors were able to establish that:

1. VisiMeet videoconferencing software technology did enable collaboration between three distanced sites (Edinburgh, Liverpool UK and Fort Lauderdale Florida, US) to create a new performance work that combined music and dance.

2. Within the limited timeframe (nine week rehearsal schedule), the video conferencing technology demonstrated that it could serve dance/music pedagogy and the creative process. However, for greater support for both teaching/learning in Higher Education and for further solutions for the arrangement and presentation of multiple projections more investigation is needed.

3. The use of VisiMeet technology was able to support linking three distanced spaces with multiple projections and with multiple audiences (in at least eight sites).

4. At the performance on 21 November 2014, we experienced issues with poor audio quality when audience members from around the world (who were on the free downloadable VisiMeet version) joined our meeting/performance. So much so, that the post-performance discussion between all sites had to be terminated. The use of external microphones at a subsequent performance and presentation on 5 May 2015 at the fifth European Network Performing Arts Production (NPAP) Workshop at the Royal College of Music, London did much to improve that issue.

5. This report will evidence the process that this project followed, and will share its model of practice which could be used by others.

2.0   Introduction

"Making Connections Through the Fifth Wall: A New Creative Place for Performing Arts and Pedagogy in Higher Education" was a JANET funded Arts and Humanities network project, which ran from January 2014-May 2015. During the funding year, JANET (the network provider for UK education and research) became reorganised as part of the larger company, JISC. The Project was a three-way collaboration between staff and students at Edinburgh Napier University Music Department (UK) and staff and students in the Dance Departments at Liverpool John Moores University (UK) and Nova Southeastern University, Fort Lauderdale, Florida, (US). It involved the use of VisiMeet software videoconferencing system to link all three sites. The project sought to develop earlier two-way telematic performing arts projects that had used Adobe Connect, Polycom and LoLa to enable a three-way connection for a synchronous performance with dancers and musicians. In addition, the project wanted to enable a link-up *both* in a webinar type situation with VisiMeet (where the audience could view and comment but not be part of the screen view) and a video conferencing situation where they could view and be seen—peeking through that virtual 'fifth wall'[1]on order for them to see and speak with each other in a post-performance audience discussion situation.

2.1   Project Directors:

Pauline Brooks, Ph.D. Liverpool John Moores University, UK

Katrina Burton, Ph.D. Edinburgh Napier University, UK

Paul Ferguson, Ph.D. Edinburgh Napier University, UK

Luke Kahlich, Ed.D. Nova Southeastern University, Fort Lauderdale, Florida, US.

2.2   Project Aims:

1. To examine if videoconferencing technology enabled collaboration between three distanced sites to create a new performance work that combined music and dance.

2. To investigate how video conferencing technology could serve dance/music pedagogy and the creative process, (specifically if and how it might engage students/tutors collaboratively within a new spatial 'frontier').

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[1] Spencer, T.M. (2012) *Breaking into the Virtual 5ᵗʰ wall: Choreographic methodologies for telematic dances*. UMI Dissertation Publishing, 3.

3. To examine the potential for linking three distanced spaces with multiple projections and multiple audiences.

4. To discover if the technology could enable audience members to join together in post-performance discussion of the work.

5. To establish a model of practice that could be used by others.

2.3 Objectives:

A. To assess how the videoconferencing systems enabled collaboration between distanced artists.

B. To evaluate the effectiveness of the pedagogical strategies used to utilise the technology to serve the collaborative music/dance process.

C. To determine the most effective arrangement of the multiple screens for more than one audience.

D. To critically assess if the technology enabled audiences in distanced locations to participate in post-workshop and post-performance critical discussion.

E. To make recommendations to improve the model of practice.

2.4 Background:

In the autumn of 2007, the dance departments at Temple University with Luke Kahlich (Philadelphia, US) and John Moores University with Pauline Brooks (Liverpool, UK) began a series of telematic projects to explore the use of the internet in teaching/learning choreography and performance through collaborative activity. The overall research was called *PhillyPool* and continued through 2011. The project moved to Florida in spring 2013 with Nova Southeastern University (Fort Lauderdale, US) and Liverpool John Moores, and the project was renamed *NovaPool*. Each year a particular paradigm or design was created to test the technology and how it might assist international teaching/learning in the creative process.

The telematic environment challenges both the teachers and the students in how to create, perform and analyse choreography when dancing with real and virtual dancers for real and virtual audiences. Discussions between the audiences and with the dancers in the *Phillypool* and *Novapool* projects have revealed new insights into how we see and perceive ourselves and others through lenses of technology and reality as well as how artists/teachers must find

new ways to teach and create in this layered visual world that offers both opportunities and challenges.

