

Aus-e-Stage – Collective Intelligence and Creative Visualisation for Collaborative eResearch

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Overview *Summarise the context that leads to this project.*

AusStage aims to deliver innovations in collaborative eResearch by taking advantage of new developments in information and communication technologies (ICTs) to solve the methodological challenges of incorporating quantitative approaches within arts and humanities research. This project applies collective intelligence, data visualization and mobile delivery to revolutionise the research utility of the AusStage database. The project will provide performing arts researchers with platform-independent, remotely accessible and visually interactive access to quantifiable research data. It builds on the success of the AusStage partnership in harnessing ICTs to performing arts research and will develop tools and services with application in other areas of arts and humanities research.

AusStage delivers a data set of national significance to researchers, postgraduate students, policy makers in government and industry practitioners. Since its inception by eight universities in 2000, AusStage has grown its community of performing arts researchers and demonstrated its capability by using cutting edge ICTs to meet researchers' evolving interests in incorporating quantitative approaches in qualitative research. Eighteen university partners and the Australian Research Council have contributed over \$1.5 million in funding. AusStage now comprises: (1) a web-accessible relational database holding information on over 45,000 performance events, and related venues (5,500+), organisations (8,400+), and artists (75,000+); (2) an integrated directory of over 39,000 additional resources with links to digitised text, image and video stored in libraries, archives and repositories; and (3) a suite of innovative eResearch methodologies for mapping the creativity of live performance over time and space and analysing networks of artistic collaboration.

Users *Identify the research communities and resource providers that this project serves; and the potential number of users. This should include some NCRIS capabilities or other data federating or collaborating research groups, and any institutions that will participate through setting requirements for or steering this project.*

AusStage is a partnership between academic researchers in theatre, drama and performance studies at Flinders University, the University of New South Wales, the University of Newcastle, the University of Queensland, the University of Western Sydney, Monash University, Deakin University, Macquarie University, the University of Adelaide, University of Wollongong, Edith Cowan University, La Trobe University, Murdoch University, Queensland University of Technology, the University of Ballarat, the University of Melbourne, and the University of New England.

A research community of around 280 university-based academics, postgraduates and practitioners is indicated by the members' network of the Australasian Association for Theatre, Drama and Performance Studies. This research community has considerably broadened since AusStage entered a collaboration with AustLit on the NeAT-funded Aus-e-Lit project to supply production data to the research community for Australian literature. AusStage supports a nation-wide network of 63 trained data entry operators in universities, theatre companies, government agencies, libraries, archives and collections. In 2008 there were 22 postgraduate students directly using the AusStage database for research.

AusStage is used widely as a primary research tool by policy-makers, arts administrators, artistic directors, event producers and performing artists and by staff in libraries, museums and archives

around the country. Collaborating partners in government and industry include the Australia Council for the Arts, the Performing Arts Special Interest Group of Museum Australia, ArtsSA and Windmill Performing Arts. We are also working with the Australian Bureau of Statistics on providing data for ABS publications.

Needs *Describe the needs of the research communities or resource providers that this project seeks to address.*

AusStage fulfills a national need for public access to reliable information on the full spectrum of live performance in Australia. AusStage records information that is not recorded elsewhere; there is no other comparable database in existence. But conventional database methods of text-based search-and-retrieval are no longer sufficiently effective in meeting the evolving needs of arts and humanities researchers. In consultations at the AusStage Symposium (25-26 September 2008), researchers demanded new interfaces to interact more flexibly with the AusStage dataset and to collaborate more productively across sectors of the creative economy. AusStage researchers want research tools and services which encompass technological evolution and range in generation from professorial expertise to postgraduate ingenuity. In short, they want tools and services which are as creative as their research.

Visual exploration, playful interaction, real-world modeling, and active participation are the hallmarks of live performance as a creative art. These are, therefore, the principles driving the development of a suite of new AusStage tools and user-services which will have broad application across the arts, the humanities and beyond. The 'new empiricism' in arts and humanities research arises from the increasing availability of quantifiable datasets about qualitative objects of analysis. The proposed tools will meet the needs of researchers seeking to interrogate and understand the creative methodologies that underpin the production of performing arts in Australia. Geographic mapping, network visualisation and audience research specially address the fundamental significance of performance sites, artistic collaboration and audience feedback to creativity in live performance.

