Research – The itemisation of Creative Knowledge

Editor // **Clive Gillman**

FACT
FOUNDATION FOR ART AND CREATIVE TECHNOLOGY

Research – The Itemisation of Creative Knowledge

ITEM (Institute for Technical Exhibition Management) is FACT's research and development programme for the exploration and development of tools and technologies for the exposition and exhibition of new media art work.
This publication features ten research projects, which have been supported by ITEM between 2003 and 2005.

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Editor: Clive Gillman
Print/Publication Manager: Wibke Hott
DVD Production Manager: Roger McKinley
Design: Alan Ward and Dominic Legge at Axis Graphic Design, Manchester

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ITEM review//

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FOREWORD

This publication provides a survey of the first 10 projects that have taken place within the ITEM programme. It contains detailed reports from each of the projects together with contextual information.

The ITEM programme grew from the hugely successful MITES service, run by FACT in Liverpool. The project came about after the first 10 years of operating MITES, when after providing support to artists and exhibitors working with video and new media, it had become apparent that the service was no longer able to function solely by just responding to the changes in needs. There was a growing realisation that MITES was increasingly being called upon to help define the evolution of the materials that the artists themselves were seeking to use as well as simply providing access to current and more familiar resources. In some ways this approach began to function at a fairly simple level – for example, the implementation of DVD authoring and exhibition at MITES in 1999 was in many ways a technological inevitability, but it still required a wholesale re-equipping of the sector in order to achieve the transition required. This process required standards to be defined and an end-to-end process to be established in order to provide quality and compatibility. This could only be achieved by MITES taking a lead in providing this definition. However, at a more complex and sophisticated level MITES was also being asked to come up with answers to future exhibition scenarios – to research and come up with solutions, often before artists had been able to effectively formulate the questions.

One response to this situation was to formally initiate a programme of research and development that would have as its aim the establishment of partnerships between artists and technologists working towards common goals of defining future trajectories of exhibition technologies. This project was first mooted with the Arts Council and NESTA, who seemed natural partners for such a scheme and both came together to support the first 6 projects in launched under the scheme in xxx date ?. Further support then came from the Arts Council North West for 4 more projects which started work in xxx date ?.

The first projects were selected through an open submission process in which artists and technologists could submit ideas collaboratively or independently (with MITES acting as a broker for possible relationships). Once selected each of the projects defined their own research objectives, although all participants were required to attend a series of joint awaydays at which common issues were aired and some of the projects presented their progress to peers. We also developed extensive three way agreements that articulated clearly the attribution of ownership of Intellectual Property around the projects, with a view to placing as much as possible into the public domain once the projects were complete.

It is clear from the outcomes that the projects produced valuable knowledge for those seeking to explore the next stage of exhibition, but the it is also apparent that projects also generated extra values – the space for consideration of future direction, the dialogue with experts from outside of ones own field – but probably of greatest significance the sense that, as an artist, it is a legitimate course of action to be making enquiries about technologies and techniques that previously might have been somewhat closed. This sense of empowerment was apparent at differing levels for the different projects, but it provides a clear impetus for the legitimisation of artist driven research – a point further explored in Simon Biggs' useful survey in this publication.

ITEM has been, and will continue to be, a valuable contributor to the knowledge around creative activity in the UK. It has been supported by financial contributions, but also by a leap of faith by specific officers, from Arts Council England, Arts Council North West and NESTA. Many thanks should go to Gary Thomas (ACE), Sarah Maher (NESTA), Sarah Fisher (ACE), Kathryn Hughes (ACE). ITEM was assisted in the selection process by Hannah Redler and Eddie Berg of FACT and was most ably project managed by Wibke Hott of FACT. The guardian angel for the project was Maggie Ellis and special thanks go to BT Exact and Grizedale Arts for hosting the first ITEM awaydays. Lastly, thanks to all the participants who invested huge amounts of energy and good will in thinking, doing and writing about what they did.

Clive Gillman
ITEM Project Director

Introduction for ITEM: artists in research environments

Simon Biggs

INTRODUCTION

This essay seeks to establish an overview of the current state of research activity amongst new media artists in the UK and the context within which they find themselves working, especially concerning recent significant changes in funding strategies. References are made to specific projects and institutions and also international examples that function to contextualise UK and, due to regionalised funding structures, particularly English practice. Research activity encompassed includes that taking place outside formal Higher Education (HE) as well as that which takes place within universities. A critique is sought on the effect of HE research upon artists practice. The scope of practice discussed covers artists working with diverse media technologies including, but not restricted to, film, video, television, computers, networks, sound, lighting, sensory systems and live art. Issues around hybrid arts/sciences practice are addressed but the primary focus here is with the impact upon new media arts practice of new and deepening relationships with institutional research frameworks and their attendant funding systems.

A comparative view is taken of the main UK research funding mechanisms operated by institutions such as Arts Council England (ACE), ACE Lottery, Arts and Humanities Research Council (AHRC – previously the Arts and Humanities Research Board), Higher Education Funding Council of England (HEFCE), National Endowment for Science, Technology and the Arts (NESTA), EU Framework 5, Wellcome Trust and other corporate sponsorship. The real impact of these funding mechanisms upon the media arts sector is outlined. How these research facilitating mechanisms have evolved, beginning with the first Research Assessment Exercise (RAE) to include the creative arts of 1997, and the contemporaneous foundation of the AHRC and the initiation of structured research funding and assessment in the creative arts in education are examined. How research has been supported through existing funding such as ACE and NESTA is also explored. Conclusions about changes in research in the creative arts are illustrated with examples employing verifiable data.

An attempt is made to contextualise the UK situation by employing certain international examples such as MIT MediaLab and the US State University research funding system as well as European institutions such as Zentrum fur Kunst und Medientechnologie Karlsruhe, Koln Hochschule fur Media and IVREA. The examples focus on those from which inferences can be drawn of relevance to the UK situation.

The context for this essay is the ITEM project initiated and run by the Foundation for Art and Creative Technology, Liverpool. The ITEM project seeks to bring together artists and specialists from diverse disciplines into multidisciplinary research teams to address specific research questions or problems and to explore how methods and practice might evolve as a result. The ITEM project can thus be seen as an important instance in a larger process of development within our contemporary culture, in the UK and elsewhere, that is witnessing the blurring of disciplinary boundaries and the redefinition of how art, artists and audiences might be constituted.

THE CURRENT RESEARCH CONTEXT //

With the emergence in the 1990's of the new UK Universities, and research degree awarding powers for many fine art departments, a series of questions around what might constitute research in a fine art context have arisen that are now being addressed. For example, the value of the exhibition as not only a research outcome but as part of a methodology of research assessment or the value of catalogues and reviews as evidence of peer reviewed esteem. The physical and social sciences have well established research methodologies and systems of assessment and in large part the creative arts could be seen to be emulating their research quality assessment methods, in some instances perhaps inappropriately. However, it is also possible that the assumed empiricism involved in the methods of traditional academic subjects, and especially their review and assessment procedures, is not as deep as expected and the frameworks and systems for evaluation can be based on somewhat arbitrarily established "traditions". This is not to suggest that such research is not rigorous, for it is; just that things might not always be as they seem and that it might not be such an unexpected development that the creative arts are able to contribute to and derive value from such academic practices.

The creative arts, with something of a "blank slate" in this respect, have an opportunity to develop forms of rigour that, in some interesting respects, are absent in traditional research subject areas. That might sound paradoxical, but it is this conundrum that is at the heart of a number of the interdisciplinary programs described here.

To establish context, and to ground the essay on some hard figures, it is interesting to note that in a matter of a few years research funding in England from the AHRC, for the arts and humanities in higher education, has risen from nothing to 61 million GBP per annum. As a proportion of overall HEFCE research funding (in excess of 1000 million GBP per annum) this is clearly far from the lion's share but it is historically significant and current policy documents show that AHRC funding, as a proportion of overall research funding, is set to grow at a higher rate than that envisaged for other research councils.

61 million is also a significant figure when compared with more traditional arts funding sources, such as ACE which in 2003 allocated 235 million GBP across all the creative arts in England as well as a further 120 million through Lottery funds. Whilst ACE's funding to the arts remains significantly higher than HEFCE's the year on year shift in figures shows that the rate of growth in HEFCE funds, like Lottery funds in the past, is outstripping core ACE funding growth. Given recent HEFCE policy statements it seems clear that this trend will continue and that whilst this does not imply an erosion of traditional

arts funding it does suggest a realignment in where the funds come from and how artists might access them.

Another example of new and unusual funding horizons for creative arts funding within HE is exemplified by art and design departments in such institutions as Brighton, Sheffield Hallam and the Royal College of Arts being successful in bidding for funds from the Scientific Research Infrastructure Fund (SRIF), a Department of Trade and Industry initiative with 1000 million GBP in funds to spend per annum on the technical and material resource base of scientific research. In these cases the funds have been directed towards developing the resource base for creative arts research projects largely involving new technologies and media.

These figures show that the overall envelope for arts funding in the UK has seen significant growth and diversification over the past several years, after what was a long period of attrition during the 1980's and 1990's, and that the emergence of new funding avenues such as the AHRC, the Lottery or the National Endowment for Science, Technology and the Arts (total funding disbursements in 2004 of 12.5 million making it too a major source of public funds) and the Wellcome Trust (400m GBP per annum for research funding, several millions of this being directed to the creative arts via the Wellcome Trusts Sci-Art and Public Engagement Programmes) have meant that artists have found new ways of working just as they have found new ways of being funded.

A significant change that can be seen as reflective of this funding context has been the emergence of the artist/researcher who exists both as an independent artist and as a research academic; either as a faculty member, often with teaching responsibilities attached, or as part of a research team associated with one or more institutions. This funding context can also be seen to have had a significant, perhaps profound, effect on those artists who choose not to work in some form of relationship with research oriented institutions.

Frameworks that facilitate artists who have chosen to work within or close to academic contexts include Trace, the online writers association based at Nottingham Trent University, the work of looser groupings of artists such as those associated with the Centre for Arts Research, Technology and Education (CARTE) at Westminster University or the more formalised but equally diversely oriented SMARTLab at the University of the Arts (formerly the London Institute).

Artists who have chosen to work outside formal educational institutions, but which can be seen as exemplary of a new research based approach to practice, include Blast Theory, the live and new media artists group who have gained international recognition for their interventionist and interdisciplinary projects. Another such group is Proboscis, composed of artists and researchers initiating large scale public arts projects that focus more on social formation as the subject and materiality of their work rather than on processes or objects as outputs. Each of these groups has adopted methods not dissimilar to the formal research methods found in academia and have been successful at gaining significant funding from sources associated with both academic and traditional arts funding. To some degree they have found themselves working with, and even within, academic contexts as they have evolved their research strategies. The emergence of such approaches to the making and situating of art could be seen as related to changes in the funding context artists are working within as much as it might be associated with developing tropes in arts practice itself.

ARTISTS, MONEY AND ACADEMIA //

In the last decade or so concerted efforts have been made in the UK to establish institutional frameworks for arts, new media and technologically based research and practice with a number of high profile and relatively well funded initiatives of particular interest. These initiatives, along with the evolution of a broader culture of academic research in art and design within UK Universities, has led to the questioning of the relationship of artistic practice to research, academic and otherwise, and how each facilitates and constrains the other.

There have been a number of academic conferences on just this topic (for example the University of Hertfordshire's series on practice based research in art and design, the latest being 2004). Another (international) example is the Digital Arts and Culture conference series (most recently in Melbourne, 2003) which brings together artist researchers, academics and theoreticians from around the world to debate the latest developments in the field.

Academics love to reflect upon their own state and some might seem to be employed as professional navel gazers. Conferences convened to debate the value of practice led research within a larger research ecology might seem especially self-reflective, but such conferences are also evidence of real changes in how the creative arts are situated in academia, not just as a subject to be taught but as an area of human inquiry and research that eventuates in real world outputs.

These developments, and others of similar character (eg: the Free Cooperation and Network conference at the State University of New York Buffalo 2004 or the Creativity and Cognition series, the most recent in Sydney, November 2004) have led to the emergence of a new kind of critical language and indeed new discursive contexts where artists are often engaged as protagonists rather than as simply the "subject". This evidences a change in engagement by artists and in their roles relative to notions of audience and the practices of other disciplines.

The ACE/AHRC's current Arts and Science Research Fellowships programme of support for artists in research environments, based itself on the earlier New Technology Artist Fellowship programme of 2002, run by ACE in collaboration with Cambridge University and Kettles Yard Gallery, is an excellent example of the kind of burgeoning research culture such conferences seek to engage. The Engineering

and Physical Sciences Research Council (EPSRC) has also initiated a complementary funding programme supporting scientists working in art schools and other creative practice contexts and the success of the AHRC initiative is shown by the announcement of its second call for proposals in September 2004.

The ACE/AHRC initiative is not about facilitating artists access to new tools and resources (although that was supported and did happen) nor about promoting or diffusing scientific methods and products (such as the Wellcome Trust Sci-Art program has set out to do) but rather was concerned with the development of new models of interdisciplinary research that will hopefully go some way beyond the old two-cultures debate; a debate that is very much alive and kicking within elements of UK academia and society.

One successful project, developed as part of the Arts and Science Research Fellowships, centred around the work of London based choreographer Wayne McGregor, who has produced a series of works noted for their innovative use of new media and interdisciplinary approach. This project involved working with researchers in neuroscience, psychology, design, anthropology and Human-Computer Interaction with the objective of developing new models of notating and interpreting dance and relating this to the physiological and psychological state of the dancer. McGregor used the opportunity to produce a new dance work, titled AtaXia, which explored the choreographic potential of disruptive stimuli that can cause the dancer to lose control.

Whilst McGregor's project exhibits a sophisticated approach to inter-disciplinary work a significant issue can arise here regarding the appropriation of one discipline by another, for its own purposes, without real understanding of what drives the other discipline. All sides of the debate, including artists, technologists, scientists, academics and funders, can be complicit in this. On the one hand artists can be seen to be seeking access to the instruments and resources of science to enhance the technological basis of their practice and on the other scientists could be accused of looking to artists as potential apologists or pedagogues at a time when science has been having to defend itself from sustained criticism in relation to issues such as genetically modified organisms, stem cell research, mass immunisation programmes and questions around the social responsibility of science.

It is early days with projects such as those initiated through the ACE/AHRC Arts and Science Research Fellowships but the hope must be that the long term objective here is to build research networks that cross our cultural divides and allow artists, scientists and social scientists to collaborate on developing not just new research programs but new notions of value and discourse in creativity. If the result is that artists become apologists for science or technologists technical problem solvers for artists then a real opportunity for cultural engagement across disciplines would have been lost.

OLD RESEARCH CULTURES //

There is an area of creative arts practice where there is a long tradition of practice related research in UK academia; music. Whilst art departments in the UK, with a few notable exceptions (the Slade, Goldsmiths, Reading or Ruskin, for instance), are largely to be found in the new universities (and thus developing within the non-research oriented educational cultures of the previous polytechnic system) most music departments are to be found in the old universities. Whilst music, like the other creative arts, had no formal research council to support them prior to the formation of the AHRC (1997) it did benefit from close association with other research active departments and the ethics they foster.

Two of the most highly regarded music research departments are those at York and Birmingham Universities. These two departments, and others like them, have had dynamic research cultures evolving over decades which have led to the establishment of a depth of research activity and a momentum we would normally associate with the physical and social sciences.