Making Connections was a collaborative project that sought to further develop and expand the work of the *Phillypool* and *Novapool* projects by making links between music and dance students in three geographically distanced universities: Liverpool John Moores University (LJMU) in northwest England, Edinburgh Napier University in Scotland and Nova Southeastern University (NSU) in Fort Lauderdale, Florida, USA. The project explored how connections could be made between musicians and dancers in distanced spaces brought together by VisiMeet videoconferencing technology. It also investigated how the technology might create new spaces for performance with live audiences in each space and on the Internet, as well as enabling audience members to join together in discussion as part of the analytical process.

2.5   Participants:

Liverpool John Moores University – England, UK

Director: Pauline Brooks, Ph.D.

Technical Staff: Noel Jones

Performers: Gemma Anderton, Emma Carter, Elizabeth Cavanagh, Louise Dolan, Pagan Eastlake, Natalie Mosedale, Georgia Richards

Project Manager: Laura Edwards

Edinburgh Napier University – Scotland, UK

Composer: Katrina Burton, Ph.D.

Conductor: Kenneth Dempster, Composer in Residence (Conductor Edinburgh Napier Chamber Orchestra and Edinburgh Napier Contemporary Music Ensemble).

Technical Coordinator: Paul Ferguson, Ph.D.

Technical Staff: Craig Ainslie, Rune Lilledal Hansen, Chris Harding

Performers: Pierre Louis Attard, Rachael Black, Laura Cioffi, Stuart Condie, Clara Galea, Darren Gallacher, Jamie Lang, Anna Wright, Alistair Walker

Nova Southeastern University, Ft. Lauderdale, Florida, USA

Director: Luke C. Kahlich, Ed.D.

Technical Staff: Edward Fitzpatrick

Performers/Co-choreographers: Becka Etheridge, Sierra Parks, Stephanie Ponce, Kristin Smeriglio.

Image 1. Company Photo

2.6   Process and Development

The educational plan behind *Making Connections* was as a collaborative distanced performing arts project in Higher Education using technology to enable the collaborative devising/rehearsal and a shared performance. The first four months of the project involved the directors/tutors and technicians in each three sites exploring how to use the VisiMeet software to link-up during the project planning and pilot stage, using, in the first instance, the free downloadable version, with extended capabilities provided free by VisiMeet. From August 2014 three room licences were purchased to enable three-way link-ups and to provide the possibility for others to join us in meetings (important for the final performance). Support and advice was provided by VisiMeet IOCOM: Phil Lowe, UK-based Technical Manager, and Gary Refka, VP and Customer Support and Operations Director based at VisiMeet company headquarters in Chicago, Illinois, (US). Their help and advice was invaluable to guide us through the initial set-up issues we experienced with audio and occasionally, image quality. Simple suggestions as to all use the same external web-cam product and to guide us with checking the system was particularly helpful. (See more in Technology Section, 6.0 p18).

On 12 May 2014 we were sufficiently confident to pilot linking musicians in Edinburgh with dancers in Liverpool, and with Luke Kahlich acting as 'critical friend' in Fort Lauderdale. We were able to maintain a link by which dancers and musicians could see and hear each other, and Directors in each site could speak with each other. By the end of the day we were confident that we could proceed with the project using VisiMeet as videoconferencing

software to enable a three-way collaborative performance project linking dance and music. A performance date was selected (21 November 2014). Katrina Burton would work June – August to complete the composition of a new score inspired by the Tate Liverpool exhibition on Piet Mondrian, to be played by the Edinburgh Napier Contemporary Music Ensemble (see Music Composition, Section 5.0, p14). The rehearsals began 19 September by bringing the distanced dancers together and introducing them to working in a telematic site while separately, the musicians were introduced to the score. On 26 September, dancers and musicians again worked (separately), but met for the first time through VisiMeet as a whole company. From 3 October 2014 the whole company began working together on a weekly basis, every Friday for 2 ½ hours for seven weeks prior to the international performance on 21 November. The student Project Manager organised a private company Facebook group and a Project Blog (see https://projectmakingconnectionsblog.wordpress.com)

In preparation for a three-site telematic performance on 21 November 2014, that would also be seen by locations in Greece (the Ionian University, Corfu), Chicago, Illinois, Texas and other parts of Florida, trials were made (with the Ionian University only) with regards to their joining the meeting during rehearsals. It became clear that the audio was severely affected, unless the additional viewers muted their microphones; to do so proved to be crucial. On the day of the performance not all those joining the performance from around the world did so, and while the actual performance was not detrimentally affected, it did disrupt the pre-performance introductions and severely impacted upon post-performance discussion which consequently had to be terminated. Learning from this, when the performance was repeated at the fifth European Network Performing Arts Production (NPAP) Workshop at the Royal College of Music, London 4-6 May 2015, all presenters used external microphones (wireless or handheld) when speaking rather than to rely on the web-cam microphones, and in addition, muted their sound when not speaking which solved the problem.

