PERFORMATIVITY | PLACE | SPACE: LOCATING GRID TECHNOLOGIES FINAL SUPPLEMENTARY REPORT

1 DESCRIPTION OF ACTIVITIES AND THEMES EXPLORED

1.1 Background

As part of the University of Bristol research theme Performativity | Place | Space, the 'Locating Grid Technologies' workshops and symposium (June-October 2006) investigated the potential of Grid technologies to produce new understandings of space and time for distributed, creative research practices. Key to the success of the workshop series was the effective interdisciplinary partnership among the PI, Dr Angela Piccini, and University of Bristol's Institute for Learning and Research Technology, its Centre for e-Research and the Graduate School of Education, in addition to the Access Grid Support Centre at University of Manchester.

The project brought together mixed-mode researchers from the UK, US and Japan to generate, analyse and re-use audio-visual documents of distributed practice-led research. In doing so, the project explored fragmentations of space and time in networked environments by: using Access Grid as a telematic performance environment and as a dissemination tool for other performance forms; using a range of software interfaces within Access Grid events to record, annotate and retrieve the Access Grid meetings; using a Semantic Web database to query that audio-visual archive in such a way as to facilitate its reuse in performance, in programmed installation environments and in virtual working environments.

1.2 Overall aims

The workshops aimed to facilitate novel interactions among e-Science experts and a range of mixed-mode research practices in the performing and screen arts within HE and in the professional and public arts sectors. The project aimed to investigate Access Grid, Semantic Web and Data Grid. Guiding research themes were:

- How might e-Science applications inform practice-led research?
- How might collaborations among key researchers within and beyond HE advance understandings of e-Science within the creative and performing arts and media?
- How might artist-scholars play a key role in determining the scope of creative e-Science applications in the UK and internationally?
- How might workshops foster meaningful knowledge transfer?
- How might the PARIP Explorer Semantic Web database (http://parip.ilrt.org), a novel, search-and-browse, end-user interface to the Grid, and Storage Resource Broker be used to address issues of located creativities?

1.3 Tools and environments

Access Grid (AG) is a flexible, interactive audio-visual networking environment. AG delivers high-quality, multiple video stream and sound across IP networks for live, distributed meetings, screenings and

performances. The project used two of University of Bristol's AG nodes: in the Graduate School of Education and the Department of Physics. These both use the proprietary InSORS Grid platform.

Initially, the project was to work with Storage Resource Broker (SRB) as the Data Grid application for handling Access Grid recordings and interfacing to the PARIP Explorer Semantic Web application. SRB is client-server middleware that provides a uniform interface for connecting heterogeneous data resources over a network and accessing replicated data sets. SRB, in conjunction with the Metadata Catalog (MCAT), provides a way to access data sets and resources based on their attributes and/or logical names. An SRB is a distributed file system, a data grid management system, a digital library and a semantic web. The guiding criteria for opting for SRB was the level of expertise within University of Bristol's Centre for e-Research and the fact that SRB was, at the time of application, the dominant UK e-Science Data Grid solution.

However, due to concerns expressed in reviews of our application, the project Steering Group revisited the rationale behind choosing SRB. Following discussions between Bristol's Centre for e-Research and University of Manchester's Mike Daw (Manager, Access Grid Support Centre) and between Piccini and the Arts and Humanities e-Science Support Centre (King's College London) the Steering Group decided instead to investigate the potential of Memetic for this project. Memetic is a JISC-funded VRE (virtual research environment) designed to extend uses of AG through advanced meeting support and information management and dialogue mapping tools. It allows for recording, analysis and replay of AG meetings. Memetic provided a single, yet flexible solution for handling AG data that presents a user-friendly front end that non-specialists can use with relative ease. Furthermore, because Memetic's backend database describes data in RDF the potential for connecting AG events through the existing PARIP Explorer Semantic Web application was judged to be of much greater potential than Storage Resource Broker. Subsequently, all events were recorded on to the Memetic server at University of Manchester.

Finally, the workshops sought to explore the development and use potential of the PARIP Explorer Semantic Web application to search and browse AG meeting documentation. Semantic Web is a mesh of machine-readable information and is an efficient way of representing data on the World Wide Web as a globally linked database. PARIP Explorer (http://parip.ilrt.org) is a groundbreaking FOAF (Friend of a Friend) database of practice-led research, initially developed by Simon Price (ILRT: Institute for Learning and Research Technology, University of Bristol) in collaboration with Piccini (as Researcher on the AHRB-funded PARIP: Practice as Research in Performance project). The FOAF vocabulary is expressed via the W3C recommended RDF/RDFS standards (foundational languages in the Semantic Web). Therefore, this meta-vocabulary can be extended to integrate disparate sources of conformant data in a straightforward manner. The project aimed to develop PARIP Explorer to pilot an evolved online environment in which digitised audio-visual materials are made easily accessible to users and are linked to

multiple descriptions of their creators, themes, timecodes, technologies, framing, to other related works, and so on.