At York a significant research project, undertaken by the Music Technology Research Group, is RIMM. This involves developing Real-time Interactive Multiple Media content generation systems employing high performance computing and multi-parametric Human-Computer Interfaces. RIMM is a trial of contemporary technologies that unites various computer music technologies, surround sound and computer graphic generation all under the control of the performer. This is a large research project funded at a high level by the European Commission's 5th Framework Information, Societies and Technology Programme. It is a challenge for any institution to gain the support of the European Commission, given that they usually fund only very large scale projects. For a visual arts institution it would be an even greater challenge, given the distinct histories noted above.

Birmingham University hosts the Birmingham Electro Acoustic Sound Theatre. BEAST has developed what is arguably the worlds most advanced 3D sound diffusion system for use in both composed and improvised performance of electro-acoustic and electronic music. The BEAST system uses up to thirty channels of sound, separately amplified, each pair having characteristics which make them appropriate for a particular position or function. The performer can create an infinite number of possible sound images and sculpt the spatial, dynamic and dramatic implications of the music in particular concert environments. To develop such high performance and robust systems requires resources not commonly available in a typical art school, even at university level (although the examples of art and design departments gaining SRIF funding marks the beginning of movement in this direction).

The reasons why the visual arts and music have such different positions within UK academia, and therefore different histories, could be seen as originating in antique cultural tropes. The proposition here is that

music has historically been seen as an intellectual pursuit and visual art, originating in the guild based system of crafts and skills, as rather more concerned with the practical issues of "making". Whilst artists and the artisan traditions they worked within often had close relations with the church through numerous building commissions musicians, and especially composers, had an elevated position within liturgical society, creating and maintaining the musical traditions that underpinned much of the religious calendar. In this they were not too different to the architects who commissioned individual artists to detail their mega-structures.

Early universities, such as Oxford, Cambridge, Venice and Florence, were founded by or in close relation to the Church and music was, from the beginning, part of the remit of these institutions. The visual arts, on the other hand, with their close relationship to the guild system, found their educational niche in skills based and technical education. As these educational systems developed the disciplines of music and visual art built upon their respective traditions and thus we ultimately had, in the UK, the university and polytechnic distinctions dominating their place in education and, to some degree, their broader social status. Now, with the establishment of the new universities, this age-old distinction has begun to erode and art and music find themselves delivered, cap in hand, to the same funding agency, the AHRC.

INTERNATIONAL CONTEXT //

The situation in the USA might be of interest here as in the US educational system most art and music departments both traditionally exist within the university system. It would seem that, as in many things, the US has been less bound by the historical weight of institutions and thus the stratification with which we are so familiar in Europe is far less pronounced there. However, the situation can be shown to be not quite that simple.

Most of the older (Ivy League) universities in the USA do not feature fine art departments amongst their subject specialisms. Most such departments in the US university system exist within the State University sector. Whilst many of these universities are centres of excellence it is the case that the state sector in the US does not attract the same inscription of status as the Ivy League institutions and has a far smaller proportional share of research funding. Just as in the UK, where four institutions (Cambridge, Oxford, University College London and Imperial College) absorb the greater part of research funds, in the USA non-State sector universities, such as Ivy League institutions Harvard, Cornell, Brown, Princeton, Yale and Columbia and research universities such as MIT and Stanford, are the beneficiaries of most US research funds.

It is also the case that whereas most academic research in the UK is funded from educationally based funds, via the various research councils, in the US much state funding is channelled through the Pentagon or its related agencies and is complemented by a far higher proportion of corporate funding. This duality of funding, once described by President Eisenhower as the "military-industrial complex", has come to dominate the character of US research methods and outputs. Due to this much US research often has a military and/or industrial flavour and is usually target or output driven. Whereas in the UK the funding system still allows space for blue-sky non-target driven research in the US there are far greater pressures on researchers from their funding agencies, whether public or private, to deliver results that will be of direct benefit to either a defined market or defence requirement. As such, research as a form of play is not tolerated to quite the same degree as it is in the UK and Europe. This has significant implications for fine art research funding in the US and it is in areas such as this that European institutions have the cultural attitude and resources to out-perform their US colleagues.

However the situation in the UK is evolving. The funding councils continue to tighten their regulations and quality control systems which results in a greater requirement for researchers to demonstrate quantifiable value in the outputs of their work. This, allied with government driven targets, seems to be leading inexorably, as in so many other realms of public life, towards a situation not too distant from the US model but without the benefits the US enjoys (or suffers from, depending on one's point of view) of private and corporate patronage.

As always, the situation in continental Europe differs in a number of ways from that in the UK. Generally other European countries, and especially the larger economies of Germany and France, as well as certain other more Northern states such as the Netherlands and Finland, have been more generous in their overall funding for both education and the creative arts. However, aside from some high profile examples, the evolution of the status of art schools as centres of academic excellence and research activity has not occurred to the same extent as it has in the UK.

A key indicator, in this respect, is the number of research students working within the UK HE creative arts sector who have come to the UK from Europe (as well as from further a field, especially the far-East) having been unable to pursue the option of developing as an artist-researcher within their own academic environments. Few European countries are as yet offering artists and related professionals the option to pursue their practice and research within the formal structure of a PhD or other terminal research degree (the USA does have this option, in the form of the Master of Fine Arts, a terminal research based degree that most American artists are obliged to take if they wish to gain a Professorship in a US art school).

In some European countries the art education system still allows its artist/educators resources and facilities for their own practice which are very generous by UK standards. Some art schools reserve large studios for the exclusive use of senior artists/academics. In a sense this could be seen as another, perhaps more traditional, means, by which to encourage and sustain professional practice, and thus

research, amongst arts faculty whilst ensuring participation in the daily life of the institution.

As UK art schools have developed their research cultures the number of PhD places has rapidly increased to the point where we are now starting to see the formation of staff/student/project arrangements that quite closely resemble those to be found in the traditional research active subject areas of the physical and social sciences. This has also been the experience in a number of other English speaking nations which have evolved their education systems out of the UK model, notably Australia which has had significant success in attracting high-fee paying international students from Japan and emergent economies such as China and Malaysia.

Whether academic institutions in Europe will follow this trend remains to be seen. There are certainly moves in this direction within the Dutch education system and there are the notable examples of research centres such as the Zentrum fur Kunst und Medientechnologie (ZKM, Karlsruhe), University of Media Arts (KhM, Koln) and IVREA (near Milan).

Interaction Design Institute Ivrea (Interaction-Ivrea) is an independent non-profit organisation, founded by Telecom Italia and Olivetti, and now part of the Progetto Italia initiative of Telecom Italia. Based in Ivrea, it offers a two-year Masters Programme in Interaction Design for participants from all over the world with prior college degrees in design, architecture, communications, computer science or psychology. It is a research-led institute where students are expected to develop their projects within a research model but as yet it does not offer a formal PhD option. Due to current funding issues there seem to be some significant concerns regarding the future of IVREA, evidencing the potential volatility of joint state and commercially funded initiatives.

ZKM has a distinct identity in that it exists as a museum, a research centre and an education institute. It is almost unique in its formation and whilst it has had a high profile and central role in the development of the new media arts in Germany, and world-wide, its very uniqueness evidences the larger context in Germany where a creative arts education, unlike the UK, has changed form little in recent decades.

An institution that does represent something potentially more significant within German higher education is KhM Koln. This independent publicly funded university was founded during the early 1990's as a research-led centre and has established a reputation for the excellence of its courses and the quality of graduates. Notably, the institution is dedicated to education and research in the area of media art. Students are expected to develop their work as research projects, often within a collaborative and interdisciplinary model of experimentation and practice, and this has led to the emergence of a certain type of artist from this context which intriguingly shifts the potential social role of art. However, as elsewhere in Europe, students at KhM are as yet unable to pursue the more rigorous option of a practice-led PhD.

Thus the UK, along with Canada, Australia and New Zealand, has developed a form of research culture in the creative arts that rarely exists elsewhere and, pursuant to that, begins to see shifts in the practice of art and its social function.

Whilst the UK is closely associated with a number of other English speaking countries, and shares other traditions with them, it is part of Europe and shares in the complex and diverse funding agencies that are responsible for managing social spending within the EU. The primary source of funding for research in the EU is encompassed within the Fifth European Community Framework Programme covering Research, Technological Development and Demonstration activities, and the Fifth Euratom Framework Programme covering research and training activities in the nuclear sector (jointly known as Framework 5, or FP5, soon to be replaced by the FP6 Programme).

FP5 has a multi-theme structure, consisting of seven Specific Programmes, of which four are Thematic Programmes:

- Quality of Life and management of living resources (Quality of Life).
- User-friendly information society (IST).
- Competitive and sustainable growth (GROWTH).
- Energy, environment and sustainable development (EESD).

Three are Horizontal Programmes, which underpin and complement the Thematic Programmes by responding to common needs across all research areas:

- Confirming the international role of Community research (INCO 2).
- Promotion of innovation and encouragement of SME participation (Innovation/SMEs).
- Improving the human research potential and the socio-economic knowledge base (Improving).

Whilst the themes determine the areas within which funding is available the horizontal programmes function to prioritise and gauge proposals. FP5 is very much concerned with promoting European integration and addressing issues that arise from the specific European situation, such as the North/South divide or linguistic diversity. This often makes it seem distant to the actual interests and real needs of potential applicants. The inherent complexity of the funding system also contributes to this impression. In reality FP5 makes up a significant and increasing proportion of the research funding envelope in the UK.

One of the requirements for many submissions to FP5 is that the application is made by a group of bidders from a minimum number of EU states. Preference is often given to bids which include proposers from a mixture of countries reflecting a range of socio-economic circumstances. In this sense FP5 could be regarded as an example of social-engineering. This can lead to debate about the function of research and/or art. Where you stand in this argument will be a reflection of your politics and what you see as the social function and obligations of art and science.

An example of a current FP5 project involves research into Distributed Interactive Audio-Visual Virtual Reality Systems, expected to

complete in early 2007. The goal of this project is to create an open source Internet platform for multi-user, interactive, distributed, high-quality 3D graphics and audio for home, public and personal use. The platform will support high-quality 3D-graphics as well as high-quality 3D-audio and acoustic simulation. The lead organisation is the Kungliga Tekniska Hoegskolan of Stockholm and partner institutions include the Fraunhofer Institute of Munich, Germany (one of Europe's leading VR research centres) and highly respected universities such as the Helsinki University of Technology. Other partners come from Hungary and the Netherlands, again evidencing the importance of an EU wide approach to such research projects.

NEW RESEARCH CULTURES //

New avenues of research funding and new definitions of what might constitute research, as has been argued above, lead to the development of innovative research cultures and can foster further novel models of what research can be. Implicit within this is the idea that current research models, and the value systems they are constructed upon, are open to fundamental questioning. Due to this we are witnessing a period of change in both academic research and in professional artistic practice as a dynamic interchange evolves between the two.

The example of Wayne Macgregor, given above, is evidence of this, as is the ITEM project initiated by FACT. In the ITEM project we have artists, other creatives, academic and industrial researchers working together in various combinations on research projects whose outputs are not overtly pre-defined (as is also the case with the ACE/AHRC Fellowships, in contrast to the output led character of the Wellcome Trust Sci-Art programme) and which thus seem to offer the potential of longer term value to all those involved.

At first it might seem unusual that experimental artists, such as are involved in ITEM, have found themselves at the heart of such a culture of research, with all its associations and affiliations with institutions and organisations that would once have been seen as anathema to the practice of art. However, what many of these artists share is an involvement with new media, particularly digital tools, and as we have seen the computer and its affiliated technologies, such as the internet, has become a facilitating and even the determining technology of social action and particularly of research. It is therefore not so surprising that new media artists, as developers and interpreters of new technologies, often find themselves associated with this essential instrument of research and thus with those institutions associated with its development.

An explicit example of this can be found in the burgeoning online discourses around new media arts. Online resources such as CRUMB, Fibreculture and Nettime have come to function as the networks that bind a global community of new media artists, researchers and activists together. This is not one community but many, often very different, groups with often divergent interests and objectives. However, by its nature, this development can be seen to lead to combinations and recombination's from which emerge constantly new approaches to practice, criticism and new forms of output. Thus we see a technology employed to facilitate exchange and discourse becoming an active determinant in the form and value of the artwork that emerges from and is the subject of that discourse. That each of these online and offline technologically mediated communities, and many others like them, are run within or in association with academic institutions is also a directly relevant factor in this.

A major issue in all of this revolves around how the creative arts are assessed and measured in relation to research agendas and, ultimately, access to funded support. Clearly the assessment criteria and methods employed in the physical and social sciences are unlikely to be appropriate to the evaluation of the success, or otherwise, of a creative arts research project. What does the idea of success mean in the arts? In the sciences it is possible for a research project to deliver a negative result in relation to a hypothesis. A negative result is as valid a result as a positive one, even if unwelcome. If the arts are to be truly experimental then obviously failure has to always be an available option, but clearly failure in this sense means something quite different to a negative result in physics.

As yet the metrics, methods and criteria for assessment remain fluid and ill-defined. Progress is being made and it is interesting to see the AHRC liaising closely with ACE on a number of fronts, suggesting that the well developed models employed by ACE are being transferred, to some degree, to the academic sector. Nevertheless, the debate on all this remains open and volatile and it will be some time yet before the guidelines involved mature.

Whilst there has been significant change in the academic status and funding of the creative arts it is still the case that they are not given the same access to resources or the same academic status as traditional research subject areas, as can be seen from what is described above, although fundamental changes in how academic and research institutions are composed are leading to a realignment in research cultures and how they are funded such that the arts do now have the opportunity of a look in. It is not yet an equal footing, certainly in terms of funding, but it is a start on which there is now the imperative to build, or lose the momentum.

Recent legislation before the UK parliament, embedded within the Higher Education Funding bill (which included the contentious and headline grabbing proposal of student top-up fees), facilitated the changing of the Arts and Humanities Research Board into the Arts and Humanities Research Council. This minor change in the name of the AHRC represents a major shift in the obligations and authority of the body that oversees arts and humanities research in the UK and suggests the further accrual of value to creative arts research. Whilst it is clear that the new AHRC will be looking to the established funding Councils for funding models, as well as models for establishing the character

and value of methods and output standards, the Council will, by its structure, become more and more the product of the research communities it services (and vice versa). The creative arts, and the new media arts as part of that, will participate in that development and will causally effect funding strategies and priorities into the future.

CONCLUSION //

If one looks at how arts practice has developed in the UK over the past decade, especially in those arts practices, such as new media, which are distant from the traditional arts market place and thus have always been funding dependent, it is notable that much of it has moved away from the artists studio. This is possibly due to universities being able to offer environments where artists are supported to do the work they wish to do. The universities do this because there now exists a research infrastructure and the attendant funding which they are chasing. They bid for artists to join their research communities as, in the long run, the artists outputs will generate more income through the Research Assessment Exercise than they have cost the institution to employ. This also encourages departments to nurture the professional artistic careers of their younger faculty in the expectation that some of them will be successful and result, again, in enhanced research income. It is all down to economics. The impact of this on a significant number of artists careers has been profound.

Whilst it is true that this is a dynamic at work in shaping how and why artists are employed in institutions it is also true that art, and artists, are often regarded as somewhat dilettante and thus expendable within the larger considerations of academia. Seen as unattractive potential administrators artists in academia often find their career opportunities limited. It is also true that opportunities for career development, especially in respect of research in the new universities, is often seriously compromised as there is not the comprehension of the value of research, and its relationship to knowledge transfer, that there is in the old universities. Given that most art schools exist in the new universities we therefore see that many artists who work in such institutions are not as supported in their research careers (which to the artist is equivalent to their professional practice) as are researchers in more traditional research subjects.