There follows a section by each director on specific aspects of the project: performance, choreography/aesthetics; music composition and the technology.

3.0 Performance and Scenography: Pauline Brooks

At the outset, we knew from experiences with the *Phillypool* and *Novapool* projects that we wanted to develop an intermedial telematic performance site – where live performances were combined with live-streaming of projections of the performers from the other two sites. We knew that we wanted to create a projection environment whereby the two screens of the two distanced dance groups were placed side-by-side to give the impression of one virtual company (see Image 2 below and Figure 1 p13). What we were unsure of was how we would organise the projections from three sites, and how we might integrate the musicians into the frame. Both LJMU and NSU had traditional studio theatres with a cyclorama that could be used for a projection screen (LJMU used back projection and NSU front projection – see Images 3 and 4, p9). Edinburgh Napier did not have access to a studio theatre, and the compromise had to be that their physical set-up would be different (see Image 5, p9). We considered adding extra screens onstage on which to project the musicians, but time was not conducive to such experimentation. We chose therefore, to go with the one projection screen, and to arrange the windows of each site in the same set-order. Initially, we each had one camera which gave us three windows on the screen. It was difficult for the dancers to see cues from the five musicians when they shared one camera with the conductor. In week eight of the project, Edinburgh Napier introduced a four camera set-up, one for the conductor and three to be shared with the five musicians. This greatly enhanced the dancers' connection with the musicians, and was commented on by the students at the project evaluation on 5 December 2014. The decision to have the four windows of the musicians at the top of the projection screen (see Image 2, p9) was mostly because it made them more visible to the audiences in the two theatres. Also, the dancers said they could more easily see them throughout the whole of the dance than when we had placed them at the bottom of the screen. However, the size of the windows of the musicians was small, and further consideration of the scenography needs to be made so that the presentation of all windows can be improved. The size of the musicians' windows was a point raised by the audience at NPAP in May 2015 – although their view may have been affected by watching the projections on a smaller screen than those in November 2104.

Image 2 Screen Image of all sites and use of centre-line split screen

Image 3 Arrangement as viewed from live audience at LJMU

Image 4 Arrangement as viewed from live audience at NSU

Image 5 Arrangement as viewed from live audience at Edinburgh Napier (rehearsal)

The challenge for all concerned was to achieve a performance product in ten weeks of rehearsals, meeting once a week for 2 ½ hours. In that time, it was possible:-

- To enable musicians to work as an ensemble to play a new score by Katrina Burton and to become aware of how dancers were listening carefully for musical cues by individual instruments.

- For the dancers to begin to develop an awareness of performing with live and virtual dancers, to have "fixed" specific visual and aural cues and to feel sufficiently confident with them to be able to begin to explore the new performance site that the technology provided (see Images 2-5, p9) and for them to begin to develop an awareness of what it meant to perform in a telematic site with multiple connections and audiences.

- For all performers, to learn to work with a conductor – whose central role became to aid the connection of the performers in each of the three sites.

Our model allowed for time at the beginning of the project for the dancers and musicians to work separately at the beginning. To do so was important for the dancers to begin to learn how to work with the new performance environment, and how to connect with each other in the physical space and on the screen. Equally, the musicians needed the time together to become familiar with a new score and playing as part of a new ensemble. What was not possible in the Project time frame, with undergraduate students, was to provide them with opportunities to build sensitive connections with virtual and live performers across the three sites, nor to be able to fully embody the movement. The company Facebook site gave them opportunities to socialise and to "talk" in between the once-a-week rehearsals.

Nevertheless, audiences in Edinburgh, Liverpool, Florida and Greece commented on the connections that they could see and hear between the music and the movement. They commented on the clear relationship with the theme, which was enhanced by the costume and stage design (see Images 2-3 p9 and 6 p11). In that sense, it is possible to say that the VisiMeet software did enable a synchronous performance of dance and music to multiple audiences around the world, who were able to grasp the artistic intent of the directors and performers.
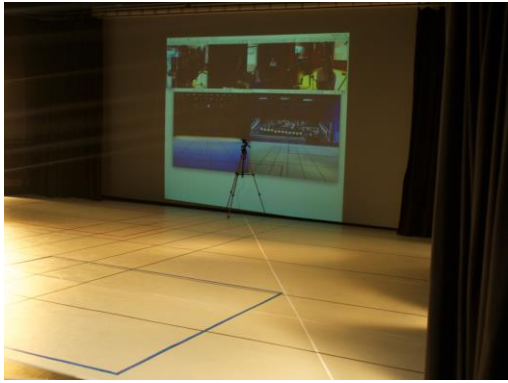
Image 6 Stage design (LJMU view)