1.4 Workshop 1: 'Distribution: an introduction to e-Science for the creative and performing arts and media' (22 June 2006, 11am-5pm)

A key objective of the first workshop was to determine themes central to facilitating distributed collaborations between the arts and e-Science. The first part of the day introduced participants to Grid technologies and their potential application in the arts. Rob Bristow (AG 'pilot' in the Graduate School of Education, University of Bristol) introduced the Access Grid. Mike Daw (University of Manchester) gave a presentation on Memetic. Jon Wakelin (Centre for e-Research, University of Bristol) gave a presentation on Data Grids.

The second half of the day demonstrated AG and Memetic through distributed performance. Orchestra Cube (a co-operative operating out of Bristol's Cube Microplex) performed in the Graduate School of Education while dancer Kyra Norman (Dance Bristol) performed in the Department of Physics. Sound artist Jem Noble (Blackout Arts) individually mic'ed acoustic and electric instruments, to run via a mixing desk directly into the AG. Simon Buckingham Shum (Memetic, Open University) worked with Piccini on an experimental 'dialogue mapping' of the performance through the Compendium software application within Memetic. The 'audience' of workshop participants was split equally between the two AG nodes.

Of specific concern was the way in which the technologies of AG and Memetic and the physical expression of AG within the meeting rooms produce particular understandings of performance spaces. Issues discussed included quality of sound transmission and sound latency; spatial flexibility for performance; and the flexibility of the Memetic platform for analysing performance. We discussed these issues through a series of practical exercises. Ale Fernandez (ILRT and Orchestra Cube) conducted the improvised performance. Following an initial timing exercise based on participants in both nodes attempting to clap in time with one another, Fernandez used a series of pre-prepared graphic symbols to direct both the orchestra and the dancer as to number of bars to play, length of sustained notes, and so on (see below for URL link to documentation). The session ended with Simon Buckingham Shum launching the Meeting Reply function in Memetic to demonstrate the initial performance analysis.

The workshop ended with a discussion of the issues raised during the course of the day with a view to developing aspects into defined research projects to be taken forward by participants,

1.5 Workshop 2: 'Connection: PARIP Explorer, Semantic Web and data grids for the creative and performing arts and media' (3 August 2006, 11am-5pm)

The second workshop focused on using the audio-visual data objects generated at the first workshop and stored on the Memetic server to develop

ways in which those data objects might be linked via a Semantic Web database application. The primary question to be addressed is how Semantic Web applications interact with Data Grid tools. The morning presentations aimed to generate themes to be developed practically during the afternoon session.

The first half of the day was devoted to presentations. Nikki Rogers (ILRT) demonstrated a pilot interface between PARIP Explorer and Memetic that had been developed by Rogers, Ale Fernandez and Damien Steer. This was followed by a presentation by Tom Rawlinson (Fluffy Logic) on peer-to-peer (P2P) file sharing, what Professor David De Roure terms 'scruffy grid' technology. The morning ended with a presentation by Jamie King (freelance artist) on the intellectual and legal challenges that Grid technologies present to copyright and Intellectual Property both within and outside the HE sector.

During the second half of the day it had been planned to use the developed 'servlet' interface between PARIP Explorer and Memetic to facilitate a practical workshop on Semantic Web and RDF schema. The organising focus was to be the fragmentation and fracturing of space and place afforded by these tools and how participants might describe this semantically for future research use. However, due to institutional firewall issues we were unable to access the writable version of PARIP Explorer within the GSoE AG node and had to amend plans substantially. Instead, Piccini and Rogers facilitated a practical exercise in which participants used the Memetic recordings of the first workshop to explore on paper the potential for collaborative tagging.

The workshop ended with a further iteration of the possible research questions identified in the first event, with an aim to produce a draft research rationale by the final workshop. Key within this were questions of absence and presence, the visible and the invisible, fragmentation and cohesion, excess and lack, to be explored through a range of technical development questions as introduced through the workshops.