Whilst imbalances continue to exist between the status and resourcing of the creative arts and that associated with conventional academic subject areas there will exist a need to establish a social context that sees research as valid in diverse areas of social engagement, whether the physical or social sciences, arts or other areas. Once that is established, and the political will to follow through the implications of such a social realignment embedded, then the resources will likely be made available, with the required consensus, and the research infrastructure required to achieve that goal attained. It will likely be a long process.

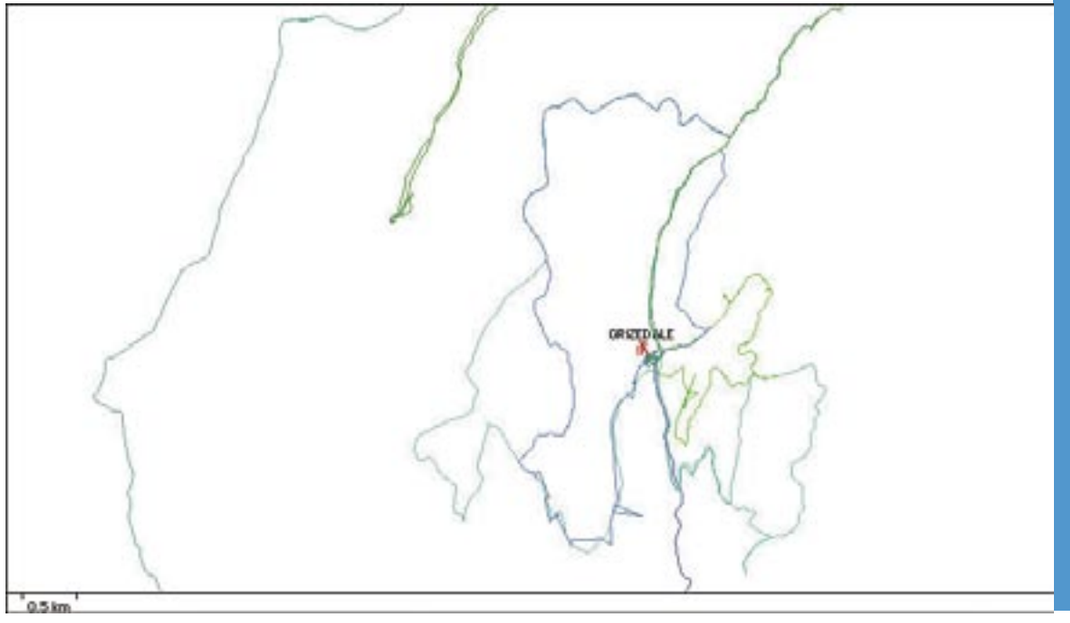
The UK experience has been uneven and difficult and, in many instances, still is. The key events were the creation of the new universities and the establishment of a competitive and more or less open framework for research funding. The first allowed art departments to have access to the same formal status as traditional university research areas. The second freed up the system such that these art departments could then bid for research funds which, until then, had been the preserve of traditional academic subjects. The foundation of the AHRC was central in this development.

Whilst it is generally recognised that there is an essential relationship between knowledge transfer and knowledge creation (teaching and research) the downside of recent developments is that UK academia now has to live within a more market driven and rather corporate notion of education. Higher education is no longer primarily about the creation of knowledge but about its transfer and, further to that, how this can be applied to generate added value (eg: profit) in the market place. The most recent developments (the creation of Foundation Degrees and the emergence of the next wave of non-research active universities) is evidence of this trend. This makes for an environment where certain ethics, many closely held in creative arts communities but also within other research oriented contexts, are seriously challenged.

A key event was the recent review of research funding, known as the Roberts Review. Initially, from the recommendations that emerged in 2002, it seemed that by the end of the current academic research cycle (2002-2007) things were going to be profoundly different and possibly not at all good news for arts practice based research models. Now though, as the recommendations have been fed through various consultative layers, they have become so watered down that it is clear there will not be any radical change in how things have been done. There is still a lack of clarity around Unit 63 (previously Unit 64) of assessment (Art and Design) and related creative arts research areas, and there are some stirrings that might suggest a less benevolent funding regime in these areas come 2008. What is clear though is that Unit 63 will continue to exist, at least in this cycle, in its current form and thus arts departments will still be playing the same game (although in a minor league) as the traditional research led departments. What is also clear is that for the foreseeable future academic research funding will continue to grow whilst the traditional funds available through direct arts funding (Arts Councils, etc) will remain, at best, static. Thus we can assume the continued evolution in how art is practiced in the UK that we have seen over the past decade and, central to that, the further enhancement of art based research, with all the implications that carries for how art is practiced and received.

Landline: a multi-user web-based drawing tool for GPS enabled mobile phones

Jen Hamilton,
Jen Southern and
Jon Wetherall



Jen Hamilton is an artist based in Saskatchewan, Canada. Her studio research investigates the connections and conflicts between sets of relations and kinesthetic experience. In 1992 she became an Associate of the Ontario College of Art and Design in Sculpture/ Installation, and received the Sir Edmund Walker scholarship to continue graduate studies at Concordia University in Montreal. Hamilton completed her M.F.A. in Open Media in 1996. Since 1997 she has taught sculpture, drawing and Intermedia at the University of Regina. She is a founding member of the art and science collective Petri's Quadrille. Her works have been exhibited throughout Canada and the UK.

Jen Southern is an artist based in Huddersfield, UK. Her process-based collaborative practice investigates everyday journeys between virtual and physical spaces, which are navigated through socially embedded technologies such as video games and mobile phones. Working collaboratively is integral to a practice that is rooted in social processes and a relationship to local environment. Jen has also gained her pilots license in order to investigate the nature of learning in physical and virtual spaces. Jen is a member of Base, a Huddersfield based group comprising technologists, producers, artists and academics who are researching mobile and locative media. She is a senior lecturer in Multimedia Design at the University of Huddersfield. Her work has been exhibited internationally in public spaces, galleries and festivals

Jon Wetherall is principal technologist at Onteca where he has worked at the intersection of Arts, Technology and Training. Recently Jon worked on *Another Green World*, a collaboration between disabled artists and computer game developers funded by the Arts Council and the *Game Plan* at Media Training North West. Jon was one of the founders of the award winning International Centre for Digital Content in Liverpool where he developed the first Digital Games Masters programme in the UK. His experience as a senior computer game programmer at Sony taught him that the most interesting work occurs when artists and technologists collaborate. Jon is committed to connecting content and experience through the application of new wireless technologies.

PROJECT DIARY

JANUARY 2004 //

First development meeting at Onteca, Liverpool, to choose platforms and to structure research. Currently we have no access to GPS enabled phones, despite industry estimates. This is disappointing because accessibility was a priority for us, but this is maybe inevitable. Initially we will use a Bluetooth GPS and series 60 phone, later we might use cell location data as an alternative. The web interface will be in either Macromedia Director or Flash (rather than Java) enabling the artists to be involved in the visual part of production. Despite the need for IP contracts we were able to confirm that all participants want the project to be Open Source. Looked at the emerging 'locative technologies' network. (www.locative.net)

FEBRUARY 2004 //

There is uneasiness about the potential negative usage of location data on personal devices. How can we prevent others abusing our system by using it to track users ?. Tracking is implicit in developing the ability to dynamically broadcast individual location data. We have to give each route a unique ID number so that they remain distinct, but we don't want to allow anyone else access to the identification information of individual users. This raised questions as to whether we should offer the code as Open Source. We are more interested in how you might

use the GPS as a reflective tool: to make travelling into drawing, to map social boundaries and personal spaces, to use GPS as a way of getting lost, or to map the city as a series of events and trajectories as much as a series of structures or buildings.

MARCH 2004 //

Bought a small Bluetooth GPS device. The data available conforms to NMEA 0183, a standard laid down for ship navigation. Initially we are developing an application to access data from the Bluetooth GPS and a separate application to draw the data as a line to the screen of the mobile phone. As Bluetooth isn't supported in Java on phones that are currently widely available, we will have to use Symbian, which is a really different programming environment to those Jon has used previously. Learning Symbian is very time consuming because there is little documentation and few similar applications. Debugging this project is also a lengthy and difficult process. Although initial testing can be emulated on a PC, the Bluetooth testing has to be done on a mobile phone, and the GPS has to be taken outside for a walk.

Also planning our upcoming residency at Grizedale Arts. (www.grizedale.org.uk) There is very little network coverage for mobiles in Grizedale Forest and the GPS signal is unreliable under dense trees. It will be interesting to see how these gaps can be used creatively in the project. We began to discuss the potential of GPS and Bluetooth in gaming e.g. orienteering strategy if you could steal route data from other players via Bluetooth. **LATER IN MARCH 2004 //** Now discovered that Bluetooth is newly supported in Java on the new Nokia 6600 we've just bought, but we'll continue with Symbian as it gives easier access to the phone's capabilities in the long term. Still no phones that allow access to GPS data. There are now also phones that support Flash which means we might be able to use it for visualisation on that end too.

APRIL 2004 //

Spent a week working at Grizedale, researching the environment and how our GPS devices and phones work within it. Jen Hamilton is over from Canada so the whole team is present. Meeting in this location gives us the chance to think about the users of our technology and the impact of a specific location. The Lake District is perfect for this with its history of recreational walking from Wordsworth and Ruskin to the walkers and tourists of today with their high-tech clothing and equipment. We brainstormed the potential of using GPS, Bluetooth and GPRS on phones in this environment, devising recreational and creative ways to use the system. We found discussing the conceptual side of the project with our technologist really useful, and came across mathematical ways to think about the same territory. In light of our extensive discussions we needed to redefine our aims for the project, to shelve some of the opportunities and focus on an achievable goal, to make "A

Multi-user Drawing Application which draws from two phones to a remote web site." **LATER IN APRIL 2004 //** Testing in Huddersfield with the whole team. Both modules are working on Jon's phone & GPS, so we wandered around the streets testing and making lines at last! It didn't work on one phone because the new GPS unit uses a subtly different syntax.

MAY 2004 //

A team away day to the Futuresonic Festival in Manchester (www.futuresonic.com). New perspectives are opened up when we meet other people and see their work with locative media. There are technical standards being developed for interchange of information and we should aim to work with them to enable possible future collaborations.

JUNE 2004 //

Slow progress as we're all working for other deadlines. The nature of freelance working means that for artists and technologists alike having spent a month on this project we needed to catch up with other work.

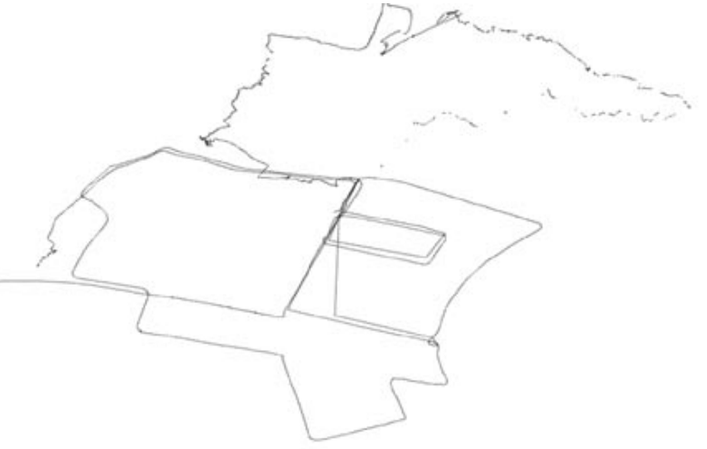
JULY 2004 //

The drawing application is now working on both phones. We did some testing which went really well, but the aspect ratio is still wrong so drawings looked weird, but still, it worked!

AUGUST 2004 //

Made great progress, we have the whole thing working on the emulator, but need to check the data and put it all together live. We have an example of the data that is sent to the server, so we can begin to develop the Flash application. We need to have a database on the server, it's the richest way to manage the information, it's flexible and there is greater potential for growth in the future. Now using xml syntax – as recommended by the locative media group – and have some files of test walks. This is probably how we will represent the data at the server end as well. There are a couple more bugs to fix and then we can test a new version. Continuing to learn Flash and develop the application to visualise the GPS data from the server. Its good that we decided to use xml as Flash handles it really easily. **MID-AUGUST 2004 //** Now that we have a version of the whole system working we had a progress meeting at Onteca. The next step is to make the process dynamic rather than modular. Dan Davies of Onteca has joined us to work on the server database. We need server space so we registered www.geodetic.co.uk. We decided to add fields in the database for other data which could then be used to modify the visualisation in Flash, such as an rss weather feed relative to the location. We began to consider the interface and user experience.

On both the phone and in Flash we've had trouble deciding how to scale the image to screen size. The start points of each line will be at the same point on screen, so drawings from distant locations will be overlaid. This also means that we are using relative data rather than specific geographic locations, which helps to address the issue of tracking. In this version we are only aiming to allow two collaborating artists to see each other's drawings on their phone screens. Several people will be able to draw at once to the web, but it is more problematic technically, visually and ethically, if they can all see each other's drawings appear on their phone screens.



LATE-AUGUST 2004 //

More progress on the Flash application, drawing two separate GPS routes and allowing a user to change opacity, line width, colour and scale of the lines. Finishing versions for the ITEM Awayday at Grizedale and got the Flash application working with data from the phone both via Bluetooth onto the PC, and from the server.

SEPTEMBER 2004 //

Using two GPS & phone combinations Jen S. and Jen H. tested the applications at Grizedale. We decided that as we had no reliable internet connection, or reliable phone network at Grizedale we would use the old version and transfer data via Bluetooth to a PC for this demo. Feedback from other ITEM groups was very useful, even though testing at such an early stage was risky. We discussed the aesthetics of walking: how might patterns of walking change if you think of them as an aesthetic pursuit? Do different people, countries, landscapes and cityscapes have different aesthetics of walking? This helped us to see that the way a line is drawn is perhaps more expressive in itself than we had thought, and of course the user experience of drawing the line is also part of the work.

Further research on the data visualisation for the Flash application, we've been thinking of the drawings as lines, but of course they are actually a series of points. More technical progress but not ready for testing with live data. There is a massive problem in getting WAP working, there are no working examples in the Symbian code, or on the internet. And there's lots of debugging. Nothing to see at the moment because this is where all the modules get joined together. It might have been more involved process at this point if we could all have worked together in the same location for a month, but scheduling was impossible.

We're getting quite close to finishing this first stage of the project; so it would be exciting to test it in the UK and Canada within the project time.

OCTOBER 2004 //

Finally cracked the WAP stuff. We pulled the data capture application into the same program as the drawing and the user interface. There is still a big problem in emulating with remote debugging. Symbian is good but "alien", and its been a big long horrible learning curve.

NOVEMBER 2004 //

Spent a day at Onteca testing and sadly discussing where to stop the project. Our application will only be a demo for our use as it will be too fragile to use in an exhibition as yet. It has been interesting for Jen S. to work alongside Jon and Dan, seeing their collaborative problem solving as they programmed.

There are still problems with one phone, getting GPRS to work and find its ID number, but uploading to server is mostly working.

FEBRUARY 2005 //

Worked with Adam Hoyle to produce a new Flash interface that loads multiple journeys, and has a more drawn quality to the line.

Presented the project at: PLAN (Pervasive and Locative Arts Network) at the ICA, London; Transmediale, Berlin, Germany; Digital Research Unit, The Media Centre, Huddersfield.

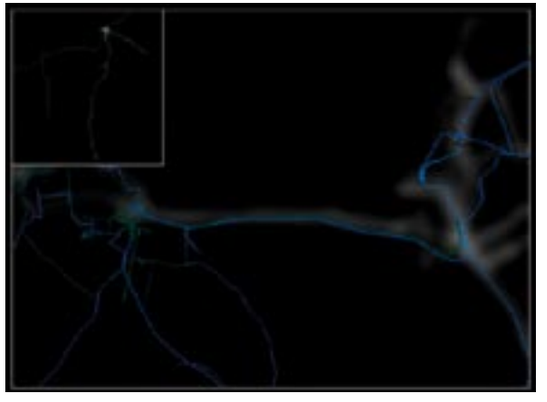
MARCH 2005 //

Satellite Bureau, a related work, is shown at Neutral Ground Gallery, Regina, Canada. Focus on the hollowing out of the city centre and the growth of mall culture, through mapping of every mall car park.