Exposing the AusStage dataset to new visual methodologies also addresses the needs of researchers in government and industry. The expression of inaccessible 'dark' data and access to audience response is enormously important to government funding bodies in policy formation. The development of new performance is a key mechanism whereby Australia's national culture is generated and renewed; and considerable amounts of public money are invested by government agencies in individuals and the organisations dedicated to supporting and producing this activity. The proposed new services for AusStage will allow state and federal funding bodies to graph the impact of this funding on Australian culture.

Services *Describe the result of the project in terms of the service(s) that will be implemented and demonstrated by the project and which could be operated in an ongoing fashion; and the proposed operator of each service.*

Three new services will be designed, tested and deployed to operate alongside AusStage's current text-based search-and-retrieval service, which is hosted by the School of Computer Science, Engineering and Mathematics at Flinders University and maintained by the School's computing services group. The new services developed by this project will also be hosted under the same arrangement, with assistance as required from eResearch SA.

Service 1: Mapping Events

The Mapping service will provide an interactive, map-based interface with which to search, manage and display AusStage data. Its functionality will include user-controlled geographic display of venues and associated events, zooming from global-scale to street-level, time-range controls, time-series animation and trajectory-tracking of companies, productions and artists on tour. Of particular value to researchers and post-graduate students will be the ability to select and overlay demographic data from

the Australian Bureau of Statistics and other sources of geo-coded data. AusStage already holds geographic coordinates for over 1,000 Australian venues; the mapping service will mandate the recording of geographic coordinates for all venues in the database. The service will also aim to provide overlays onto historical maps for historical data. A prototype of this functionality has been developed using maps from Picture Australia.

Service 2: Navigating Networks

The Network service will provide an interactive interface for navigating and analysing the network of artistic collaborations embedded in the AusStage dataset. Node-link network graphs will depict artists and their collaborations, thereby humanizing the representation of artists in AusStage by modeling the collaborative ethic of the performing arts. Tools for quantitative analysis of the collaboration network graphs will also be provided. This service will present existing data in new ways and allow researchers to interrogate the collaborative methodologies underpinning creativity in the performing arts. There is widespread interest in understanding the human factors in productive collaborations, ensuring the applicability of this service. The CSIRO ICT Centre recently sought AusStage input for research on human collaboration in virtual environments.

Service 3: Researching Audiences

A new mobile interface will allow AusStage to solicit live, location-based input from users, providing AusStage with data that is missing from present archives: immediate, on-location, experience-near responses to Australian performing arts practice. This project will create (1) a remote-access feedback facility for spectators to respond to productions by recording short SMS-style comments (and longer blog-style reviews in a desktop format) for other users to read and comment upon, (2) a social networking tool for researchers, spectators and practitioners to track the popularity of live performance events, and (3) a real-time, location-aware, map-based service providing up-to-date information on productions, artists and venues, and access to box office services. An automated content analysis system will aggregate the emotional, aesthetic and critical content in spectator responses, visualise aggregated response data using mood tags, emoticons, heatmaps and quotes, and simultaneously deliver these displays back to users to inform spectator choice, as well as providing a repository of audience response on performance to researchers, something that is currently unavailable.

NeAT Characteristics

eResearch effect *What changes in behaviour and activity are expected from the project that will demonstrate the broader adoption of eResearch practice?*

The proposed suite of eResearch services will harness the collective intelligence of the AusStage research network and distribute responsibility for collaboratively sustaining AusStage as an authoritative and accessible database. The services will enable researchers to shed new light on ‘dark’ data – data stored in AusStage that have previously been difficult to aggregate, analyse and display in meaningful ways. The services will expose existing datasets to new modes of interrogation and analysis, stimulating innovation in research methodologies and the productivity of research.

The **Mapping** service will introduce a geographic intelligence to research applications of the AusStage data set. AusStage currently has limited capacity to represent the geography of performance events to researchers in a meaningful way. The mapping service will provide researchers with the ability to chart the geographic distribution of performance events. Researchers will be able to visualise the archeology of performance sites by treating time as a third dimension and displaying events in time-slices layered onto two-dimensional maps. Researchers will use this service to map regional ecologies of performance in line with their development, exposure, influence and after-effects, thereby revealing the socio-political histories of performances, venues and communities. The service will also allow researchers to search, manage and display AusStage data relevant to particular Australian geographic regions. The service has direct application in several ongoing projects. Prof Joanne Tompkins (UQ) draws on spatial theory and virtual reality in analyzing cultural politics of space and place in Australian drama. Assoc Prof Paul Makeham (QUT) is using the notion of ‘flow’ to visually represent the scope, scale, reach and pattern of metropolitan-generated touring product through regional Australia. Assoc Prof David Watt and Dr Gillian Arrighi (Newcastle) are exploring the social significance of site-specific performance to regional cultural ecology. Postgraduate Bill Dunstone (Murdoch) is researching the transmission of British culture in Australian settlement as a venue-specific performance of place.