1.5 Workshop 3: 'Location: the impact of Grid technologies on the performativity of space and place in the creative and performing arts and media' (14 September 2006, 11am-5pm)

The final workshop aimed to test the limits of the Grid technologies explored in the first two events in order to generate useful technical guidance for other users and to produce a series of questions for future research. It was also a significant investigation into the places and spaces of performance within multiple networked environments. A key objective was to use these technologies to make small-scale collaborations exploring space, place and location.

The day began with a practical session led by Teresa Dillon (Polar Produce) on how participants might collaboratively classify creative practices. This was an extension of the second workshop and focused specifically on how the Semantic Web might facilitate the reuse of tagged audio-visual data objects in further creative research within AG environments. It facilitated participants'

engagements with issues around the construction, representation and organisation of knowledges.

The second half of the workshop was a large-scale distributed improvisation that saw the Bristol AG node meet with others in Southampton, London and Manchester. Dancers, musicians, poets, performers, visual artists, film makers, digital artists, sound artists, archive-based researchers and e-Science researchers participated in a series of 'call-and-response' exercises. These were intended to explore the impact of locational context on performance. Each AG node took it in turn to initiate an improvisatory practice that subsequent nodes would then follow. Jem Kelly's undergraduate students from University College Chichester participated from University of Southampton; Live Art collective mmmmm participated from Imperial College London using voice and objects; and a range of artist/researchers worked in Bristol, including Helen Bailey, Teresa Dillon, David Hopkinson, Nathan Hughes, Shi Ke, Jem Noble and Orchestra Cube.

By bringing together a very large group of people who do not ordinarily work together, we were keen to test the limits of these technologies in order to highlight research and development potential for developers. These are outlined in section 5, below.

The workshop ended with a final iteration of the scope of research to be drawn up as an application to the AHRC e-Science call.

1.6 Symposium (19 October 2006, 11am-5pm)

The final event was an AG symposium that brought dancers from Japan, theatre makers from Utah and telepresence and digital artists from the UK to share their experiences of Grid technologies as they compare with existing technologies for distributed creative research. A specific focus of the symposium presentations was the impact of Grid technologies on the 'place of place and space' in practice-led research.

The day's presenters were:

- Angela Piccini and Rob Bristow, University of Bristol: Introduction: e-Science and the Performing and Screen Arts
- Paul Sermon, University of Salford: Telematic Installations and Performance - From Telephones to Multi-cast, Practice-based Experience (via AG)
- Michael Daw, University of Manchester: Access Grid, Memetic and the Arts (via AG)
- Yukito Obara, Choreographer, Yukihiko Yoshida, Telematic Dance Network, Japan: Hands Dance Project (via AG)
- Ale Fernandez and Nikki Rogers, ILRT, University of Bristol: PARIP Explorer and the Potential for Semantic Grid Tools
- Teresa Dillon: The Art of Taggin': Locative-based Performance and the Construction of Shared Interpretations

- Prodromos Tsiavos, Creative Commons, London School of Economics: Creative Commons and Distributed Digital Media
- Jimmy and Beth Miklavcic, University of Utah: Inter Play, Performing on a High Tech Wire (via AG)
- Helen Bailey and Martin Turner, University of Bedfordshire and University of Manchester: Stereo Bodies: Improvisation and Choreography within the Access Grid (via AG)

Documentation from the workshops and symposium is available in various forms and online locations. Public descriptions are held on the Arts and Humanities e-Science Support Centre website (www.ahessc.ac.uk); internal discussions are documented on the University of Bristol secure Moodle site (http://mash.ilrt.bris.ac.uk/moodle/login/index.php); moving image and sound are held on University of Manchester's Memetic server; Orchestra Cube documentation is held at https://secure.irational.org/discourse/viewtopic.php?t=74 and http://orchestra.cubecinema.com/scores/art_grid_score.ppt; and publicly accessible still image documentation can be found on the following Flickr pages:

www.flickr.com/photos/38204625@N00/sets/72157594488499552/
www.flickr.com/photos/38204625@N00/sets/72157594488500800/
www.flickr.com/photos/12578533@N00/sets/72157594174798402/
www.flickr.com/groups/71382401@N00/pool/

2 OVERVIEW OF PEOPLE AND TYPES OF COLLABORATIONS

e-Science is about collaboration in distributed, secure, networked environments. The performing and screen arts are, therefore, well placed to contribute to and benefit from e-Science in that collaboration is at the heart of this subject area, whether research is archive-based or practice-led. What follows is an overview of contributors to this project with a description of the type of collaboration involved.