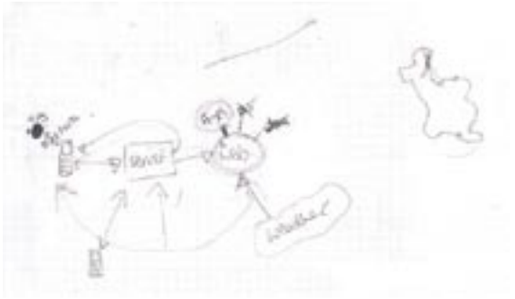
OCTOBER 2005 //

Satellie Bureau: Ebb & Flow, is shown at 'May You Live in Interesting Times', Cardiff. http://www.satellitebureau.net

Our application for funding to the Arts Council of England, Yorkshire has been successful. We will rewrite the application in Java which in the end was a better approach. The application will be used in several exhibitions in 2006 where it will be robust and flexible enough to be used by the public. It will also allow people to make collaborative drawings between different countries. Although it has taken three years since the decision to start this project, and other versions of this device have been made elsewhere, we still have not seen anyone working on making collaborative drawings between phones. We now hope to really start exploring what we can do with now that we can fully use it.



REVIEW



The development of this application supports previous work by Hamilton and Southern in the field of social interaction and GPS drawing within their artwork. This work has been developed through a motivation to include social groups in the production of their work and also through a wish to engage more closely with location through active collaboration with an audience.

In 2003 Hamilton and Southern had become frustrated with the lack of tools that might facilitate a live GPS drawing made by a group to be transmitted to a publicly available forum. All GPS drawings made in this way were essentially static by the time they were exhibited, in contrast to the dynamic process of making the journeys. Jon Wetherall of the Liverpool company Onteca had been working with mobile gaming design, but within an unstable games market had been unable to prioritise speculative research into mobile multi-user locative games.

This research project set out to build an on-line multi-user collaborative drawing tool for GPS enabled mobile phones, in which users create drawings by moving in real space. This tool would be used in exhibitions in which the audience participates and contributes to the evolving installation. It will therefore simultaneously be a tool for creation as well as an exhibition tool for multi-user art in which the artist collaborates with a wider social group, addressing some of the problematics of working with process based social practice.

GPS (Global Positioning System) devices use satellites to pinpoint the latitude, longitude and altitude of the device on the surface of the earth. When a series of these pinpoint measurements are recorded (like breadcrumbs dropped during a journey), a line can be drawn representing the path travelled by the person or vehicle using the GPS device. There are two common methods of GPS drawing: co-incidental drawing – in which you merely see what your path looks like, as a snail leaves its trail behind it; and purposeful drawing – when you set out to draw a pre-determined image by walking, driving or flying a particular path. When tracking the locations visited during regular activities we begin to build up maps of sociological interest, seeing which locations are used most and in what order places are visited. However when the GPS is used to purposefully make specific drawings the drawer sees the city in a new way, akin to Situationist walking practices. When these two methods are combined we can begin to see where individuals have stepped outside of everyday routines and are using the geography of their surroundings for less orthodox pursuits.

To date anyone wishing to participate in GPS drawing has required a specific, often expensive, device whereas this project is intended for a new generation of GPS-enabled phones that the industry 'helpfully' predicted would be on the market 'soon'.

LOST AND FOUND IN GRIZEDALE FOREST //

An early residency at Grizedale Arts in Cumbria helped to shape the project and establish a collaborative style. It was useful to initially explore the wider potential of mobile multi-user locative technologies in order to see whether the original goals of the research were appropriate. The whole team were taken out of their usual working situations and met in a location specifically focused on walking and outdoors pursuits. This helped to establish in a more concentrated way an understanding of a

place in which the system might be used. It also stimulated discussion and significantly aided the conceptual development of the project.

Using a GPS system with a camera-phone enabled for Bluetooth and WAP in this location afforded many exciting and exploratory ideas. The ability to send, receive, share, steal and collect information in the form of locations, images, narratives, texts and routes, in addition to the usual voice calls was investigated. Information delivery could be triggered by specific locations, and changing data about latitude, longitude, altitude, time and date had the potential to control a wide variety of content including audio pitch, narrative feed and interaction. The team explored interaction with the landscape through goal seeking, collecting, and testing self against environment – the kind of experience familiar to walkers who regularly climb the mountains of the region. Discussion of the system to be developed from both technical and artistic points of view revealed its potential for both gaming and conceptual exploration of environment, walking, drawing and place. It was important to the collaborative and social nature of the project that the insight of both the artists and the technologists were applied to the conceptual and technical discussion.

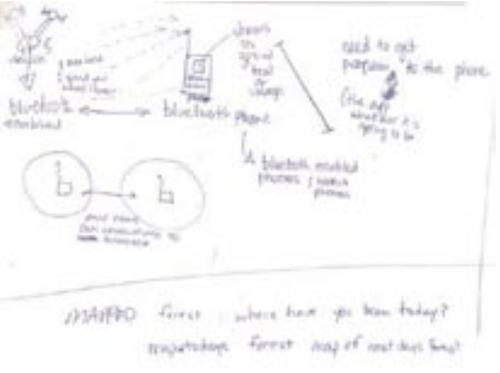
At Grizedale the team became interested in the different roles played out in the forest including issues of tourism, economics, privacy, ownership (forestry), place, industrial site, and consumption. They also had an ongoing interest in getting lost. The forest is an industrial landscape that is worked by Forest Rangers, Farmers, shop and café workers and GPS is already used in that environment, so contact was made with a shop selling walking gear including GPS devices. A specialist suggested that many people buy a GPS in order that it will prevent them from getting lost – despite the fact that they cannot read a map, and have no experience of hill walking and its dangers. The Mountain Rescue Team however use GPS to find walkers, many of whom get lost or injured because they are not properly prepared for mountain walking and weather. The promise of GPS to tell you where you are and to prevent you from becoming lost is only partially borne out, and in this situation tracking people can be useful.

In a previous project 'Distance Made Good' (2002) the artists had collaborated from distant twin towns, in order to explore cultural difference through geographical distance. On the 9th June 2002 Jen Hamilton visited 5 'waypoints' in Stratford Ontario and on the same day Jen Southern went to the same 5 'waypoints' but in Stratford-upon-Avon, UK. These waypoints were a river Avon, an exhibition space called 'The Gallery', a station, a Shakespeare The gs. The topology of these two routes can be seen as mathematically equal. If a path A-B-C-D-E is travelled in two different places it is essentially the same path, whilst on the ground of course the experiences are different.

It was here that the potential of international collaboration was reinforced in the project brief. Linking Grizedale with another real location would enable users to virtually swap features of the two landscapes, exchange their routes and make hybrid drawings.

COLLABORATIVE PATIENCE //

In an otherwise easy working relationship between the artists and the technologists there were times where the process was somewhat dislocated and slow, with periods of productive collaboration and times where individual development was more appropriate. The most collaborative aspect of the project happened in the area of problem solving and brain-storming, particularly when working at Grizedale. As the research into the technology developed there were decisions and choices to be made which had a big impact on the creative development and vice versa. But once a project specification had been devised – albeit through many experimental stages – the bulk of the programming work finally had to be done. For the artists this stage was frustrating as they could no longer focus on the reflective process but had to hand the project over to Jon to develop technical solutions. At this stage much of the work went on 'under the bonnet' – and whilst it was encouraging to know that different parts were developing, it was a bit like being told by a car mechanic that 'the carburettor is working properly' – it helps to know that it's working, but you can't yet start learning to drive, or set off on a journey!



DYNAMIC MULTI-USERS //

Up until the point at which this research was undertaken, GPS device data could be downloaded after a journey had finished. This research developed an application to collect the data dynamically and draw it in real time to a web site. Data from many journeys could now be combined in one web-based drawing, creating a separate on-line space composed of these journeys.

The application enabled this by linking a mobile phone with a separate Bluetooth-enabled GPS device and drawing a line representing the location data to the phone screen. This information is then dynamically relayed to a remote server via the WAP functionality of the mobile phone. Information can also be requested from the server by a phone using the system. If the user accesses live information from a different city or country they can make collaborative drawings or navigate via

the routes and decisions made by a distant audience, allowing them to see their city anew, and be connected to the spatial experience of another place and another individual.

Another aim was to devise a way to combine and display these geographically distant drawings on the small screen of the mobile phone, and to keep users anonymous in order to prevent the system from being abused by others who might be tracking users. To solve both problems, all drawings were designed to start at the same point on the mobile phone screen, therefore only using relative data, rather than geographically fixed location data. This also fixed a problem with scaling the drawings to screen size if the smaller numbers of relative positioning are used. This solution will have a very different impact on two distant collaborators than it would for an exhibition audience who might all be starting drawings from a gallery. A local community could use the system to collectively map significant journeys and events, whilst Hamilton and Southern in Canada and the UK could use the system to collaboratively explore spatial and kinaesthetic practice at a distance. This will be further developed according to individual projects and locations, perhaps allowing collaborators to choose a specific point to join each others routes.

The user interface has been kept as simple as possible, allowing users to make multiple drawings simply by using new route names. The only other input needed would be to control the relative scale of the drawing, so that collaborators can draw within the same screen even if one journey was longer than another. Logging off occurs when a simple 'end drawing' menu command is selected.

The information saved to the server is also visualised live in Flash on a website. This flash application allows the viewer to see drawings appear live as they are produced, but also to modify the line qualities, such as colour, opacity, scale etc. The speed of travel is expressed in variations of line thickness. Future versions of the application will include use of rss feeds such as tide and weather, and incorporate images and text sent from the phone.

'Walking in the City', by the writer Michel de Certeau, influenced the development of this aspect of the project. De Certeau claims that the experience of walking is different to seeing a place from above. Although the GPS line is a plan view it is different from a map as it traces individual tracks of journeys and events rather than structures and buildings. Other information was researched to add qualities of the embodied experience of place and location to the visualised line. Other data such as altitude, time, date, and a number of rss data feeds (such as live weather data) can be added to the database and used to modify drawings as they are made.

At Grizedale we had become intrigued both by loss of signal and the experience of being lost. When programming the database any signal loss was detected using differences between the time at which GPS data is collected and the time at which it is received by the server, thus mapping any areas where data could not be sent due to lack of network coverage. The drawn line can then be altered to map areas that are remote from connectivity. These two aspects will be developed further in more sophisticated visualisations of the research.

FUTURE DIRECTIONS//

The project website will become a place where the final application can be downloaded and used. The resources collected during the project (particularly for using Symbian) will be shared as a 'tool kit' on the website. The team are still discussing whether to offer the code as Open Source. As there is currently no open source code available for dealing with the WAP aspect of the project it would be of great benefit to the artistic community, but it would also be of benefit to the mobile developers who may be Onteca's direct competitors for future work.

Technical development has been much more time-consuming than expected, mostly because of using Symbian and co-ordinating a high number different elements; the mobile phone, the GPS, drawing to screen, Bluetooth, WAP, web server, database and Flash applications. Although all aims have been fulfilled, the system is only at a beta stage and is still too fragile for groups of users and public exhibition. However, an exciting outcome of this research is that this core of programming is a strong foundation for a diverse range of mobile projects. It can be easily adapted and opens up many further possibilities – such as sending images that are tagged with location data. The next aim is to make it stable enough for exhibition and to develop it further for specific projects and locations.

During this project the team have built a good working relationship which has been mutually beneficial. They intend to continue working together on this and other projects, evolving technologies to exhibit process-based socially inclusive art works, and possibly explore the commercial potential of these technologies in mobile, location based applications and games.

Mathias Fuchs and
Wibke Hott with
Darkhorse Venture
and **BTexact**

Virtually FACTicious: new media – old memories

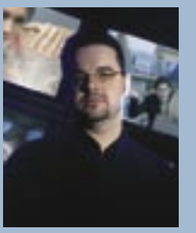
Mathias Fuchs
Studies in computer science and electronic music triggered my interest for electronic arts. I worked with different media, setting up installations at museums, festivals and in public space (ISEA, ars electronica, EAST, Millennium Dome, resfest05). Former activities as a Research Fellow at Electronic Music Studios in Stockholm, lecturer at the University of Applied Arts in Vienna, the University of Music and the University of Design and Art in Linz, Guest professor at Sibelius Academy Helsinki. My main focus is the design of ludic spaces. I am interested in game engines as artistic tools and in games as platforms for social discourse.

I have been collaborating with different artists in this field; recent collaborations include 'PlastiCity' (Bradford) with Steve Manthorp and Vera Schlusmans, 'postvinyl' (Vancouver) with Michelle Jay and 'Uncanny' (Pittburgh) with Paul Sermon, Andrea Zapp and Steve Dixon. I am programme leader of MA Creative Technology and of MSc Creative Games at Salford University, Manchester.

Wibke Hott
I am passionate about creativity; I believe it is one of the most important energies in our life because it makes us learn and grow without any conscious effort. Everything we do with a passion is creativity, be it dancing, singing, drawing or acting but also less acknowledged forms of creativity, which include amongst others working with bricks, numbers, people or books. It is a means of expression, communicating our inner most ideas, desires and thoughts and thus helping us to develop by seeing ourselves reflected in the world around us, turning a monologue into an exchange, a participation, a collaboration.

My interest in people's personal development and how we relate to each other is reflected throughout my work, research and studies. In my work for FACT I have a strong focus on cross-disciplinary collaborations between arts and industry, as community artist I am engaging people in creative processes through music and creative technology and in my studies I am currently reading person-centred Counselling at John Moores University.

Kelvin Ward and Umran Ali
– 3D modellers Kelvin and Umran both graduated from Salford University in 2003 with degrees in Computer & Video Games and Creative Technology. As freelance designers and 3D artists they have been collaborating with Mathias Fuchs on PlastiCity, a multiplayer urban planner game, reshaping Bradford City centre. Kelvin is currently working as demonstrator, Umran as lecturer at the University of Salford, Manchester.



Rod Martin
Rod's first involvement with the city's art and culture scene was through creating nightclub visuals, which quickly progressed into 3D animation to create interesting experimental club visuals for Cream. He collaborated with other artists in live art performances under the banner of 'Visual Stress', commemorating the African slave trade legacy that built the city. Recent projects include programming a mobile phone events alert service for A Foundation for Liverpool Biennial 2004 and programming for 'Pussy Weevil', Marina Zurkow's collaborative project with Julian Bleecker exhibited at FACT 2004. Rod is currently freelancing as web designer and publisher, programmer and IT consultant.

BT Exact – Daniel Ballin is a Creative Technologist in the Radical Multimedia Lab, at BTexact Technologies, where he has filed several patents in the area of digital media, and agent technologies. He graduated with an honours degree in electronic engineering in 1996. After working for the ABB group in Sweden he returned to England to pursue a doctorate in the field of embodied agents in virtual environments. He has published and lectured widely and is Executive Editor for the Journal of Virtual Reality.