The success of the performance on 21 November resulted in the project being invited to present and perform on 5 May 2015 at the fifth European Network Performing Arts Production (NPAP) Workshop at the Royal College of Music, London 4-6 May 2015. The extension of the rehearsal period enabled refinement of the connections between the performers, and practically and pedagogically, the model of a longer process time is much preferable. It enabled the refinement of the connections between all of the performers – between the live and the virtual dancers and with the musicians. The dancers were sufficiently confident in the material that in order to accommodate the vastly reduced performance space at the Royal College of Music, significant adjustments could be made to the choreography. Such was the refinement of that technical performance on 5 May that when the Internet connection was completely lost for some 20 seconds or more, all performers in each of the three sites continued, and once the Internet connection was resumed, all three were still in time with each other. It can be demonstrated that the VisiMeet software did support the collaborative development and refinement of a synchronous telematic performance of a new work with live dancers and musicians geographically distanced across two continents, and three countries.

4.0   Choreography/Aesthetics: Luke C. Kahlich

The traditional approach to choreography on the stage is one from the creator's perspective, acknowledging that a performer and audience member interpret. Generally, the choreographer (most often one person) is given "authorship" and noted as one who makes creative decisions for the dance work. In *Making Connections*, the collaborative telematic process challenged this traditional model by offering multiple perspectives in creating, performing and viewing the work. Indeed, there were multiple versions of the work created simultaneously using live, virtual and recorded environments.   In this model, the choreographers included the director, the performers and the camera. The idea of authorship was shared even by the Internet audience, who were able to select their own arrangement of video screens. The final "product" was thus one which included and excluded elements that create the various versions offered to the audiences.

Telematic Performance

- Refers to a live performance where two or more distanced partners/locations are linked synchronously by technology through the Internet
- Mixes live and virtual "Data"
- Makes use of telecommunications and information technology
- Employs standard or emerging video conferencing software/equipment

Some important ideas and values that guided the choreographic process include:

- What telematic work offers choreographic pedagogy
- How telematic work might contribute to, detract from and/or reshape process and pedagogy
- Telematic work and its effect on the creative process
- Telematic work and the aesthetic framework for the audience/perception of real and virtual
- Telematic work and process and value of international collaboration

Elements of the process of telematic collaborative choreography required:

- Students, faculty and cameras are partners – reconceiving the "authorship" role
- Live vs telematic /choreography
- Creating and coaching as parallel processes
- Visual "travel" and connection across the screen

- Using equipment and software to create an environment
- NOTE: Three sites had originally sought to incorporate musicians in the choreography

Some "givens" in the project were: Technology(ies)/equipment may or may not work – audio, video, connectivity, speed, compatibility; five hour time difference (including remembering seasonal time changes) ; Curriculum design elements in UK and US, and Camera as editor/partner.

The following diagram attempts to display the elements of the telematic environment in which the choreography is viewed. With the multiple perspective and choices given in the process of creating and viewing the work, the choreographers are challenged to co-create with the performers, the musicians and the cameras. The choreographers and the performers must strive to understand the multiple perspectives technically and manipulate movement material from multiple perspectives, including the independence of each site in the final work.
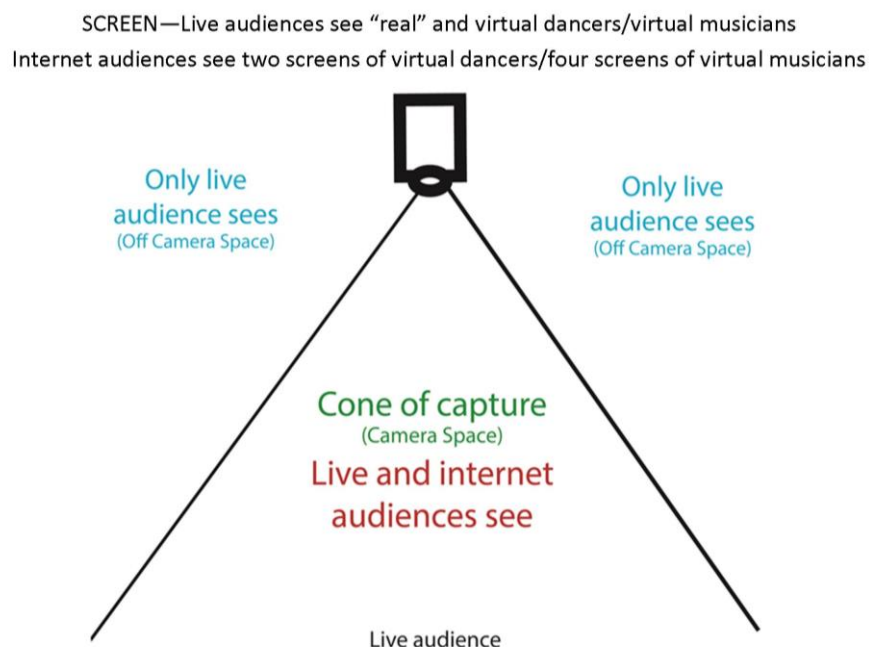
SCREEN—Live audiences see "real" and virtual dancers/virtual musicians
Internet audiences see two screens of virtual dancers/four screens of virtual musicians