2.1 Institute for Learning and Research Technology (ILRT), University of Bristol

Nikki Rogers (Web Futures Manager), Ale Fernandez (Technical Developer) and Damien Steer (Technical Developer) played highly significant roles in the project as consultants in the area of developing semantic interoperability between Memetic and the PARIP Explorer Semantic Web application. They contributed core content to the second workshop and final symposium, with both Rogers and Fernandez presenting. The ILRT collaboration with this project, while in the form of paid consultation, can usefully be described as interdisciplinary: the shape of the creative practices undertaken were influenced by the parameters of Semantic Web while their own development of PARIP Explorer was profoundly shaped by the practical and intellectual concerns of practice-led research. The collaboration is ongoing as Rogers is co-applicant in a major bid to the ARCH e-Science Research scheme with Piccini; and co-applicant with Mike Daw on a JISC application to develop

interoperability between Memetic and IUGO (http://iugo.ilrt.bris.ac.uk/). Bith Rogers and Fernandez were members of the Steering Group.

2.2 Graduate School of Education, University of Bristol
Rob Bristow manages and 'pilots' the GSoE AG node. His enthusiasm for and interest in the range of creative practices undertaken helped throughout the series to produce an atmosphere in which e-Science specialists, practice-led researchers and artists from outside the academy could come together to collaborate. This type of collaboration can be described as transdisciplinary in that both Bristow and Piccini took on each other's roles and found their practices transformed through the collaborative working environment. Bristow's further effective collaboration with the Manchester-based Access Grid Support Centre ensured that each AG session handled the complex activities to demonstrate the full potential of this environment.

2.3 Access Grid Support Centre, University of Manchester
Without the generous involvement of the AGSC (in particular, Mike Daw and Andrew Rowley) the project would not have attained the broad-based success that it did. They increased Rob Bristow's own AG piloting skills and were excellent ambassadors for AG both in the UK and internationally and participated actively from Manchester at each workshop and in the final symposium. This form of collaboration was multidisciplinary in that it required the effective working together of various separate specialist skills.

2.4 Memetic VRE project, Universities of Manchester, Southampton, Edingburgh and Open University
Through Memetic lead investigator Mike Daw, co-investigator Simon Buckingham Shum and technical researcher Andrew Rowley's invaluable contribution, the workshops were able to use Memetic in new ways that both extended the project's aims and, ultimately, the aims and outcomes of Memetic itself. Thus, Memetic's involvement in the workshops was a successful interdisciplinary collaboration. Daw, Rowley and Buckingham Shum also facilitated training in and use of Memetic and ensured that the system worked effectively for this project. This collaboration is ongoing as Memetic plays a role in Piccini and Rogers' application to the AHRC e-Science research scheme. Memetic has also collaborated with Rogers on a JISC application to develop Memetic / IUGO interoperability.

2.4 University of Bristol Centre for e-Research
Ian Stewart and Jon Wakelin made significant contributions through presentations and participation in the workshops, particularly in the area of Data Grids and as Steering Group members. Jon Wakelin liaised with Mike Daw in Manchester at the inception of the project in response to referees comments on our application. Together we shifted focus from use of SRB to Memetic in the project, which ensured successful completion of aims and objectives. As such, this was a multidisciplinary collaboration. Ian Stewart has effectively networked this project to a wide range of cognate e-Science projects both within University of Bristol and beyond.

2.5 Orchestra Cube (http://www.orchestra.cubecinema.com/cgi-bin/wiki.pl)
Orchestra Cube is the official musical wing of co-operative performance and screen arts space Cube Microplex, Bristol. For the project, Orchestra Cube included dancer Kyra Norman (Dance Bristol) and Ale Fernandez as conductor (see also his input via ILRT). Participation of the Orchestra in the first and third workshops was central to the success of the project. Their enthusiastic engagement with the leading-edge technologies allowed new areas for research into both AG and Memetic to be identified. Specific contributions were made in the area of sound amplification, audio and video latency and the proprioceptive (spatial awareness and ability) aspects of improvisatory work that relies on both visual and audile cues.
Particularly given Fernandez's role in both ILRT and the orchestra, this marked a truly transdicsiplinary collaborative aspect of the project.

2.6 Blackout Arts
Sound artist Jem Noble shared his particular skills with Rob Bristow in the GSoE AG node. By working effectively with Orchestra Cube to mic acoustic and electric instruments via a central mixing desk directly into the AG equipment, Noble was able to demonstrate the benefits of professional sound processing within an AG environment. This was tested in the first workshop when audience members in the Physics AG node listed to the orchestra first through the fixed room microphones and then via the independent microphones. This significantly improved sound quality.