The **Networking** interface will transform research practice in the performing arts with far-reaching implications for arts programming and the development of policy. The application of network visualisation and analysis will reveal patterns of collaborative creativity in the performing arts that have previously been unrepresentable using conventional text-based displays. The networking interface will readily substantiate analyses which were previously difficult to deliver, including: lines of artistic contact, influence and cross-fertilization; organisational cycles of growth, consolidation and release; patterns in career pathways and professional development; and emerging clusters of collaborative creativity suitable for strategic investment. Such analyses are critically important to arts and humanities research, policy development and industry analysis. Dr Jonathan Bollen (Flinders), Dr Glen McGillivray (Sydney) and practitioners Kim Durban (Ballarat), Nanette Hassall (WAAPA-ECU) Richard Murphet (VCA-Melbourne) are taking an entirely new approach to analysing the AusStage dataset by asking the question, ‘who works with whom?’ and tracking the interactions between artists, as they train, rehearse and work together.

The **Mobile** interface will create a whole new data set of audience response that is currently inaccessible. Recording spectators’ responses to live performance, on-location and as it happens has long been a challenge for research. Audience response data is difficult and often prohibitively expensive to procure by conventional means. The mobile service will revolutionise how audience research is undertaken by overcoming the time-lag between audience experience and research response. Prof Julie Holledge (Flinders), Prof Peta Tait (La Trobe) and Dr Helena Grehan (Murdoch) are internationally-recognised experts on the analysis of emotional interaction, aesthetic perception and ethical relations in spectator response to live performance. Their expertise will be embodied in an automated content analysis system to aggregate audience response data and visualise results using emotional iconography. We are currently participating in the Australian government-funded Mobile Enterprise Growth Alliance (MEGA) program to develop a business model for the mobile interface

which will create a framework for audience research collaborations between university-based researchers, industry organisations and government agencies.

Broader adoption *Which additional communities, resource providers or organisations would also be expected to benefit from the provision of the same or similar services should the project succeed?*

AusStage-developed innovations in collaborative research methodologies are spreading – through the network to early career and postgraduate students, outside the university to industry and government, and now far beyond the fields of theatre, drama and performance studies.

Researchers from Berkely, UCLA, Nanjing University and the University of Oslo are working with Prof Julie Holledge (Flinders), Prof Joanne Tompkins (UQ) and Dr Jonathan Bollen (Flinders) in applying AusStage-developed **mapping** techniques within the international Ibsen Between Cultures collaboration, a project funded in Australia by the ARC. The mapping tools and techniques also have application in projects from other disciplines, such as the ARC-funded *Mapping the Movies* project led by Prof Richard Maltby (Flinders) and QUT's Creative Industries National Mapping Project.

The capabilities of the **networking** service enabling researchers to visualise, navigate and analyse social networks has application to a range of people-oriented information services, such as the National Dictionary of Biography (ANU), the Australian Women's Archive (Melbourne), the Dictionary of Australian Artists Online (UNSW) and the People Australia discovery service (NLA). The CSIRO sought AusStage expertise for research on scientific collaboration, after attending our presentation on visualising artistic networks at the eResearch Australasia conference in 2008.

The **mobile** interface will be developed for uptake within industry-based audience research and market development. Adoption is initially envisaged by organisations producing multi-event festivals such as the Adelaide Festival of Arts and the Adelaide Fringe Festival, and production companies with extensive touring programs such as Windmill Performing Arts and Circus Oz. The significance of the mobile interface as a demonstration project for researchers seeking a continuous flow of research data from mobile, dispersed subjects will be readily applicable in media studies, cultural studies, cultural tourism, arts education and consumer research.

A key strength of AusStage is that it draws on collaborative skills intrinsic to the creation of live performance. AusStage researchers are experts at building teams and working collaboratively to fuel creative endeavours. Taking this expertise in collaborative practice and embedding it in the design of eResearch services will enable AusStage to demonstrate new approaches to collaborative research, beyond sharing research data to driving the uptake of innovative methodologies. Projects which could adopt AusStage-developed methodologies include the national research databases in the arts and humanities, such as AustLit (UQ), Australia Dancing (NLA), the Australian Media History Database (Macquarie), the National Dictionary of Biography (ANU), the Australian Women's Archive (Melbourne), and the Dictionary of Australian Artists Online (UNSW).