Only live audience sees (Off Camera Space)

Only live audience sees (Off Camera Space)

Cone of capture (Camera Space)
Live and internet audiences see

Live audience

Figure 1: arrangement of the performance site at NSU and LJMU

5.0   Music Composition: Katrina Burton

As a composer, *Making Connections* marks my first experience composing for dance. The work is scored for five performers: alto flute doubling bass flute, alto saxophone, viola, percussion (vibraphone and congas) and piano. The project commenced with a short trial of the software in May 2014 which involved musicians at Edinburgh Napier and dancers at Liverpool John Moores working with two short contrasting sections of music. Having viewed footage of previous projects between LJMU and Nova Southeastern University, all of which had a strong thematic presence, a theme was established which in turn influenced the music, choreography, costumes and dance performance area. Inspired by a visit to Tate Liverpool to view the 'Mondrian and his Studios' exhibition, the composition is informed by the paintings of Piet Mondrian.

Early discussions with the choreographers informed certain aspects of the musical score, such as the concerted effort to create a work with a very clear sense of structure and the incorporation of strong musical cues for the dancers. The composition is structured in three sections, each based on a different period within Mondrian's career.

The short gestures and fluctuating movements in the opening section are suggestive of Mondrian's early paintings, many of which depict scenes of nature; *The Red Tree* informs the first section. While the colours are vivid they don't yet reveal the bold treatment of the primary colours found in Mondrian's later grid based paintings. The intensity of the tangled, bare branches evokes a strong sense of atmosphere and tension, reflected in the music.


The Red Tree 1910

The influence of cubism is the focus of the second section, primarily Mondrian's *Tableau No 2*, below. Noticeably more abstract, the strong sense of line in this painting led to a substantial rhythmic section; a propelling force created through the constant congas line.


Tableau No 2 1913

The tempo is substantially reduced in the third section as an impression of stasis and space is revealed, evoking the openness within Mondrian's famous grid based paintings, such as *Composition No. II, with Red and Blue*, below. The physical gestures created through bowed vibraphone and glissandi in the viola allude to the prominent use of line in these works.
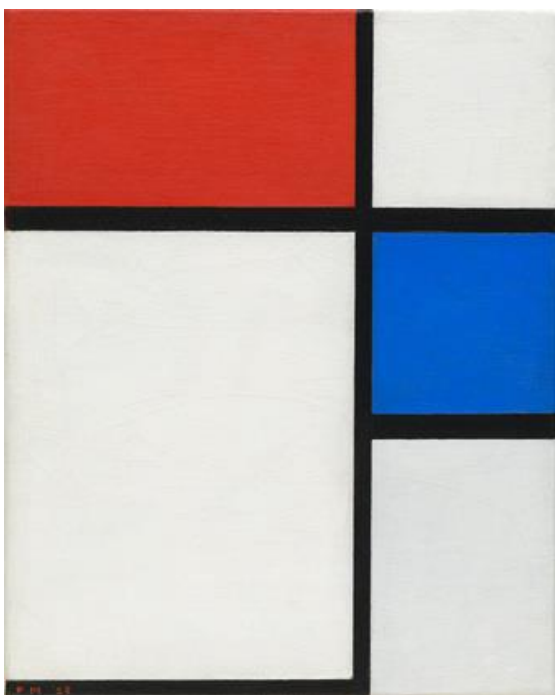
Composition No. II, with Red and Blue 1929