2.7 University of Utah
As AG innovators in a US context, Jimmy and Beth Miklavcic's involvement in the final symposium to share their InterPlay AG performance work was key to the day's success. Their work demonstrated high-end applications of AG in practice-led performance research and paved the way for future collaborations. They have since been in contact with Neal Farwell of University of Bristol's Music section to develop further research activities. The Miklavcics contribution was in the area of interdisciplinary collaboration.

2.8 Polar Produce
Company director Teresa Dillon's participation in the workshops and symposium provided a distinct, non-academic input in the area of Semantic Web, community-based tagging and mobile media. Her expertise in this area is evidenced elsewhere in this report and it is notable that she has successfully transitioned from academic positions at Open University through to significant work with FutureLab (associated with NESTA) and now to her own professional company. During the project she has explored the potential for future collaboration with the Institute for Learning and Research Technology. Her own work is fully interdisciplinary and her collaboration on this project extended this.

2.9 Japan Telematic Dance Network
Under the leadership of Yukihiko Yoshida, TDN collaborated with this project to produce a short piece of distributed choreography for performance at the final symposium. This was an exemplary instance of knowledge transfer as TDN use either ISDN or Skype in its distributed performances. With the

guidance of Rob Bristow and Manchester's Access Grid Support Centre TDN was able to install and operate open source AG successfully. Furthermore, TDN's participation is leading to future work with University of Leeds and University of Bedfordshire.

The following list comprises individuals from multiple disciplines who participated in the workshops to facilitate interdisciplinary work

2.10 Alison Allden, Director Information Services, University of Bristol and WUN representative. Allden's participation in the project provided an extremely useful broad-based view of e-Science across the HE sector. Her senior standing and expertise in this area lent a particular weight to the project and her input during discussions was invaluable.

2.11 Prof David De Roure, Southampton University. As one of the key members of the AHRC's e-Science panel and as a key international figure in the fields of pervasive and ubiquitous computing and in Semantic Web, De Roure's input was particularly welcome and presented an invaluable networking opportunity for all workshop participants.

2.12 Watershed Media Centre's digital media manager Gill Haworth was invited on to the project's Steering Group. Although Haworth attended the symposium only, her input to meetings and comments on the structure of workshops was invaluable. Her commitment to the project led to the Watershed Media Centre becoming a listed project partner in the subsequent application to the e-Science Research Scheme.

2.13 David Hopkinson, artist who contributed work, facilitated collaboration and fostered new interactions in the workshop series.

2.14 Nathan Hughes, artist who contributed work, facilitated collaboration and fostered new interactions in the workshop series. With a background in telematic art through training with telematics pioneer Professor Roy Ascott, Hughes is a leading edge Bristol-based digital artist. This collaboration entailed bringing his knowledges and skills into an AG environment to explore transferability and the potential interoperability of video manipulation software.

2.15 Jamie King, artist who contributed work, facilitated collaboration and fostered new interactions in the workshop series. His specific field is in copyright and electronic media, particularly in file sharing and cultural mapping through Semantic Web. This is an ongoing collaboration as Piccini is involved in testing new applications developed by King and his artistic partners.

2.16 Tomas Rawlinson of Fluffy Logic contributed work, facilitated collaboration and fostered new interactions in the workshop series. Fluffy Logic is currently worked with South West Screen and University of Bristol to pioneer secure peer-to-peer video sharing within the UoB network. This is an ongoing multidisciplinary collaboration as Fluffy Logic is part of the Piccini and Rogers application to the AHRC e-Science Research scheme.

2.17 mmmmm: Luna Montenegro and Adrian Fisher of Live Art collective mmmmm contributed work, facilitated collaboration and fostered new interactions in the workshop series. They performed via the Imperial College Access Grid node and contributed detailed feedback that confirmed Bristol's initial findings around the need for flexible sound, camera and projection facilities.

2.18 Prof Nick Kaye and Gabriella Giannachi (Performing Presence, University of Exeter) significantly contributed to the workshops and symposium. Prof Kaye, in particular, fed into the development of subsequent proposals to the AHRC e-Science scheme.

2.19 Jem Kelly (University College Chichester) actively participated in workshops 1 and 3. In workshop 3 he brought undergraduate performance students to the AG node at Southampton University to participate in a distributed improvised performance with Bristol, London and Manchester. This contribution was invaluable to the project in that it highlighted further issues around sound transmission. Participation in the project also provided a useful introduction for his students to telematic performance.