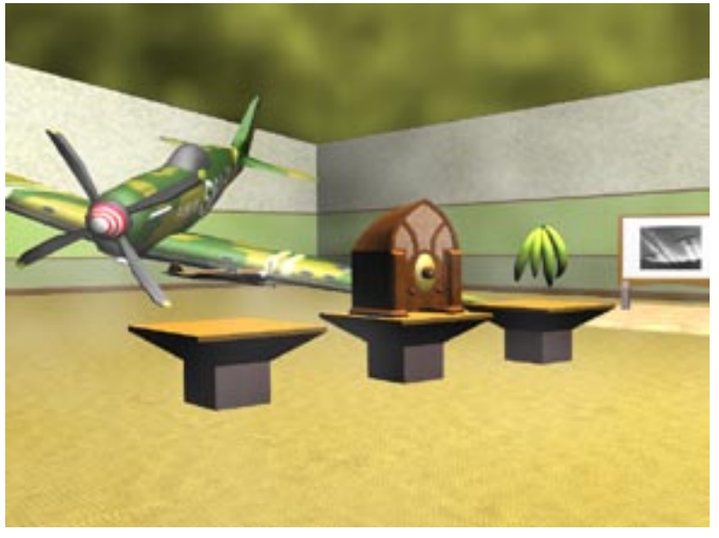
PROJECT DIARY

The initial idea for Virtually FACTicous came through a previous collaboration between FACT and the Darkhorse Venture as part of Common Channel, a community-led webcasting channel. A group of Venturers has been working with Wibke Hott on a live webcast and expressed their enthusiasm for creative technology.

"webcasting is just the beginning! I want to send a 3D holographic image of myself to people to communicate with them" Norman,(aged 58)

At the time we believed that the closest we could get to communicate through a holographic image was to create a virtual reality space that would be populated by avatars. Mathias Fuchs, a Manchester based multimedia artist with a fantastic track record in creating artistic games joined the project as lead artist and together with technology partner BT Exact and their rendering engine TARA we started to develop a concept for the creation of a virtual environment that would begin to explore how to fulfil the aspirations of the Darkhorse Venturers.

At our first workshop in October 2003 we met five members of the Darkhorse Venture: Mary Thomas (founder of the Darkhorse Venture), Ada Wilcocks, Grace Lloyds and Daphne and Richie Dabbs. In order to help them understand what the project was about and to introduce them gently into the world of virtual realities we played a few computer games with them: SIMS – a real life simulation of social interactions, Ottomatic – a robot tries to rescue humans from being abducted by aliens, and Moorhen Hunt – a 90 second shootup game. Even though this was the group's first encounter with computer games and virtual reality applications, they rapidly engaged with the technology.



Mary Thomas recalls the first workshop:

"The day we had to play the computer games was the day I thought 'What am I doing here?!!' I've never used a computer and as for controlling the mouse...! Ada was sitting with me and she had some experience with a computer, thankfully. The game presented to me involved shooting moorhens. I like moorhens, so shooting them was not very funny! Anyway, we got started. The worst worry was the mouse. Where is the cursor? [...] On occasions when the cursor was in the right place I actually shot the poor little moorhens. I thought I got quite good at it thought I must say I did become overexcited, almost screaming with laughter and sweating profusely! Some weeks later when it was my turn to scan in the photographs concerning my life I was much more confident, especially with the mouse and the cursor, which actually went and stayed where I wanted it to be! Much more advanced than games, it was great fun."

Mary did enjoy herself very much indeed during this first session. Her initial hesitance towards the game's objectives, shooting moorhens, soon gave way for feverish shouts "Shoot! SHOOT!!!" when her co-player missed the target. After a few games Mary and Ada became a good team, one of them pointing out where the cursor was at any given time and reloading the weapon, the other one aiming and shooting. When we later confronted Mary about her sudden change of mind, she thought about it for a moment and said: "Well, the shooting is not real. It's just a game." And with regards to the cruel killing of innocent birds "I know what this is! It's harmless violence!"

Over a series of workshops we presented commercial and artists' applications for virtual representations of knowledge and discussed the possibilities and constraints of those applications with the Darkhorse Venture group. A research visit to BT Exact in Ipswich helped shaping the initial idea for a 3D environment, which would contain the rich body of memories, fantasies and images the Darkhorse members held in their minds and in the drawers and cupboards of their homes.

Ada Wilcocks recalls her visits to BT Exact in Ipswich:

"Part of the project meant trips to Ipswich and I was the one that went both times. [...] Dan Ballin was the BT representative who met us and took us to his office. Dan is a programmer in charge of other programmers there and it was he who was meant to listen to Wibke and Mathias' ideas and put them into a context whereby he could give advice on how it could be worked on with help from him and his expertise. [...]

On the second visit things were a little easier and he brought a colleague into the group who was most helpful and friendly. This was BT programmer James Bulman. [...]

I am not in any way an expert in all that is involved in this project but Dan did say at one point that I should ask questions if things were too technical for me. to follow. [...]

I think I was the oldest person they had seen there. For me personally it was something from another planet, well almost. [...]"

Together with BT Exact and their rendering engine TARA we hoped to be able to develop a virtual environment, one which would contain precious memories and moments of each of the Venturers' lives in the form of images, text and sounds. Much discussion was given over to the metaphorical structures that might best serve to illustrate and contain these artefacts of peoples live. The final architectural structure of this environment was finally determined as a suite of rooms representing the decades of past history. A walk through these rooms would aim to unveil sights and sounds from each of their lives. The structure of the rooms, the size and the lighting would catch the subjective feeling of each of the participants' lives at that point in time. The metaphor we tried to use for an implementation of the spatial structure of the 3D environment was "the ups and downs of a person's life". We wanted to implement ascending and descending slopes in between the decade rooms to represent increases and decreases in subjective well-being. The quality of life in each of the decades from the 1930ies on would turn into an architectonic feature of the rooms containing the memories of these decades.

Mary, Ada, Grace, Daphne and Richie collected stories and memories for each decade they lived in and found images and objects to further illustrate their stories. Over a period of several months we met regularly at FACT, listening to each other's memories of life in the '30s, '40s, '50s, '60s, '70s, '80s, 90's and the new millennium, hearing

about the highs and lows and made editorial decisions which stories to include and which to leave out. Each Venturer had eight rooms to fill with images, objects and stories.

During the process of collecting the images we encountered the dilemma that certain items and thoughts were much easier to be shared than others. Some of the objects and memories were kept close and only communicated reluctantly. However we sought to arrive at a point where we were provided with personal objects and viewpoints that would extend beyond the common clichés of historical imagery and offer up a more personal and ambiguous space that might represent the individual histories of these people. At this stage we were very conscious of how iconic these objects and images might become, as if we were seeking to create a template for a massive museum of personal, ordinary artefacts, each with immense significance, but explorable through the lightweight tools of virtual space.

Richie Dabbs recalls the collection of memories:

"Providing pictures etc. to go with stories opened up many other memories. This often entailed going through boxes that had been forgotten about for years and instead of taking a short time resulted in hours of reminiscing. It was surprising to find that photos we didn't find interesting were suddenly meaningful. After learning how to scan them, that lead to the inclusion of objects relevant to the subject. Very often this reminded us of smells and sometimes smells lead up to pictures."

In order to design and implement the technical structure for each of the rooms, the Venturers had to decide how to rate a decade in comparison to the previous one.

Unsurprisingly this was a difficult process and the decisions were very subjective. It grew to be very complicated to agree on a grade to describe the decades as, for example, miserable, neutral, fair or wonderful.

Although a decade like the 1940s was overshadowed through political events and war, an individual's perception of this decade, a child then, might have been very positive and bright.

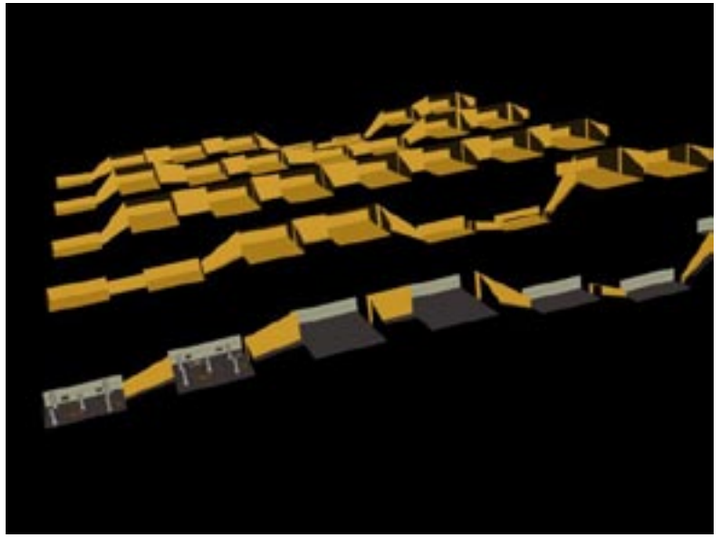
Grace Lloyds recalls the rating of the decades:

"One of the aspects required of this project was to grade our decades into those that had been the happiest and those that had been less so. The classification was from +3 to -3. As most lives do not run on a straight line this proved most interesting and made for deeper reflection on our past experiences from the point of view of overall happiness. The experiences in some decades appeared to be all on a fairly even plain while in others you can experience great roller coaster ups and downs which makes it very difficult to assess. In the end I think it possibly boils down to a personal general approach to life and whether our glass is half full or half empty."

When we compared the five lifelines, we realised that there was an interesting difference between Mary's lifeline and those of the rest of the group. Ada, Grace, Daphne and Richie all lost their partners in the late 70s/early 80s and the resulting hurt and pain was reflected in their lifelines which leapt up and down the scale. However, Mary never got married and although there have been significant ups and downs in her life, she never experienced the loss of a partner and therefore rated her decades highly throughout.

We spent about 2 months on digitising the material and one by one the Venturers came to FACT to use the Medialab and resource archive to learn how to scan images and type out their stories. We also recorded the Darkhorse Venturers telling their stories to use the video and audio as additional exponents in the virtual environment.

At this stage of the project we introduced two 3D modellers – Kelvin Ward and Umran Ali – to help us realise the creation of the virtual environment. Together with the group we talked about the interior design of the rooms for each decade. Wallpaper samples for anaglypta



and woodchip, dado rails and lino floor tiles, images of milk churns, gas lamps and many other items as per description by the group were sought out through the internet and incorporated into the rooms. When the Darkhorse Venturers saw the first draft of the decorated rooms interesting discussions arose about the social-political context of each decade and the varying personal circumstances that placed the Venturers in them.

Daphne Dabbs recalls the discussions and reflections:

"I've felt that [this] project has been excellent for it shows how everyone has different views on the subjects we've been discussing. I feel that it has broadened my mind in knowing how people can get together in a project. [...] The amazing thing is when we get down to a subject we all contribute in our own field of thoughts and senses all come together in mind and thoughts. I feel that the programme that we're doing will be of great benefit to those who'll be watching it, showing how times were in days gone by. How hard it was without all the benefits that people can lay their hands on today."

Despite their very different lives many events, memories and objects are shared by all members of the group and therefore represented in each lifeline. The Queen's jubilee, the role of the 'wireless' – and their joining of the Darkhorse Venture all featured across lifelines. Shared memories also emerged as connections between the Venturers' lives bridged their lifelines. This became represented through transfer points in the virtual environment, allowing players to switch from one lifeline to another, joining the new life at the moment when the memory was shared.

Throughout the project we needed to accept that there would probably remain a gap between understanding the practical tasks that the Darkhorse Venturers have been through and the theoretic description of these tasks. We found it useful to break down terms like 'virtual environment', 'avatars' and 'digitising' and establish a new glossary in which Virtual Environment is described as a computer-based copy of a real or imagined environment, an avatar is a computer-based copy of a real or imagined person and a 3D modeller is a virtual architect, thus introducing abstract concepts in non-specialist terms. It was interesting to see how certain details of the process of digitisation and modelling enhanced their understanding of the media. "Why does my hair look so unrealistic on the avatar?" led to questions of polygon count and computer performance. Problems of image quality led to questions of resolution and render properties.

As we began to move from digitising the artefacts to building the virtual environment Rod Martin joined the group as programmer. With support from BT Exact he familiarised himself with TARA and programmed the interactivity in the form of text and audio/video clips as well as the transfers between related memories. After consulting with the group, he also developed two options for the navigation system for the virtual environment.

After two months of programming the interactivity and editing the texts and content, we presented the pilot of the virtual environment to the group for their feedback and input. At this stage the virtual environment was far from complete, with many transfers and additional text and audio/video information still missing. Despite this the project was received very well and the group remain hopeful to use the pilot to help develop a virtual Liverpool enriched through the personal and relevant contributions from its people.

Richie Dabbs summed up the project in the acronym-rich terminology of the new technology enthusiast :

"ITEM = Interactive Tales of Experience and Memories"

PROJECT REPORT

The knowledge retrieved throughout the period of project development was quantitatively huge and very intense in regard to personal, subjective information and memories. Due to the high level of personal contact and the friendly relationships we were able to develop, the meetings became a very open and unprejudiced exchange of information, starting from historical observations leading into intimate memories and feelings, developing a pool of very subjective images, sounds and stories. The material collected could be seen as a miniature museum of a certain group of inhabitants of the city of Liverpool. The project team certainly learned a lot about life in the northwest of England from the 1930s on. Almost none of the information retrieved could have been found on official websites or in local museums, as they were formed from private memories, secrets and personal narratives. One of the most enjoyable aspects of the project – apart from the fun of creating the artwork – was the personal contact with men and women from a different age group, social background and city and the interesting conversations with them, which made us aware of unknown aspects of 6 decades of life in Liverpool.

The project aimed at research output guided by 4 research objectives.

1. To research ways in which the representation of people's lives influences the architecture and construction of an interactive virtual world.

This process was led by the investment made in how best to map the subjective qualities of people's lives into architectural properties of the virtual world. An increase in quality of life was mapped into an ascending slope; a decrease of individually perceived happiness was mapped into a decreasing slope. We also changed room size and the

colour of the rooms in order to suggest good and bad times. The spatial design was influenced by earlier work of Mathias Fuchs, as described in "Game Engines for Interactive Storytelling". Despite this we felt some uneasiness regarding whether the assumed link between the topologically rising sectors of a games level and the increase in life's quality would do justice to the subtlety of experience contained within the piece. Even though this metaphor made sense for all of the project members and a small test audience, we cannot assume that it holds for a wide range of cultures – not to mention different historical times or other influencing factors. As I tried to prove in the essay "Schwarze Töne – Weisse Töne" ethnomusical investigations give a strong indication for different interpretations of spatial primitives in different cultures. One can not assume that a rising scale signifies optimism for all men and women on this planet at any time. The same holds for the colour codes we used. The record album "Abbey Road" by the Beatles is a famous example for culturally differing interpretations of colours. The colour white of John Lennon's suit is supposed to signify mourning, as white is the Indian colour of mourning. Most Western recipients are not aware of this connotation and interpret the colour of white as denotative for virginity, cleanliness or weddings. With all care taken to avoid presenting our mapping considerations as valid in a very general way, we would however not hesitate to say that they work in the context of a contemporary European framework of interpretation.

2. To explore how particular community contexts and relationships can effect the desired representation forms of virtual worlds.

The context of the Darkhorse Venturers' community played an important role in the design process of the virtual world. We checked each design guideline with the Venturers and would have arrived at a completely different design with members of another community. For a scientific community, or example, we might have tried to be quantitatively more precise. However we soon found out that a high level of numeric detail was not significant for our target audience. It might appear obvious, but despite trying to not make assumptions about the project partners, one could also state that the age of the community with which we worked played an essential role in the design of the virtual world. The 'playability' and ease of use became significant, but also the temporal structure used for the game. The concept of decades is one that makes little sense for children and teenagers – yet it does for people in their 60s.