This texture continues, moving seamlessly into the final part of the work which involves short interjections of a manipulated 1920s Charleston recording. Research undertaken prior to starting work on the composition revealed that Mondrian was a keen dance enthusiast and particularly fond of the Charleston. It felt appropriate, given the nature of the project, to acknowledge this. The piece concludes with a longer Charleston recording which moves to an unaltered state, affording us a glimpse into Mondrian's sound world. *Broadway Boogie Woogie*, below, informs the final part of the composition.
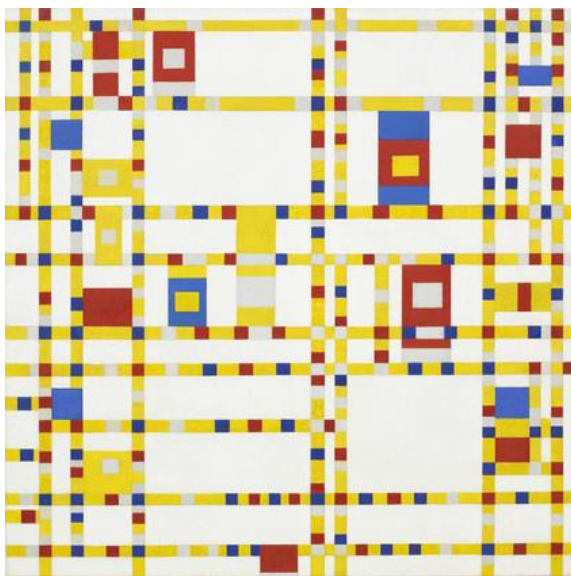
Broadway Boogie Woogie 1942-43

Making Connections opens with music only, introducing the instruments in turn: alto flute, vibraphone, viola, alto saxophone and piano. As the dancers are not on stage at the beginning a strong musical cue, in the form of a low trill on the piano, was incorporated into the score. Providing an effective signal for the dancers to enter the stage, this gesture was easily identified by the dancers.

Creating a work for an entire student-based ensemble, none of whom had any experience in remote distributed performance, did influence the compositional process. Acknowledging that the student musicians and dancers were perhaps less familiar with abstract contemporary music, certain sections of the work were rewritten several times in order to create an appropriate balance with respect to the complexity of the score for both the instrumentalists and the dancers responding to it.

The diversity of instruments employed in the ensemble allowed the dancers to locate and follow individual lines, impressively distinguishing between the different instrumental timbres early in the rehearsal process. The use of contrasting instruments (two winds, one string, piano and percussion) was not in fact intentional but simply a personal predilection towards this particular ensemble. However, the distinctive timbral contrast within the ensemble allowed the choreographers and dancers to make compelling connections with individual instruments, perhaps more so than with a homogenous sounding ensemble, a string quartet for example. During the rehearsal process I was struck by how quickly the dancers were able to recognise and follow the music, listening for and anticipating certain moments, such as unison climaxes and prominent entries. I envisaged that the use of live music might impact on their timing, owing to the slight differences in duration which are inevitable in live performance. This never seemed to be a major concern and the use of four cameras enabled the dancers to take visual cues from the conductor and musicians. At an evaluation session following the first public performance the dancers enthused about working with live musicians, reflecting that the opportunity to collaborate and connect with the conductor and performer during the rehearsal process allowed them to connect with the music at a deeper level. The musicians were aware of the importance of the visual, as well as aural, cues that they provided the dancers.

Building on the work achieved with the *Making Connections* project, discussions are under way on a second collaboration for 2015-16. The new work will seek to explore closer connections between all three sets of students, examining ways to further strengthen the link between the musicians and the dancers. Sections of the musical score will be semi-improvised, facilitating a way to provide the musicians with an element of freedom which the dancers will respond to.

6.0 Technology: Paul Ferguson

Before presenting technical details of the implementation it may be useful to address why the team choose the VisiMeet videoconferencing system for this project.

The network connection

Edinburgh Napier University has been extensively involved in low-latency research using the Italian LoLa system. LoLa has an audio/video lag that is typically 30 to 50 times better than video conferencing systems but requires a high-performance network connection and audio/video hardware to achieve this. In the UK, the JANET National Research and education Network (NREN) provides a 100Gb backbone that connects the UK's research and education establishments to form a very fast network with low jitter. In turn, JANET connects to equivalent NRENs such as GARR in Italy and INTERNET2 in the USA.

Unfortunately, any performance gains from JANET can be lost by a University's network infrastructure. Any security firewalls, traffic shaping or slower switches will impair the network performance and LoLa will simply not work. VisiMeet, on the other hand, makes low demands on the network connection. It is designed to work over the busy lower-performance commodity networks outside academia. To achieve this it compresses the video <u>and</u> audio streams and employs larger buffers to overcome variations in network performance.

Distance

A working figure of 1ms per 100Km can be used to determine the additional latency caused by the distance between collaborating sites. In practice, typical network transit times Edinburgh and Liverpool are around six milliseconds round trip. Over transatlantic distances such as Edinburgh to Florida this figure approaches 150ms and to an extent negates LoLa's 'realtime' advantage and forces the artists to accept and adapt to the combined system plus distance latency.