2.20 Sita Popat, University of Leeds was a particularly active participant in the workshops and symposium. With a background in computer-aided choreography she shared her own significant research background in this area. The workshops provided her with the opportunity to develop skills in Access Grid and Memetic and directly led to her collaboration with Helen Bailey and Simon Buckingham Shum in an application to the AHRC e-Science Research scheme. This collaboration was interdisciplinary, with a potential for transdisciplinarity.

2.21 Helen Bailey, University of Bedfordshire was a particularly active participant in the workshops and symposium. With a background in computer-aided choreography (including collaboration with Manchester's Martin Turner on the Stereoscopic Choreography project) she shared her own significant research background in this area. The workshops provided her with the opportunity to develop skills in Access Grid and Memetic and directly led to her collaboration with Sita Popat and Simon Buckingham Shum in an application to the AHRC e-Science Research scheme. This collaboration was interdisciplinary, with a potential for transdisciplinarity.

2.23 Gregory Sporton, Birmingham Institute of Art and Design, University of Central England is a fellow recipient of ARHC e-Science Workshop funding. It was therefore important to have Sporton involved. We were able to share best practice and explore the potential for future collaborative applications. However, with the limited time available to devote to research projects Piccini had to decline an invitation to be a co-applicant in Sporton's application to the AHRC e-Science scheme.

2.24 Without the support and participation in the project by Tobias Blanke of Arts and Humanities e-Science Support Centre, the project would not have

succeeded in the way that it has. It was important to have this new voice present to facilitate future e-Science research in the arts and the AHeSSC overview of the field was invaluable. AHeSSC will continue to play an important role in skills brokering and collaborative networks.

2.25 Nigel Derrett (3CR) significantly participated in the workshops and symposium. 3CR is a limited company based at University of Bristol that targets and exploits the convergence between the worlds of communications, computing and multi media content production, storage and distribution. Their expertise fed into workshop discussions while the project's activities have contributed to 3CR's future research plans.

2.26 MiMeG (Mixed Media Grid) is based at Bristol and King's College London. It is an interdisciplinary collaboration between computer science, social studies and education. The project aims to generate tools and techniques for social scientists to analyse audio-visual qualitative data and related materials collaboratively. MiMeG researcher Marie Gibbs shared her expertise in this area, while the workshops contributed to future planning for MiMeG activities.

2.27 Prodromos Tsiavos of Creative Commons UK contributed a presentation and a PowerPoint that he licensed with CC licensing under the Attribution-ShareAlike licence. Creative Commons allows content producers to 'tag' their electronic work with a set of simple licences. It allows producers to determine rights, including Attribution, non-Commercial use, ShareAlike and whether they will allow Derivative works to be made from original material. Tsiavos' contribution directly fed in to the major application to the AHRC e-Science Research Scheme.

3 EVALUATION OF THEMATIC ADVANCEMENT THROUGH WORKSHOPS

3.1 Significant advancements

In terms of the performing and screen arts, it was clear that the area around questions of the geometries of performance space were of particular interest. In the literature around telematic art much has been made of the so-called 'third space' – a virtual space in which elements of two or three distributed 'real' places are digitised, networked and brought together into a third, digital space of audience-witnessed performance. AG differs significantly in that any AG meeting represents a one-to-many relationship. Each AG node experiences a very different understanding of the live event because of the multiple combinations of live bodies and AG windows on projection surfaces. There is no 'singular' performance, but a non-hierarchised multitude.

With regard to the Semantic Web and Memetic interface, this helped to raise important issues around ownership, visibility and hierarchies of knowledges. Clearly 'total information awareness' is neither possible nor desirable. Yet, how are relationships among people and their documentary artefacts made meaningful through Semantic Web applications in ways that will be acceptable to practice-led researchers themselves, useful to other

researchers and remain open enough for development for future research? The workshops and symposium raised important questions about the methodologies and criteria by which we come to classify documentation.

Also highly significant were the advancements made by the project in understanding the potential for Semantic Web applications to interoperate with distributed data sets of highly complex audio and visual material. The servlet developed by ILRT successfully interfaced between PARIP Explorer and Memetic. This proof-of-concept application provided the core of the subsequent application to the e-Science Research scheme and allowed the project to develop thinking about the potential spatial relationships to be developed between the graphic interfaces of PARIP Explorer and Memetic and how these might best be developed for use in a performing and screen arts context.