Value adding *Identify the components of the project that could be based around generic technologies or be implemented through shared services for which the project would provide an exemplar use case or requirement set.*

The mapping, networking and mobile services will be implemented as shared services, based around generic, open-source software technologies and standardised data formats in XML.

The mapping service will be built using the KML-encoded geographic data which can be displayed in Google Earth. The Google Maps API and the Google Earth API enable KML-encoded geographic data to be embedded and displayed in web-pages via javascript and plug-in.

Prefuse Visualization Toolkit (Java) and Prefuse Flare Toolkit (Flash) are likely candidates for developing interactive web-based visualizations of network data. Vizster, a tool for visualizing online social networks developed by Jeffrey Heer at Berkeley, provides a model for the AusStage network interface. We also have experience in using a range of network visualization tools, including Visone, SoNIA, BioLayout3D and Cytoscape.

The mobile interface will be designed to operate on a wide range of mobile devices. Functionality will be simplified in order to maximize operability across diverse platforms. A version of the service will also be delivered via standard web browsers.

Standardisation

Describe the global technology development or standardisation work that will be adopted, adapted or extended within the project and any risk reduction available by collaboration with similar activities occurring elsewhere in the world.

The mapping service will use the OpenGIS KML Encoding Standard, an application of XML, the W3C's open standard markup language. Many applications display KML, including Google Earth, Google Maps, Google Maps for mobile, NASA WorldWind, ESRI ArcGIS Explorer, Adobe PhotoShop, AutoCAD, and Yahoo! Pipes.

No standard for encoding network data has emerged; a set of XML-based candidates, including GraphML, DyNetML and gml, are in current use. The Prefuse Visualisation Toolkit uses GraphML.

The mobile interface will be developed using web-standards for mobile delivery, from the W3C's Mobile Web Initiative. Maximising operability across major mobile platforms will be a priority.

The AusStage data model is project-specific, developed with reference to guidelines for Open Archival Information Systems (OAIS) and the Dublin Core Metadata Initiative (DCMI), and with the involvement of the Performing Arts Special Interest Group of Museums Australia.

The AusStage database is an Oracle 10g database delivered using open source Java code. The current text-based data entry and search-and-retrieval interfaces are accessible with standards-compliant web-browsers.

The project will be cognizant of related national and international activities in other areas of humanities, such as the mapping work of the Archaeological Computing Laboratory at the University of Sydney, and the W.M. Keck Digital Cultural Mapping Program at UCLA. AusStage has been invited to participate in an Institute in Advanced Topics in Digital Humanities focusing on techniques for the discovery, visualization and analysis of networks for the Humanities, to be held at UCLA in June 2010 and June 2011.

Project Scoping

Key Participants *Name any Pfc components, any NCRIS capabilities, or any other institutions or groups that will need to be involved in the project planning and execution.*

This project fits within scope of the capability for the Humanities, Arts and Social Sciences (HASS), anticipated for the next NCRIS round.

Key participants are Prof Julie Holledge and Dr Jonathan Bollen at Flinders University, with the involvement of the AusStage partnership comprising academics from 17 other Australian universities, the Performing Arts Special Interest Group of Museums Australia (collections), the Australia Council for the Arts (government) and industry partners.

The project will establish a Reference Group that will act in an advisory capacity on all aspects of the project, particularly input from users of the services. The Reference Group will include a Development Advisory Network to provide access to technological expertise. The Network will draw on expertise from ARCS and ANDS as appropriate, and from AusStage partners and associates. We have already held discussions on interface development and design for the mapping, networking and mobile services with Prof Chris Marlin, Prof John Roddick, Assoc Prof Paul Calder and Dr Theodor Wyeld from Computer Science and Digital Media at Flinders, and with Ian Johnson and Steven Hayes from the Digital Innovation Unit at the University of Sydney.

Proposed Project Committee

- Ian Maxwell, University of Sydney, President of Australasian Association for Theatre, Drama and Performance Studies (ADSA), or nominee (Chair)
- Jenny Fewster, AusStage Project Manager
- Jonathan Bollen, Drama Department, Flinders University
- Prof Chris Marlin, School of Engineering and Computer Science, Flinders University
- ANDS Executive Director, Ross Wilkinson, or nominee, currently Andrew Treloar
- ARCS Executive Director, Tony Williams, or nominee, currently Paul Coddington
- NeAT Project Manager, ex-officio

Project Scale *Identify the overall scale expected in the project, eg. 1 to 3 years, total effort in any year, and nominate any parties that have indicated a willingness to participate through providing resources. (funded or in-kind, people or facilities).*

Duration: 24 Months

NeAT funded Staffing: 2.5 EFTs

- A half-time **Project Manager** will coordinate all work undertaken on the project. Meeting regularly with AusStage team members and the Project Committee, the project manager will ensure that milestones are delivered on time, that associated project partners are informed on all aspects of the project's development, produce reports and documentation according to the work plan outlined below and provide logistical and necessary support for the software engineers. The Project Manager will also coordinate gathering of requirements from the user communities and demonstrations of the software to users.