3. To research ways in which these interactive virtual worlds can be experienced, altered and explored by user choices.

We were successful in providing the user with an interface that would allow for various user choices. The choices not only include the selection of a particular person's life to be explored, but also the speed, pace and path the exploration takes. Certain decades can be investigated

carefully or just at a glance. The selection of the person who is to perform the task of invisible narrator can be taken at the game start. It can be restricted to just one lifeline or be expanded to many different ones. We did not accomplish the implementation of a rich variety of possibilities to alter the virtual world due to constraints in time and to technical restrictions, but we were realistic about what would be achievable when the project began. Future research would have to explore the ways on which it might be possible to change the game further. During the course of designing the game we felt it would be desirable for the user to be able to leave comments with the system, or to add imagery or sounds and to make the added information accessible for future users.

4. To evaluate applicability of methods and technology used for collaborative efforts and community processes.

At the time this report is written, there has not yet been an extensive phase of testing the project results in public, because the project still has to be premiered in a public context. The initial observations we made through some test presentations was that potential recipients are able to access the information we intended to provide. There was some criticism uttered in regard to the input device we used. Non-gamers ran into massive problems with the joystick and even when navigating with a mouse there was a small user group who found it difficult to navigate the virtual world. This is an inherent problem with game-related environments and cannot be solved without large-scale research, software and hardware development.

Applicability of the technology used has to take into account that we decided consciously to use the software our technology partner could provide – which may have necessarily been the tool which would be the most effective one for the project undertaken. This led to certain problems, which we were able to document carefully and communicate with the technology partner.

The technology partner's 3D engine is not a mature commercial product but rather a prototype. This led to the problem of learning a new engine, with little documentation and a high risk of programme bugs. As opposed to engines which we were familiar with, like the UT2003 engine or other commercial products there is no user community for the new engine and only a handful of programmers who have an understanding of the functions and problems. As a consequence we had to go through 3 version updates, find out about bugs and undocumented features ourselves and cope with problems that users of more mature technologies would not have to cope with. The amount of material to be transferred into the interactive 3D environment turned out to have become much larger than originally planned and our modellers spent much more time than they were contracted for in accomplishing the construction of the required interactive 3D space. As the original concept of placing the authored 3D environments in public broadband phoneboxes began to dwindle, we found we were struggling with a tool that suited our purpose less and less.

Suggestions for Future Research and Project Continuation

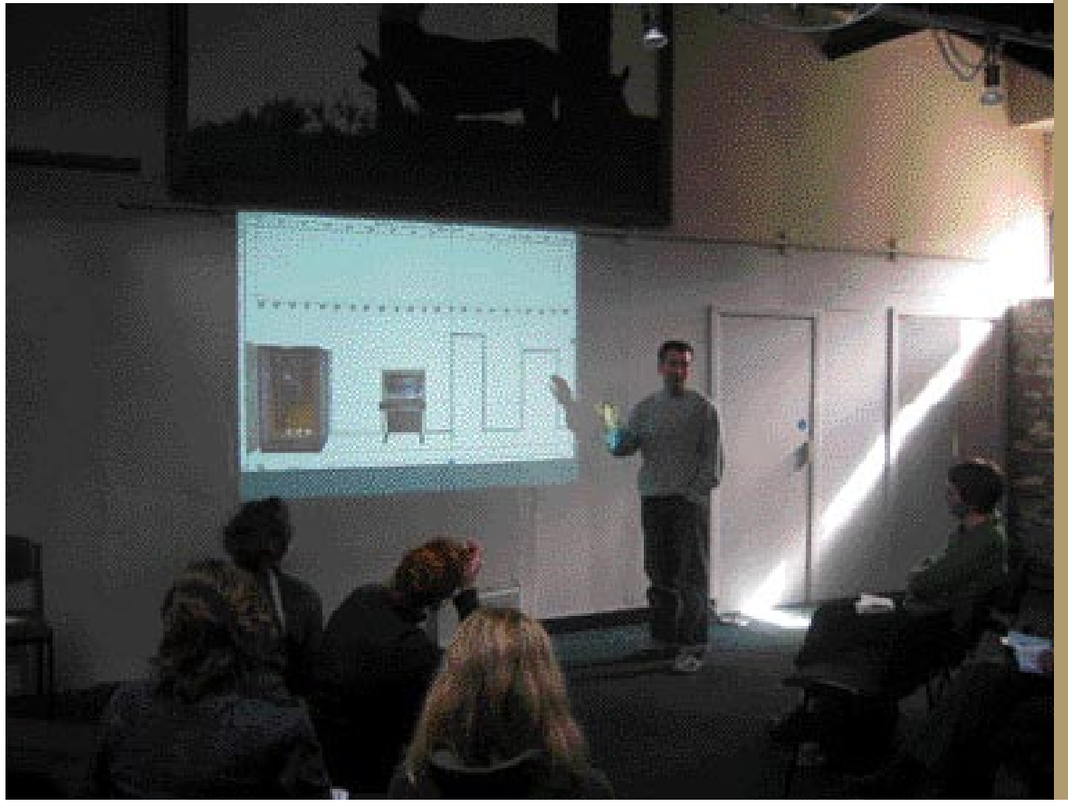
It would be desirable to add further imagery and objects and to fine tune the appearance of the rooms. This would require a design revision, a brief for the modellers and texturers and the process of working on the environment for a few more weeks. Additionally the audio features and more complex interactive features could be implemented by the programmer in collaboration with the artist. A higher degree of interactivity could also enhance the gameplay features of the virtual world. It has to be assessed however whether the TARA engine is the best tool to accomplish that.

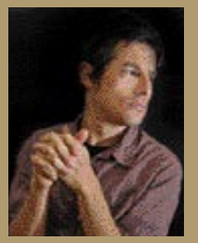
We also recommend to have a user manual produced which would not only contain instructions of how to use the programme, but provide with additional information about the men and women represented in the 3D environment.

Ideally a CD-ROM with a booklet containing the programme and content could be produced to be made available for a selected user group.

Towards a museum of zeroes and ones

Ben Coode Adams
& **Kris Cohen** with
Professor Hilary Kahn
and **Intellident**





Ben Coode Adams & **Kris Cohen** Kris Cohen is a sociologist who writes about technology and society. Ben is an artist with a special interest in museums and communicating with audiences. Ben and Kris started working together in 2002. So far, our practice has been to find stories which seem difficult to bring alive for audiences, and to try to bring them alive. Our methods are guided by two ways of approaching material: expediency and endurance. We tend to start projects by researching our subject obsessively. We use the results of this research to unpack and sometimes undermine the familiar narratives told about our subject. We like to find the fault lines in familiar historical narratives. Our story telling is unabashedly subjective. We've done strange, artistically ambiguous projects like *Is someone coming to get me?* This was an hour-by-hour re-enactment of the famous 1996 Mount Everest climbing disaster, which we first performed at the Hastings Museum and Art Gallery and later at the Banff New Media Institute, Canada. We used scrap timber to model the mountain, tiny blocks of wood to represent the climbers, and some string to connect the climbers with reading material on their individual backgrounds (expediency). We then stayed awake for 42 hours moving the little blocks, every fifteen minutes, all 112 of them (endurance) according to the succession of events we had created through research. The ITEM project offers us an opportunity to obsess about computer history, and to explore new systems for the delivery of stories.

www.bencoodeadams.com

www.soc.surrey.ac.uk/incite

www.weeklyincite.blogspot.com

Professor Hilary Kahn is a long-time faculty member of Manchester's Computer Science department and de facto curator of Manchester's collection of computing artefacts. This is a department with an important history, well worth preserving and telling. She wonders whether this project can help to make a case for building a publicly accessible museum within the department.

hilary.kahn@manchester.ac.uk

Intellident are the UK's leading RFID solutions provider specialising in the design and supply of software driven asset tracking and recording systems. Intellident is responsible for the successful design, management and roll-out of the world's largest supply chain RFID implementation to date.

Andy Chadbourne
Marketing & Communications Manager
chadbourne@intellident.co.uk

We also worked with a network of incredibly generous and clever people, who have all helped in their own ways, including Brian Napper, Chris Burton, Mary Almond, Joyce Bowker, Dai Edwards, Tilly Blyth, Rob McBride, Kit Rattanathikun, Carolyn Ekong, Axel Bottenburg, Durrell Bishop, Clive Gillman, Wibke Hott, the ITEM support and IT staff, Suzanne Briscoe, and David Withers.

PROJECT DIARY

Ben gets obsessed with things sometimes. That's how this all began. Back in 2001 when he first saw the "Baby" replica in the Museum of Science of Industry in Manchester and wanted to know how it worked (the "Baby" is the name that was given to the first stored-program computer built at the University of Manchester). Seeing it, and thinking about museums, accessibility and narrative, as he does, Ben had an idea to build a Star Trek-style "tricorder" that would allow a viewer to scan the machine to learn how it worked, as though it was an alien technology, which in a way, it was. He realised many other people had built similar devices, but if you wanted your own you had to build it yourself, just like if you wanted a computer in 1950, you had to build it yourself.

Then an important meeting happened. We met Professor Hilary Kahn who, along with her husband Brian Napper, know pretty much everything there is to know about computing in Manchester (at least, we think they do). Having lit on the idea that we might like to do a project on the history of computing, we eventually wrote an proposal for ITEM. Hilary Kahn was willing to be a technology partner. And as she had recently been in discussions with a company called Intellident, she brought them on as the other part of the technology partnership.

Intellident would enable us to build the "tricorder." Using their Radio Frequency Identification (RFID) tags, and their expertise with implementing and adapting their systems, we could embed stories in objects, in computer artefacts, or appear to do so at least. This was the ambition.

All of which brings up an important point about arts and technology research: in our project, we had a set of interests before we had a technology. And, the technology that we came to experiment with, although clearly close in function to our early ideas about a "tricorder," was not one we had gone specifically looking for. So, to a certain extent, our interests were re-shaped around the work of testing that particular technology. In hindsight, this seems like a reasonable way to proceed – one tactic out of many possible tactics for approaching an arts and technology project – but it does impact on the way that the project will play out, as we'll describe.

PHASE 1 // PROSELYTISING

Because the network of people who deal with computer history in the UK is broad and dispersed, and our research would to a certain extent rely on this network, our first action was to give a presentation about our proposed ITEM research to the University of Manchester Curators' Forum, chaired by Sam Alberti (30th March 2004). The goal was to alert relevant people about our work, our goals and methods, to enlist support where possible and to simply inform the rest.

Hilary's attitude towards us and the project, at this tender stage, was nicely expressed in her introduction to the Forum: "I don't know what the

hell they are going to do," she said, honestly. Fair enough. We weren't her typical project partners, and while she had no good reason not to trust us, neither did she have reason to trust us.

But on that occasion, we kind of blew it. We spoke about the technology too much. Maybe this is an occupational hazard in this kind of project – to fetishise the technology and ignore or marginalize the rest of our interests. We would learn that the work (between art and technology) needs to be more of a negotiation between the interests of the project partners, the needs of the subject itself, our backgrounds and talents, and the needs and capabilities and potentials of the technology. We couldn't ignore the technology, but neither could we build a project around it. We would struggle to get this balance right for the rest of the project. The outcome that day was that people left the meeting a bit nonplussed. Certainly not "enlisted" in any enthusiastic sense. But at least they knew we were around, and we would meet again.

We presented our project again on 16th April to the other ITEM awardees, and then one last time, in its inchoate form, on 1st May at the Banff New Media Institute (a conference called *Simulations and Other Re-enactments: Modeling the Unseen, http://www.banffcentre.ca/bnmi/programs/archives/2004/simulation/*). Each of these talks helped us to re-formulate our initial interests in negotiation with our technology partners and our technology. In other words, they helped us to find our interests again.

PHASE 2 // RESEARCH

First things first: we had to learn a lot about the history of early computing – and not just at Manchester, because Manchester was not an island, but was connected however obscurely to a vast network of researchers and institutions (one of our partners was a professor, after all. What if we got tested?). We read much of what was available to be read. We reported our thoughts intermittently to Hilary, who unflaggingly corrected us, point by point – unflaggingly, if not always gently. Our frequent errors weren't simply attributable to being neophytes, they affirmed something that has been a point of departure for many of our collaborative projects, viz. that books present a very particular kind of knowledge, and that other kinds of knowledge are harder to access, although no less worth accessing for that fact. Following this line of thinking, and a formative desire to tell the social history of computing, we began to conduct interviews with some of the early computer pioneers from Manchester, looking for another perspective on this history. In fact, the interviews were the crux of our research plan from the beginning; the books, in a sense, qualified us to do the interviews.

We talked at length to Dai Edwards, who was one of the two students hired in 1948 to work on Manchester's early computers. We also talked at length to:

- Dr. Brian Napper, who did important early work on compilers and who has more recently written an excellent and compendious history of computing at Manchester (www.manchester50.org);
- Prof. Hilary Kahn, our project partner;
- Joyce Bowker, a first-generation computer operator;
- Dr. Mary Almond, who taught computer science at Manchester in the 60's, and who had, even at that time, been working in computing for many years.
- Chris Burton, one of Ferranti's early computing engineers, who recently did a most extraordinary thing: he led the project to rebuild the "Baby" (Manchester's, and arguably the world's, first modern computer) for the Museum of Science and Industry in Manchester.

We videotaped all of the interviews, planning to use them as content in the system prototype. We took detailed notes after each interview and have since watched and coded all of the videotapes.

Incidentally, these interviews form a new and important primary source for the history of early computing in the UK, as many of these people had not been interviewed previously. Whatever the outcomes of our project, they will be a good resource long after our project is complete.

We also conducted some background fieldwork. We visited Bletchley Park, the British code-breaking site during WWII and home of the Colossus computer. And escorted by Dr. Tilly Blyth, curator of computer collections at the Science Museum, we toured the Science Museum's off site collections at Wroughton and Blythe House. There was a lot to learn.

PHASE 3 // ANALYSIS, OR, THINKING THROUGH DOING

In good social scientific fashion (remember that Kris works in a Sociology Department), we started to work with the interviews as data. For us, they became the important foil to everything we learned from books (which we found to be unanimously obsessed with two things: 1. who built the first computer and 2. Alan Turing – not that these aren't deserving subjects, but we felt there was more).

To test our nascent ideas about what was emerging as important, and about how to present this history to a public, we hosted a seminar on 19th August 2004. We invited a variety of experts, and were lucky enough to have most of them attend. This included: Hilary Kahn, Brian Napper, Chris Burton, and Mary Almond, all of whom were involved first-hand in the history of computing; also by Jenny Whetton, curator of the computer collection at the Museum of Science and Industry in Manchester; Dr. Sam Alberti, Lecturer in Manchester University's Art Gallery and Museum Studies and Research Fellow at the Manchester Museum; Jeff Horsley, Design Manager for Manchester Museum; Louise Sutherland, also from Manchester Museum; James Sumner, from the Centre for the History of Science, Technology and Medicine and the National Archive of Computer History; and by Rob McBride and Kit Rattanathikun, both of whom were to work on software development for our project.

The 6-hour seminar went extremely well (and it was Ben's birthday, so we had cake). Given the dispersed nature of computing history in the UK, it stands as a significant outcome of the project simply to get this important group of people in the same room for a day. Together, they represent most of the key centres of this history, and their collective enthusiasm and input both encouraged us and significantly improved the story we wanted to tell. Our favourite quote of the day was one we overheard on the way to the loo: "I'm surprised. For people who started out knowing nothing, they've done ok." We'll take that.

We then started the process of translating our research, and the feedback we had just received, into content for a prototype display system– stories that would be delivered through the RFID system. Initially, we thought this could include small pieces of text, short video clips from interviews, and explanatory animations which translated what we had learnt into content suitable for a handheld device, and for different types of audiences. We started to produce content for a handheld computing device with a bizarrely proportioned 640 x 240 screen.