3.2 Moderate advancements

A significant obstacle to uptake of e-Science in the performing and screen arts has been the availability and long-term use of other, open source and proprietary software and low-cost, flexible hardware in distributed, collaborative practice-led research. Familiarity with such resources is amply evidenced by conferences associated with the ARHB-funded PARIP project (www.bris.ac.uk/parip) and with Digital Resources in the Humanities and the Arts and in the Digital Performance Archive (www.intute.ac.uk/artsandhumanities/cgi-bin/fullrecord.pl?handle=humbul3294). Furthermore, the recently published *AHDS Performing Arts Scoping Study: Getting to Know Our Audience* (http://ahds.ac.uk/performingarts/) and reports from Lesly Huxley's (ILRT, University of Bristol) 'Gathering Evidence' AHRC-funded project (www.ahrcict.rdg.ac.uk/activities/strategy_projects/) and Sheila Anderson's AHRC-funded e-Science Scoping Survey Experts Seminar (detailed elsewhere in this report) all indicate the high levels of ICT expertise in the screen and performing arts. Yet, as evidenced in Anderson's Scoping Survey this had not always translated into engagement with the e-Science agenda.

The active participation in these workshops of national and international artists working outside of academia evidences the importance of the project in terms of knowledge transfer and in terms of working through some of the barriers to e-Science. The work of the Tokyo-based Japan Telematic Dance Network and Utah-based InterPlay in addition to the London-based mmmmm and Bristol's Orchestra Cube and Polar Produce contributed to the development of this project. In turn, the project itself facilitated future collaborations between and HE and non-HE sectors in the performing and screen arts.

However, feedback from participating artists focused on how they might effectively engage with the e-Science agenda without the funds and infrastructure available in HE. This specifically relates to Access Grid, which requires significant development before it will prove useful to the professional

artistic community. The Semantic Web aspects of the project were of greater interest to artists.

3.2 Less significant advancements

There are a wide range of proprioceptive issues – that is, issues pertaining to the sense one has of the relative positions of parts of the body – that are raised by working through an AG environment. The fragmentations of space provided by the camera views and AG window arrangement, together with the fragmentations encountered through the limitations of the technology itself are performatively disorientating and produce new understandings of the relationships among bodies, data objects, performance spaces, projection surfaces and audiences. Arguably, however, conventional telematics raise many of the same questions and in much the same way. As Donna Haraway writes of the radical potential of this telematic subject 'the split and contradictory self is the one who can interrogate positionings and be accountable; the one who can construct and join rational conversations and fantastic imaginings that change history' (1998: 195).

3.3 Overall evaluation

Given the modest funding sought and acquired, the project made significant thematic advances. Through the documented attendance list for the 'Locating Grid Technologies' workshops and symposium it is clear that this project has generated high levels of interest across the subject area, particularly amongst those researchers already involved in broadly defined digital performance areas. I would conclude that the greatest impact of the workshops was in the area of practice-led research in the performing and screen arts – the target subject area. Longer-term impact within the subject area will be more clearly identified once the selection process for the current AHRC e-Science Research Scheme is complete and made public.

4 THE KEY ADVANCES IN UNDERSTANDING THAT EMERGED FROM THE DISCUSSIONS AND, IF APPLICABLE, PARTICULAR REFERENCE TO THE ADVANCES IN THE STUDY OF THE RELEVANT AHRC STRATEGIC PROGRAMME.

The Locating Grid Technologies series of workshops achieved a number of significant milestones:

4.1 The successful introduction of workshop participants to Grid technologies has resulted in higher levels of understanding in the screen and performing arts, as evidenced by the increasing numbers of people participating in events over the project's lifetime and by research applications outlined below.
4.2 Significant advances in understanding of the application of Memetic in the recording, analysing and re-analysing of performing and screen arts research within an AG environment, as evidenced by the Memetic End User Evaluation document, http://www.memetic-vre.net/).
4.3 The successful linking of the PARIP Explorer Semantic Web application to the Memetic server in Manchester has significantly pushed forward the real-world application of Semantic Web and led to a major application for further

development under the e-Science Research scheme. The ability to search, browse and play documentation held in Memetic via PARIP Explorer presents a significant contribution to research in the performing and screen arts. Because PARIP Explorer can be user edited and tagged, the 'knowledge status' of documentation remains open-ended.