Multiple connections

Unlike the point-to-point nature of the current version of LoLa, VisiMeet is a server-based technology that is hosted by the JANET network. All 'clients' wishing to collaborate connect to the server rather than directly to each other. Although this may cause longer signal routes

and incur additional latency this server-based approach allows a large number of sites to interconnect and thus allowed the project team to fulfil its pedagogic aims through participation with additional 'observer' institutions.

Hardware

Unlike the high-performance PC-based LoLa system and bespoke VC systems such as Polycom, a minimum VisiMeet configuration is can be a standard Mac or PC laptop with its built-in camera, microphone and loudspeakers. Three levels of hardware were tested in increasing complexity:

Nova Southeastern:

Apple MacBook Pro with built-in camera and microphone or external webcam. Trolley loudspeakers.

Liverpool John Moores:

Apple MacBook Pro with external Logitech HD webcam/microphone. External auditorium loudspeakers.

Edinburgh Napier University:

Mac Pro with four external Logitech HD webcams. Six studio microphones externally mixed and connected to the Mac Pro via a class-compliant USB audio interface. External studio loudspeakers.

VisiMeet in practice

A major contribution to our eventual success using VisiMeet was due to active participation from IOCOM's Phil Lowe. Phil sat in 'virtually' on several rehearsals to monitor network traffic and to help us determine the best configurations for audio and video.

Uncompressed audio is not a selectable option in VisiMeet. The highest quality codec available is 'uLaw 16K' with a 128Kbps data rate, this is described by IOCOM as wideband audio. This codec was used by all three sites, the compression artifacts were audible in the live music streamed from Edinburgh but the result was still musical.

The best music performance was achieved with Echo cancellation turned off. It was sometimes turned on for speech-only production meetings. VisiMeet's low bandwidth requirement meant that production meetings were possible using home broadband

connections. This was a significant advantage considering the time zone difference between the UK and Florida. It should be noted that audio and video dropouts occurred in most sessions even when high-speed network connections were used.

Reliable video performance was experienced in Edinburgh, Liverpool and Florida using either Logitech C920 HD webcams or the built-in FaceTime HD cameras in Apple MacBook Pros. The VisiMeet 'Room' license allows up to four cameras per computer. Edinburgh was the only multi-camera site and used four C920 USB2 cameras connected to a 2013 Apple Mac Pro.

Undoubtedly, the biggest technical problems experienced by the project team were audio-related. As with any live audio event the combination of live microphones and loudspeakers means feedback is an ever-present risk and this was compounded as more and more sites were introduced into the project. This was most apparent in the November performance. The combination of network delay, codec and echo cancellation (if enabled) meant that feedback exhibited a sonically different and delayed characteristic compared with conventional live sound reinforcement. Because all sites received and amplified audio from the remote sites their microphone had potential to cause feedback of that remote audio and it was often difficult to pinpoint which site that was causing a problem.

As for any sound reinforcement, separation of microphone and loudspeaker and keeping microphone gain to a minimum is key. The presence of an audience in all three sites means loudspeakers must be used although they could be supplemented by in-ear monitoring. Although a useable VisiMeet workflow resulted from careful muting of microphones and use of the software's 'Press-To-Talk' function, a significant improvement would come from individual tie-clip or headset microphones for communication.

7.0 Conclusions

The *Making Connections* Project has demonstrated how VisiMeet videoconferencing software technology enabled collaboration between three distanced sites (Edinburgh, and Liverpool, UK and Fort Lauderdale Florida, US) to create a new performance work that combined music and dance with undergraduate students from three universities: Edinburgh Napier, LJMU and NSU. The video conferencing technology demonstrated that it could serve dance/music pedagogy with undergraduate students in Higher Education and the creative process. However, the time frame of the project (a nine week rehearsal schedule meeting once per week for 2 ½ hours, and where for the first two weeks the dancers and the musicians met separately), was not sufficient to fully support the refinement and development of connections between live and virtual undergraduate performers with each other and the technology. Subsequent additional rehearsals (5 x 2 hours) and preparation for a further international performance allowed for that refinement.