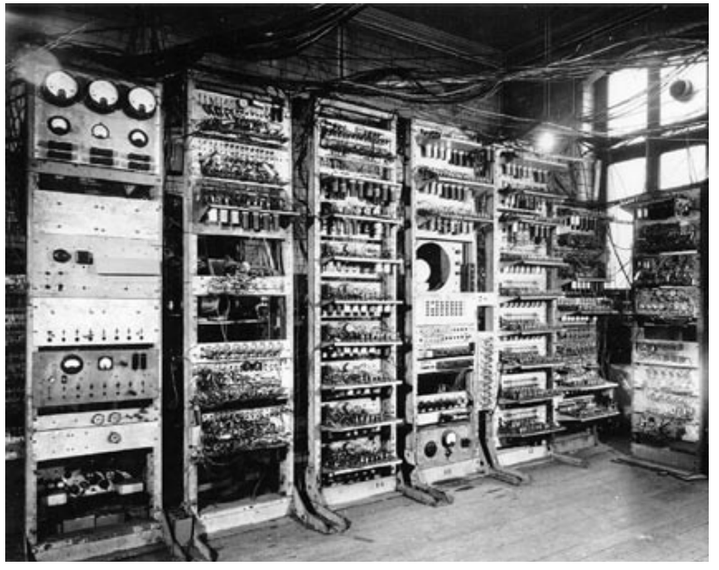
We also videotaped ourselves a lot, because the prototype would need an introduction and someone had to introduce it. But also because whenever we tried to write text, it very quickly assumed the dry tone characteristic of museum displays, and we wanted to avoid that, if only because we weren't very good at writing it.

And so the work goes, distilling content in the form of short video clips from out of our research, and trying to learn what kind of content does well delivered through this kind of system. We end our project diary with a kind of excuse for why, at the time of writing, the project continues. Bruno Latour, sociologist of science and technology, puts it this way: "technologies betray our most imperious desires".[1] Anyone who works with technologies knows this. In other words, we control technology no more effectively than it controls us. Working with technology (just like, let's not forget, working with humans) inevitably leads to surprises, troubling consequences, delightful consequences, disappointments, and just far more work than you ever think it will in the naive beginnings of it all.

1 Latour, B. (2002) 'Morality and Technology: The End of the Means', *Theory, Culture and Society* 19 (5/6): 19, 251.

REVIEW

Our objectives, as we set them out in the original proposal, are given below. We'll start our project review by responding directly to each objective, then close with some more general comments.



1. To research and prototype an information delivery system comprised of RFID tags and receivers, a computer database, and a handheld PDA.

If what we're doing is building a prototype of a museum system – and from Hilary's point of view, that's what we were doing – then there will be problems with the fragility and portability (read: steal-ability) of the handheld devices. Also, the wireless network is going to be frustratingly slow in downloading video clips. And most people using the system will have to be taught how to use it, which means that we have to create a lot of context content explaining how to use it. These problems are a given of PDA-based museum systems.

One thing that a PDA-based system doesn't do as well as a simple room full of objects is telegraph to a visitor everything that can be done in that room: everything there is to know, do and learn. This is useful because it gives visitors an opportunity to orient themselves, to find their own interests and be guided by those interests in their encounters with objects. Handheld devices don't naturally give this overview perspective. This means that we have to design something in the computer system to replace it. We'll have more to say about working with this sort of system in the general comments.

2. To explore appropriate content for such a system that takes into account the level of user knowledge.

This has been perhaps the most difficult part of the project. We began thinking about it simplistically: we would develop content, or perspectives on the material, for beginners and experts, or for old audiences and young audiences. We wanted to let people identify themselves to the system, then receive content in return which was tailored to their interests and/or expertise. And it was this idea that initially led us down the path of synthesising our research in lots of small and not-so-small bits of text, which we intended to read on camera. It was an easy mistake to make: none of the raw video clips seemed to easily lend themselves to particular audiences, so the problem seemed to demand some second-order solution, e.g. written scripts. The problem (learnt only after writing a lot of dull text) was that we weren't very good at writing scripts for 10 year olds, let alone for computer experts. And writing something to be read, verbatim, lent itself to a pretty dry tone of voice. In any case, this approach took us away from our strengths, and our interests.

Eventually we started over, trying to think again about the resources we had available to us. And in this effort, we started to look at the tapes of the interviews again, which showed themselves to be full of ripping good yarns and compelling personalities – far better than our dry text. Starting then to edit the video led us on to the idea that we could view this problem of audience from the other way around. Instead of producing content (text or video or what have you) tailored for specific audiences, we could create a set of commentators with whom visitors might form affinities. So, for instance, video clips of Kris might represent a social perspective on the history of computing and some visitors might be interested in that particular angle. While clips of Dai Edwards could represent a first-hand account of the development of the first computers and Brian Napper or Hilary Kahn could represent an historical perspective. It would be like choosing one's own guide. At the time of writing, this is still our best and most promising idea and we're continuing to edit video clips to this end.

3. To research the feasibility, desirability and management of user feedback and participation.

As long as we're thinking about the prototype being sited at Manchester University, in the computer science department, we're actually thinking about a somewhat specialized audience. We want to cater less for the "how are we doing" sort of feedback and more for stories that people who played a role in the history of computing might leave. We expect that this kind of visitor might be pretty common in the computer science department.

We discussed making a wall out of white board and embedding both RFID tags and the artefacts in the work. This would allow visitors to quite literally leave their thoughts on the wall. Accessible, easy, although not so easily archiveable and some people might be dissuaded by the

public nature of this form of commentary. But we still think this is a good idea. One part of a final solution.

We've also talked about building similar "graffiti" capabilities into the handheld device. One of the exciting opportunities offered by the handheld device (which is an input device as well as an output device) is to integrate visitor comments into the database of information we've already created, so that comments might get left in response to particular artefacts, instantly archived to the database, and future viewers would have the option to view these comments. This seems like an elegant way for the system to grow over time: to incorporate new perspectives and new forms of knowledge. But the problem remains: how to best invite people to read other people's comments and to leave their own? Between the analogue feedback system and an electronic one, there are of course tradeoffs. The best system might include both.

GENERAL COMMENTS //

Technology as Means or End?

It seems to us that the central problem of arts and technology projects is how to handle the technology. For our part, we knew very little about RFID technology, and even if we've learned a few things in the course of the project, we might never have the facility with them that we do with other, more familiar media. Because we didn't know how to work very actively (technically) with RFID systems (install them, adapt them, etc.), and because neither of our partners had time to work on the project as full collaborators, we would often get stuck in hypotheticals and dead ends. In hindsight – and this might be our most significant insight – we think we could have gone much further in testing RFID systems for use in our long-term collaboration if we had either known the technology ourselves, or been able to work very closely with someone who did. In the context of an arts and technology granting scheme, the latter is probably the envisioned scenario, in which case, having technology providers is not quite enough. Both Hilary and Intellident were excellent partners, but both had full-time jobs at least; neither had time to provide the collaborative input we needed.

We've used the word "negotiation" before. The ITEM project involved us in a process of negotiation with the technology, with Hilary and the University, and with our own skills and interests. But in an arts and technology project, it is too easy to consider the technology as the point, or focus of the work. The technology is a partner in the process – it's probably best that it never become more than that.

Did the Project Advance our Practice?

Very definitely. But to specify how exactly this was the case is harder than simply feeling it to be true. In the sense that our previous work has been about researching and telling complicated stories, the opportunity to simply try it one more time, in a different environment, with a different story, was itself invaluable. But in past projects, expediency has guided our choice of medium and presentation format. For example, in the Everest re-enactment, we built a model of the mountain out of wood. It was unadorned, to say the least – maybe even a bit simple. From this perspective, then, the ITEM project represented a decisive change for us. First, because the presentation technology (media) would, in a sense, be guiding or at least structuring our presentation of the work.

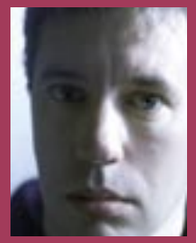
Second, we were working with a technology that we didn't know a lot about, going into the project – although we know a few things about it now. From this point of view, the structure of an arts and technology project really threw a spanner into the machine of our collaboration. Which, like any disorienting process, is in the first instance disorienting, but in a final analysis, is extremely clarifying. It forced and still forces us to decide what is important about not only our work, but our work together. What aspects of our work are central and irreplaceable, and which are merely comfortable?

To give only one example, we learned that to the extent that our work together... works. It does so because we are able to communicate our enthusiasm for the subject to audiences. Our enthusiasm, in a sense, supplements the audience's own. This being the case, our early attempt to author scripts to be read, dryly, by ourselves, videotaped and then played back through the PDAs was precisely the wrong tactic. At first, the formality of a pristine computing system seemed to demand this approach – the formality of scripting, of careful wording. But we learned that an RFID system might be easily adapted to a more personal approach, and eventually this is the direction we took the project. Here, and all along, we were forced to make such clarifications.

Moments of clarity punctuating moments of profound confusion...what better way to advance one's practice?

Spin

Brendan Dawes



Brendan Dawes
Creative Director, magneticNorth
As well as leading the creative and development team to produce innovative commercial work at mN, Brendan spends a lot of time exploring and developing the potential of new media tools. Brendan's personal projects include the highly acclaimed Saul Bass web site alongside its quirky offshoot, Psycho Studio (an application built entirely in Flash that allows you to edit your own version of the Psycho shower scene) and Cinema Redux, which explores the idea of distilling a whole film down to one single image.
Over the years Brendan's work has been featured in many industry publications including Create Online, Graphics International, Creative Review and he has received various awards including 3 'Shockwave Sites of the Day', a New York Flash Film Festival award, a nomination in the prestigious Webby Awards in San Francisco.
Brendan is a regular speaker at design seminars across the world including Flashforward New York and San Francisco, Macromedia Web World, Seattle and the New Media Age Congress in London. He was one of the co-authors of the ground breaking book, 'New Masters Of Flash' published by Friends Of Ed, and has published his own solo project for New Riders called 'Flash ActionScript for Designers: Drag Slide Fade'. He also writes Dreamweaver extensions and wrote the official QuickTime extension in conjunction with Apple and Macromedia. In addition Brendan has been featured in Californian design house 'Juxt Interactive's' book as one of the ten most inspirational designers in the world.
Brendan's developing passion is interactive installation and he is exploring a wide variety of projects including:

• Wind Chime – A piece in which people can interact with the screen to create wind chime like noises. The sound pitch and dot size are based on the colour information that is picked by the video camera in real time.
• Sonic painting – This explores the idea of mapping music/sound to create a unique fingerprint of the music being played. The colours, shapes and position of the paint spots are all dependant on the frequency content in the music.
• Audio typography – Again this explores mapping frequency information, only this time the phrases are mapped onto a scrolling canvas, with the speed of the scrolling controlled by the volume of the music.
• Sonic splatter – Real time sound analysis resulting in a constantly moving, evolving 'painting'. Speed of movement as well as colour, shape and position are all controlled via the incoming sound.

GKut
Gareth has been playing music to dance floors for 7 years. He started playing hip-hop, then finding the samples used by hip-hop in funk & soul records, playing at a variety of hip-hop or funk & soul clubs. At the world famous 'Magnet' club in Liverpool, a former northern soul venue in the 60's, his broadening taste in music burgeoned onto the unsuspecting public and people were soon dancing to reggae, northern, latin, electro, easy and the odd European film score as well as the usual mix of hip-hop & funk.
Another aspect of DJ culture also runs alongside playing music in clubs – scratching. At first, it was used only to embellish his mixes, but it soon began to exist as an entity on its own as he developed scratch techniques that allowed him to enter battles (DMC, ITF, etc.) and to make turntable music.
As he learnt these techniques he also began to teach them. This started at The Technics DJ Academy in Manchester where he taught and managed and helped to author the world's first qualification in DJ technique.
In collaboration with magneticNorth he hopes to take the skills he has currently and employ them in a totally new and uncharted way.

PROJECT DIARY/REPORT

JANUARY 5TH 2005 //

Received the specially encoded vinyl record we need for the project from Ms. Pinky in the U.S.A. The package comprises of 2 12" pieces of vinyl, one pink the other black. One side of each vinyl is for playing at 45rpm, the other at 33rpm.

Looking at the surface of the vinyl you can only just see the grooves of the record – at first glance the records look totally smooth and you think to yourself surely the stylus will just skate across the surface! Have we been conned? Does this thing even work? Only thing to do was to try it on a turntable.

Not having got a professional turntable setup like the one GKUT would be using I shoved the pink vinyl on my 40 year old Bang & Olufsen Beomaster 1000 turntable I got for a steal off ebay. Sure enough the stylus did play fine on the vinyl. But what sound came out of it ? Think old-school modem or the loading of a program off tape into your Sinclair Spectrum and you get the idea. It was essentially timecode. For me it was a serious of numbers. Numbers that GKUT could manipulate into a computer. And once you have numbers or data coming into the computer the world is your oyster. It was Pythagoras who first said "everything is number" meaning everything in life can be represented by a numbers. Thankfully computers love numbers. This to me is a beautiful mutation of the analog and digital worlds.

JANUARY 6TH 2005 //

I am due to meet up with GKUT at his flat tomorrow but before that I spend the day getting familiar with the out-of-the-box software that Ms Pinky provides, together with how the technology actually works. Ms Pinky provide several components that make up the software you download from their site once you've bought the vinyl. The most powerful of which is the "externals" for Max/MSP – plug-ins for the software that allows Max to communicate with the vinyl and receive the signals from the timecode. They also provide some standalone applications that come ready to use. These provide basic manipulation of video and mp3 sound files. I figure this would be OK to test the initial performance of the vinyl, but the real power would come from writing my own Max 'patches' using the Ms Pinky externals.

The technology itself is quite brilliant. I read all about Ms Pinky and their 4 year research into vinyl control of digital technology on www.mspinky.com. Part of the technology that Ms Pinky has developed owes a lot to Dr. Gottfried Ungerboeck, whose 'Trellis Coded Modulation creates an optimal way to encode the ones and zeros in analog waveforms to allow the maximum amount of data to be transmitted over an analog telephone line by minimizing small noise induced distortions'.

One key bit I read and something that GKUT is concerned about is the amount of latency there will be – i.e, when the vinyl is manipulated how long does it take for that information to get interpreted by the software ? On the Ms Pinky website it states that the physical location information (where the stylus is on the vinyl at any one time) is updated every 12 milliseconds, with the velocity and direction information updated every 1.5 milliseconds. This should be fine but again this is something we will have to test.

Apparently I was wrong calling the information on the vinyl "timecode". Ms Pinky is keen to point out that they use "physical location stamps" instead, the reason being that this information can also be interpreted backwards as well as forward – timecode can not be demodulated in reverse – apparently.

As yet I haven't built anything with the provided externals. Not having the correct turntable and mixer means I will have to wait to go into the studio before I can fully explore the software and start to build the necessary patches. I figure that my first foray with the software will be best on my own rather than have GKUT stand around while I figure out the basics.

JANUARY 7TH 2005 //

Spent about 4 hours at GKut's place with the intention for him to show the various scratch techniques that he would like to explore on the project. Selecting some vinyl from his extensive collection situated on a huge rack on one wall of the room GKut took me through the basic techniques using first just one turntable and then more advanced techniques using 2 turntables. GKut is a true master of his art in my opinion. As I filmed the techniques, I never ceased to be amazed by the speed and instinctiveness of his vinyl manipulation. Most of the time it was hard to correlate what you heard through the speakers and what you saw with your eyes. A piece of vinyl containing separate kick drum, snare and stab were magically turned into a full drum track – this technique funnily enough being called 'drumming'.