4.4 Significant advances were made in the use of AG. While we entered this project with an understanding that the inflexibility of existing AG nodes might restrict the scope of creative research possible, it was only through the complexity of the activities engaged in that this was evidenced. Best practice key points are:

- the need for a separate AG 'pilot' to run sessions as facilitators cannot manage complex performance activities and run the AG simultaneously;
- the need for AG 'pilots' to have high-level computing expertise and knowledge of performing and screen arts research concerns to facilitate interoperability;
- the need to attend to the size and position of AG windows as central to the narrative drive of the research;
- related to above point is the need for flexible sound and camera arrangements to suit the research impetus of specific events

4.5 The work entailed in planning and implementing these workshops presented the collaborators with excellent case examples of the central importance of rehearsal, detailed planning and repeated testing. The complexity of negotiating institutional firewalls, software compatibility and interoperability, unstable beta versions and developing new, leading-edge applications tested project collaborators' limits. That the events themselves proved so successful is a testimony to the effective collaboration enjoyed.

4.6 Related to 4.5 is the important issue of translation. A key advance afforded by the working practices of this project was in the area of communications. Everyone involved in the project quickly discovered that they had different means of communicating and different modes of work practice. The experience of running this project has confirmed and extended the importance of numerous iterations of information to ensure that complex working patterns smoothly flow.

5 FUTURE TOPICS FOR INVESTIGATION THAT WERE IDENTIFIED

5.1 Demonstrated urgent need to research more flexible, higher quality sound solutions within Access Grid environments.

5.2 Further research into sound compression issues with an AG environment.

5.3 Further research into constructing stereo and/or surround sound effects from the mono sound output from AG.

5.4 Further research into interoperability between AG and other computing applications. Sharing complex video and audio material in distributed meetings proved very difficult. Specifically, proprietary InSORS Grid was not designed to handle multimedia content and there is lack of on-the-ground development expertise. Specifically, research should focus on developing interfaces with commonly used software in digital performance (Max/MSP, Isidora, games engines and so on).

5.5 Further research to address issues of audio and visual latency.

5.6 Further practice-led research into how latency produces different performance forms and understandings of performance space.
5.7 Device-based extensibility, in particular, the interface between AG and a range of mobile devices such as mobile phones and PDAs.
5.8 The performance and screen arts implications of the role of documentation in producing the work.
5.9 Further practice-led research needs to be undertaken to determine the truly innovative uses of these technologies.

6 FUTURE COLLABORATIONS OR RESEARCH PROJECTS THAT EMERGED FROM THE NETWORK/WORKSHOPS

6.1 Yukihiko Yoshida (Japan) and Helen Bailey (University of Bedforshire) and Sita Popat (University of Leeds) in the field of telematic choreography, with resource provided by InSORS Grid.
6.2 University of Bristol (Angela Piccini, PI), ILRT (Nikki Rogers, Co-applicant), Watershed Media Centre and Fluffy Logic. Funding sought from AHRC e-Science scheme for 'Semantic Grid Approaches to Digital Media Archives' project that seeks to develop further PARIP Explorer to search, browse and play moving image data.
6.3 University of Bedfordshire (Helen Bailey, PI), University of Leeds (Sita Popat, Co-applicant), Open University (Simon Buckingham Shum, Co-applicant), University of Manchester (Mike Daw) on use of Memetic in digital choreography. Funding sought from AHRC e-Science scheme.
6.4 University of Exeter (Gabriella Giannachi), University of Nottingham (Mixed Reality Lab), Blast Theory. Funding sought from AHRC e-Science scheme. Specific details not made public.
6.5 Birmingham Institute of Art and Design (Gregory Sporton, PI). Funding sought from AHRC e-Science scheme. Specific details not made public.
6.6 AHDS Performing Arts (Daisy Abbott, PI) application to AHRC to run further workshops on e-Science and ICT in Performing Arts
6.7 ILRT (Nikki Rogers, co-applicant), University of Manchester (Mike Daw, PI), application to JISC VRE to develop Memetic / IUGO (research event information database) interface.
6.8 Ale Fernandez and other ILRT researchers invited to the Royal Music Association Research Students' conference (3-6 January 2007) to give a presentation on 'Grid technologies for music and the arts', based on findings from this project.
6.9 Piccini invited by Daisy Abbott (AHDS Performing Arts Support, Humanities Advanced Technology and Information Institute, University of Glasgow) to speak on e-Science in the Performing Arts for an upcoming series of workshops.
6.10 Piccini invited by Tobias Blanke of the Arts and Humanities e-Science Support Centre to present on e-Science and the Performing Arts at the e-Science Institute in Edinburgh.

7 PLANS FOR FURTHER DEVELOPMENT OR ACTION

Any further plans for development are dependent on feedback from AHRC e-Science research scheme application.

REFERENCE

Haraway, D. (1998) 'The Persistence of Vision', in N. Mirzoeff (ed.) The Visual Culture Reader, pp. 191–8. London: Routledge.