- Two **Software Engineers** will be responsible for all technological development outlined in the work plan. The software engineers will work on software development, integration, testing and deployment, develop documentation, user guides, training material and other project deliverables to the project manager and document work processes to ensure the project's future-proofing.

In-kind effort:

- **AusStage Research Liason** – Dr Jonathan Bollen (0.1 Flinders in-kind) will oversee the academic development of the project, and provide leadership and liaison to promote uptake and adoption of new methodologies products amongst researchers and postgraduates.
- **AusStage Project Manager** – Ms Jenny Fewster (0.1 Flinders in-kind) will provide administration services to the project, interfacing with Flinders University human resources, finance and research offices, and ensuring that new developments integrate with the ongoing delivery of AusStage services.
- **Flinders Digital Humanities Coordinator** – new position (0.1 Flinders in-kind) will provide assistance with transfer of knowledge, skills and services to other eResearch projects, such as the ARC-funded *Mapping the Movies* project led by Prof Richard Maltby (Flinders).
- Computer Science department, Flinders University will provide technical support for the software engineers, and co-location for two AusStage servers in the department's data centre. In-kind server co-location, backup and OS Maintenance is estimated at a value of \$265 per server per month.
- It is expected that other in-kind will be available, including from other members of AusStage community, other user groups and eResearch SA.

Major Steps

Identify the key steps that will be visible to users as the services develop. Note that some observable deliverable is needed every half year and projects may be reviewed based on the achievement of these steps.

Development and implementation of the services for Mapping Events, Navigating Networks, and Researching Audiences will be undertaken according to the work plan outlined below. Each service requires four major developmental steps:

1. 'Back-end' technological development – the construction of the unseen aspects of the final services – construction and installation of server-side software, for example.
2. 'Front-end' technological development – construction and installation of the graphical user interface (GUI) that the public users will use when accessing services.
3. User-testing and iteration – internal alpha testing, improving, public beta testing and releasing.
4. Dissemination – demonstration projects, education activities, uptake promotion.

The project will begin with the implementation of the Mapping and Network interfaces, building on work already undertaken during the ARC LIEF-funded AusStage Phase 3 (2007-2008) and two eResearchSA Summer Scholarships (Dec 2008-Jan 2009). The Mapping and Network service development will be undertaken simultaneously to reach production release by month 14, with prototypes available for demonstration and testing after 6 months.

The Researching Audiences services will require a longer development phase. Building on the business plan currently in-development through our participation in the government-funded Mobile Enterprise Growth Alliance (MEGA), this service will reach production release by month 16, with a prototype ready for demonstration and testing after 12 months.

The annual conference of the Australasian Association for Theatre, Drama and Performance Studies, held in July, will provide the major forum for project promotion and service demonstration. If the project commences July 2009, the mapping and networks services will be in beta-testing but would be

ready for demonstration during the July 2010 conference; demonstration of projects using production services for mapping, networks and audience services will be possible by the July 2011 conference.

Month	Mapping Events	Navigating Networks	Researching Audiences
2	Service descriptions and project plans		
4	Develop Mapping Engine	Develop Networks Engine	Develop business plan
6	GUI development	GUI development	Revise service description
8	Alpha-testing	Alpha-testing	Back-end development
10	Service revisions	Service revisions	GUI development
12	Beta-testing and bug fixing	Beta-testing and bug fixing	Alpha-testing
14	Production release	Production release	Service revisions
16	Documentation and training	Documentation and training	Beta-testing and bug fixing
18	Demonstration projects		Production release
20		Demonstration projects	Documentation and training
22			Demonstration projects
24	Dissemination activity		

Dependencies

Identify dependencies that exist to activities or developments external to the project.

The AusStage network is applying for funding from the ARC and university partners through the LIEF scheme for 2010. The outcome of this funding application will be known in late 2009. The availability of LIEF funding will expedite the uptake of the new services across the AusStage network, in particular, through the support of data acquisition, infrastructure development and methodological innovation for partner research projects.