The use of VisiMeet technology was able to support linking three geographically distanced spaces with multiple projections and with multiple audiences (in at least eight sites). However, greater consideration needs to be made in terms the quality of the link (especially the impact on audio) as more audience members join the "meeting". At the performance on 21 November 2014, such were the issues with poor audio quality as audience members from around the world (on the free downloadable VisiMeet version) joined the audiences situated in the three sites with full-room licences that the post-performance discussion between all sites had to be terminated. At a subsequent performance and presentation on 5 May 2015 at the fifth European Network Performing Arts Production (NPAP) Workshop at the Royal College of Music, London the use of external microphones for each speaker at each site, in conjunction with each muting their sound when not speaking, did much to improve that issue. Post-performance discussion was thus enabled.
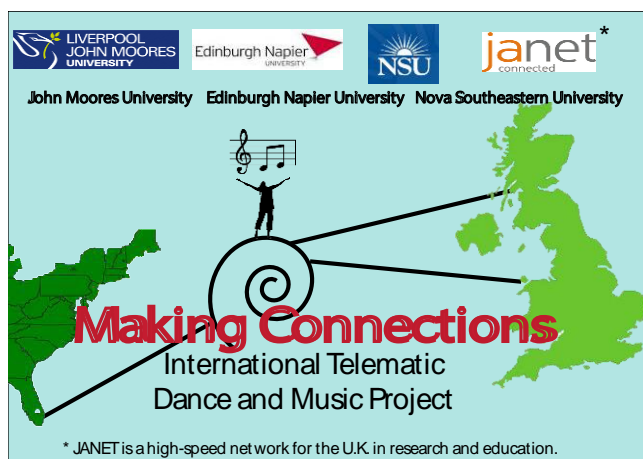
Future Developments and Suggestions:

We used an arrangement of one camera each at LJMU and NSU but four at Edinburgh Napier. It meant that the dancers had a better view of the musicians and the conductor than when Edinburgh Napier had only one camera for all five musicians and the conductor. By having four cameras at Edinburgh Napier, it led to stronger connections between the movement and the music because the dancers were able to utilise visual cues as well as aural

cues to their performance. However, the introduction of the additional three cameras at a late stage of the project (week eight) meant that there was not time to explore other stage designs for the projection of the windows. That would be something that needs to be explored in further projects, along with the possibly of including additional screens for multiple projections as part of the scenography.

The full-room licence of VisiMeet allows for up to four cameras at each site. There is much to be explored both artistically and pedagogically in terms of what such use could and would lead to – for the impact that it would have on learning, on the design of the performance site and the scenography for the audience. If switching between camera views was a possibility during performance, there is much scope for development for exciting new visual designs for telematic performances and still further connections to be explored between live and virtual performers.

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APPENDIX

1. PR/Evidence for project

2. Blog created by Student Project Manager Laura Edwards:
https://projectmakingconnectionsblog.wordpress.com

3. Announcements online at LJMU
https://www2.ljmu.ac.uk/NewsUpdate/viewarticle/1890/

4. Announcements online at Nova Southeastern University
https://www.fcas.nova.edu/events/performances/performance-series/
http://nsunews.nova.edu/international-technology-enhanced-dance-performance-novapool-may-5/
http://nsunews.nova.edu/novapool-dance-project-feature-live-performances-nsu-overseas/
http://nsucurrent.nova.edu/?s=Liverpool&x=39&y=10

5. **Announcements online at Ionion University, Corfu, Greece.**

   http://www.ionio.gr/central/en/events/read/6409

6. LJMU Research in Action Day, 26 June 2014 included *Making Connections*

Project https://www2.ljmu.ac.uk/RIS/128795.htm

Programme:
https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnx
wYXVsaW5lYnJvb2tzbGptdXxneDo2NDU1N2M1Yjc0Njc5ZjU1

7. **Recordings -**

- ***Making Connections* Performance, 21 November, 2014:**

Sudley Theatre, Liverpool John Moores University, UK: https://youtu.be/eJ830elh6HY

Edinburgh Napier University, Scotland, UK: https://youtu.be/2AMN1Rg2UHk

Performance Theatre, Nova Southeastern University (Division of Performing and Visual Arts), Fort Lauderdale, FL, USA: http://youtu.be/hWjsCJoeeww

Internet streaming version: https://youtu.be/6aHQoumMNA0

- ***Making Connections*, 5 May, 2015 – Fifth European Network Performing Arts Production (NPAP) Workshop Royal Academy of Music, London/UK** https://youtu.be/D0itBKqTQk4

8. **November 2014 programme:**
https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwYXVsaW5lYnJvb2tzbGptdXxneDxxneDo3ZmQzNDQ1MjM3NDk5MThj

9. *Programme:* **4-6 May 2015 Fifth European Network Performing Arts Production (NPAP) Workshop.** *Making Connections 5 May*
https://www.terena.org/activities/network-arts/london/programme2.html

https://docs.google.com/document/d/1IjgeVH9J0ikKAXVDQeGc5ldZz6qLp_3YXSzVVXNV8BY/edit?usp=sharing