This was exactly why GKUT and myself had come together to explore what we could do with this technology. It's one thing to have vinyl control digital media, but it's another to put that idea in the hands – quite literally – of someone like GKut. Here was someone who twisted media on a day-to-day basis. What appealed to me was that this is also how I approach the medium of programming. Where GKut twists vinyl, I twist ones and zeroes.

As GKut showed me the various techniques we bounced around a few ideas we felt we should explore. The forward motion of the vinyl could play one video, the backward motion could play another. And the motion of forward and backwards would mix between the two. And what about the drumming technique tied to video ? A video of a Jazz drummer hitting the snare, footage of Coltrane blowing on the sax – and god knows what else. All manipulated on the fly with the vinyl. But we also recognised that it's not just the simple playing and rewinding of video we can explore. The vinyl could easily alter the brightness of an image, or make some crazy effect come into view. Or rotate an image, or split the screen up into many screens, or make things zoom in and out. Anything and everything – it's all just numbers.

By now we were getting pretty excited about what we could achieve with this project. Why stop at video? We could manipulate anything. Maybe navigate websites using vinyl, or control real world physical stuff like lights and motors. It was really up to us where we took this. But does this thing actually work ? We hadn't really planned to try out the software today, with me not having had time to build any patches yet. But we were keen to see how this thing would perform. Would it

actually work as well as we hoped ?. So I took out my iBook to begin to see what the out-of-the-box software could do. At least it would give us some kind of indication of the power of this thing.

So we fired up a browser, typed in www.mspinky.com and took at look how you go about setting up the turntable and the mixer with the computer. But we didn't get it at all. It just didn't make any sense. It looked like the output from the mixer didn't go into the computer at all, but the signal went directly from the turntable into the computer via a pre-amp. Now the thing is if we set this up in exactly the way shown on the site the mixer has no effect whatsoever on the signal going into the computer. That means that the manipulation of digital media is done entirely by the action of the vinyl, not the action of the vinyl combined with the sliders on the mixer – which we had imagined would have been the case. We both believed that this just couldn't be right. So we ignored the advice on the website and hooked it up the way we thought it should be done.

We took a feed from the output of the mixer and plugged that into the iBook via an iMic – a USB sound input device which you need as the iBook doesn't have a built-in sound input connection. We then fired up the "maxi-patch" – the provided standalone application that would allow us to do some basic tests of video manipulation. We next chose a video for us to test the vinyl video manipulation with. I had previously downloaded some public information films from the excellent Prelinger archive at archive.org (and all royalty free too).

And then we tried in vain to get the sound input to work. No matter what I did the maxi-patch could not hear any audio input. Maybe it didn't work with the USB sound input device ? This wasn't the best of starts.

So I suggested we download the PC version of the software and try it on GKut's desktop Windows PC.

After downloading and installing the software on the PC GKUT first found an mp3 file to use with the vinyl. Sure enough it worked – and what's more it worked well.

The mp3 seemed to react really well with the vinyl with hardly any latency – not so you would notice anyway. As you sped up the vinyl the mp3 would speed up too. It was pretty impressive. But what about the video ? GKut managed to find a small Quicktime movie file but this time the results weren't that impressive. The video didn't seem to react correctly to what was happening with the vinyl and the sound appeared to be dropping out. Maybe the PC was too underpowered to handle the amount of processing that a video file requires?

At that stage we decided to call it a day. We knew the system sort of worked but there were many problems to overcome, not least of which were the issues with the sound input and the control of video.

MARCH 15TH 2005 //

Today was my first full day on my own trying to get to grips with the Ms Pinky externals, together with a decent turntable and mixer set-up. Blueprint Studios had provided a studio space to use for the project so now I had everything I needed to begin to get my head round the Max/MSP stuff

I decided to tackle the problem bit by bit. To begin with all that I wanted to do was build a patch in Max that would show I was receiving information from the vinyl. Using the iBook again I finally found why the sound hadn't been picked up on our previous attempt. It is necessary to explicitly turn on and select the correct sound input channel via the

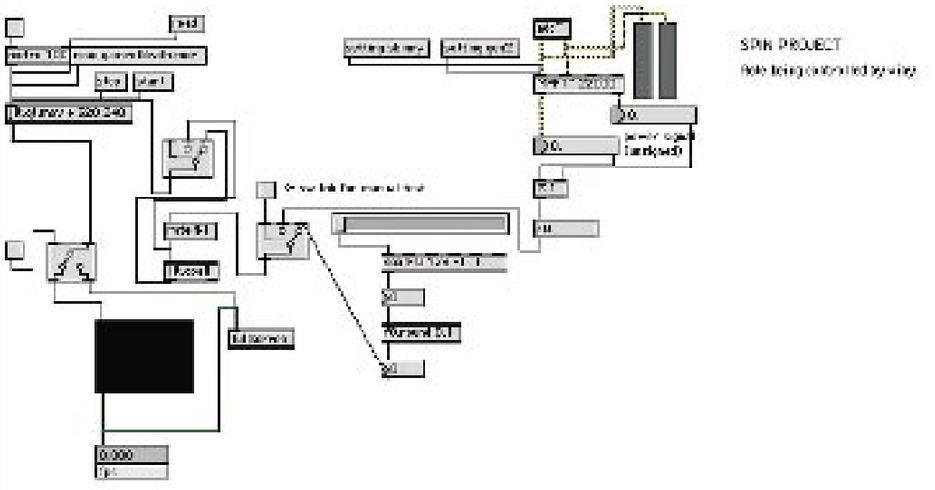
Max/MSP DSP menu. I had expected that the external would have automatically been able to turn the sound input on at least. But no – it always has to be turned on by the user.

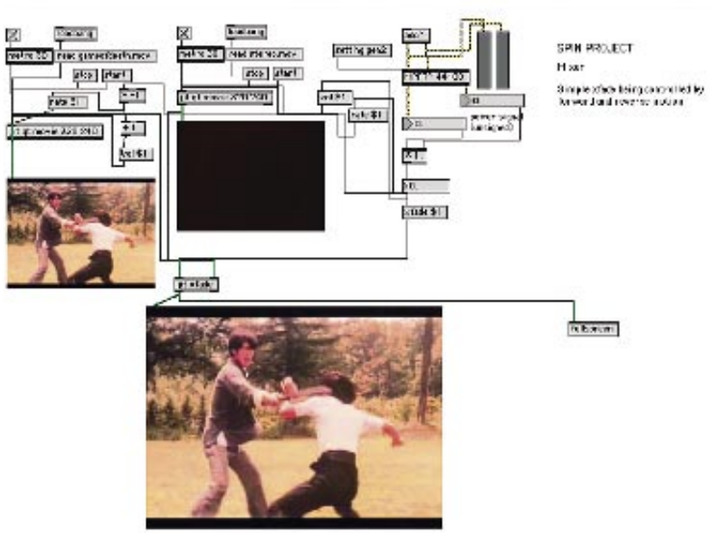
As I worked building these small patches I quickly realised that the documentation for the Ms Pinky externals was very limited. You were provided with some information and the odd example patch but for the most part you were on your own – save the Ms Pinky forum that is.

So now I had a patch in Max/MSP that could get the needed information from the vinyl. This would form the basis for all subsequent patches.

Next I built a very simple patch that would attempt to use the vinyl to control the speed of a video clip. This kind of patch in Max/MSP and Jitter (the extension to Max specially formulated for manipulating matrices of data like video) is fairly easy to create. All I had to do to control the speed of the video is attach the velocity information of the vinyl to the rate parameter of the video. Sure enough it worked straight away – accelerating the vinyl accelerated the video – and rewinding the vinyl made the video rewind. But it's important to note here that the video was not tied to the vinyl directly so to speak. Putting the stylus on another part of the vinyl did not make the video jump to another part of the movie. In effect all that was happening was the vinyl was acting as a 12" plastic speed controller. While this was great and looked pretty impressive this wasn't going to be good enough for what GKut and I wanted to do. But this was at least a start.

I next built a patch that would play one video whilst the vinyl was playing forward and then flick to another video when the vinyl was playing backwards. But one problem I noticed was that when I kept cutting the signal with the fader on the mixer the software was pretty slow to react. This was likely to be potentially problematic. And I was only doing this relatively slowly – nothing like the speed at which GKUT would be throwing the fader up and down.





MARCH 18TH 2005 //

This was the first time GKut and myself had met up since January. In the meantime I had got a few patches ready for GKut to try and I was getting more confident with the workings of the Ms Pinky patches. Firstly we tried the simple 'vinyl controlling video speed' patch I had made previously. Two days ago I was quite pleased with how this was working but as soon as GKut started to put it through its paces flaws quickly became apparent. The video seemed to react a lot slower than before mainly because this time a real scratch DJ was working the controls. I figured the CPU of my G4 800MHz iBook was seriously getting hammered so I realised I needed to look at how I could speed things up a bit.

In my patch I had two ways to display the video. One was a simple small window that displayed within the patcher and the other was a full screen window that you could toggle on or off. I decided to see what would happen if I removed the in-patcher window, as when the video was being displayed full screen this window would effectively still be playing underneath (i.e the computer was attempting to play the video twice). Straight away the video in the full screen window sped up quite considerably. I then added the in-patcher window back in to the patch but this time added a 'GSwitch' – a gated switch to toggle between the two states.

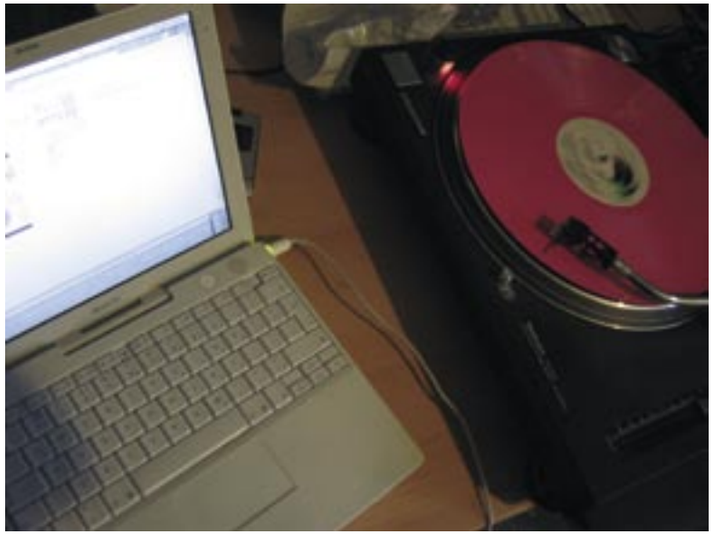
Doing this highlighted the need for a much faster computer. What we were attempting to do with this project was beyond the abilities of my iBook. Maybe now it was time for the desktop G5.

We put this to one side though and began to look at other things we could do with using the software programme Jitter. Using a Jitter object (jit.brcosa – brightness, contrast and saturation) we could manipulate those parameters using the speed of the vinyl. This looked great. Effectively it was vinyl control of video effects. Real-time effect generation using nothing more than a turntable. We also tried other software objects like jit.rota which could orientate the picture in relation to the vinyl.

At this point there was still no absolute positioning of the stylus to accurately relate a specific point on the vinyl to a specific point on the video. So to try to tackle this I built a patch that would take the absolute position data from the vinyl and map that to the number of QuickTime frames. It sort of worked. The more I fiddled with this algorithm the more success we seemed to get and the more accurate the results became. We had video footage of a record spinning on a turntable and we used this footage to test the tracking of the vinyl. As GKut slowly turned the vinyl the 'vinyl' on the video moved in sync. It looked great, but it was not absolutely accurate. And we needed it to be perfect. Maybe there was a better, more simpler way to do it ? Maybe a faster computer would be the answer?

MARCH 22ND 2005 //

While I wasn't at Blueprint today, which meant I was without turntables, mixer and GKut, I spent the time building some patches in Max that I felt may come in handy during the project. I built a patch that could create split-screen displays as well as very simple patches for zooming and scaling. As someone who has come from a programming background (mainly in Flash, and using languages like Javascript, Java and Pascal) using Max/MSP/Jitter is at times a bit a challenge. But creating patches like this that do simple things, things that would be second nature to me in a more traditional language, allows me to become more familiar with Max. And it's a very different way of building applications.



I also spent some time looking into how we could record the 'mixes' that GKut would eventually create. I thought this would be a pretty easy thing to do in Max/Jitter but it wasn't to be the case. Recording the Quicktime output to a file is not a problem but it doesn't record the sound, just the video. I managed to figure out how to record a separate sound file together with the video file, but the two were never in sync. I also tried using the 'direct to firewire output' Jitter object (jit.qt.videout) but this also doesn't record sound – not in this version of Jitter anyway. At that stage it wasn't a priority but obviously it's something that will eventually have to be worked out as the recording of these media manipulations would be great.

MARCH 31ST 2005 //

Made more progress with GKut today and we seem to be getting there with the positional problems, though to be honest it's still not perfect and I can't help thinking that there has to be a better way. I rounded some of the numbers down we had been using to work out the positional information in order to lessen the computer processing required and it did seem to perform a lot better when we did this. We also started to use the Apple G5 computer as opposed to the iBook. This gave a massive performance boost. Video needs a lot of CPU power and you need something as powerful as a G5 to handle the sort of things we keep throwing at it.

Another problem we've been having is the sound playback. It seems to audibly 'click' when playing a movie. When we explored what was making this annoying sound we found it was in total sync with the positional information being updated off the vinyl. I went on to the forums to ask if anyone had had any similar problems but no one had reported anything. We also found the same problem when we used the maxi-patch – so we knew it wasn't something that we were necessarily doing ourselves.

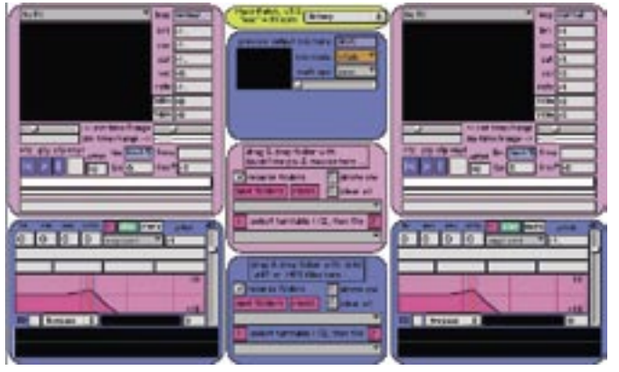
One thing we did notice is that the sound in the Quicktime movies we were using didn't play backwards, it would simply skip backwards then play forwards !. So I took a look at how the soundtrack was made up on the Quicktime file. I discovered that the sound was compressed and that the decompression was unlikely to be bi-directional (i.e it will only work when played in the intended direction). So I re-exported the Quicktime without applying any compression on the soundtrack and this time the sound played backwards as expected.

We also continued to look at different types of effects we could apply. As ever, many of the available effects look far too cheesy. Much like the first time many of us use a tool like Photoshop – you think all those filters are great but eventually you realise that a couple are all you ever need. We decided we would have to make a conscious effort to make sure any effects we used looked credible. We didn't want this to look like the myriad of VJ sets we'd both seen and hated. It was important that the project had a credible design aesthetic as well as exploring the capabilities of this technology.

We were however becoming slightly frustrated with our progress on the project. The 'positional' problems together with the sound clicking problem meant we had not even begun to consider the media we were to use in order to construct something worthwhile. GKut did point out though that some of the best visual scratches seemed to be when he manipulated the slightest movement. An elbow moving, or some smoke being blown from a pipe, or a simple twitch on a persons face. These were all things that go unnoticed day to day but yet seemed almost hypnotic when played with in this way.

APRIL 12TH 2005 //

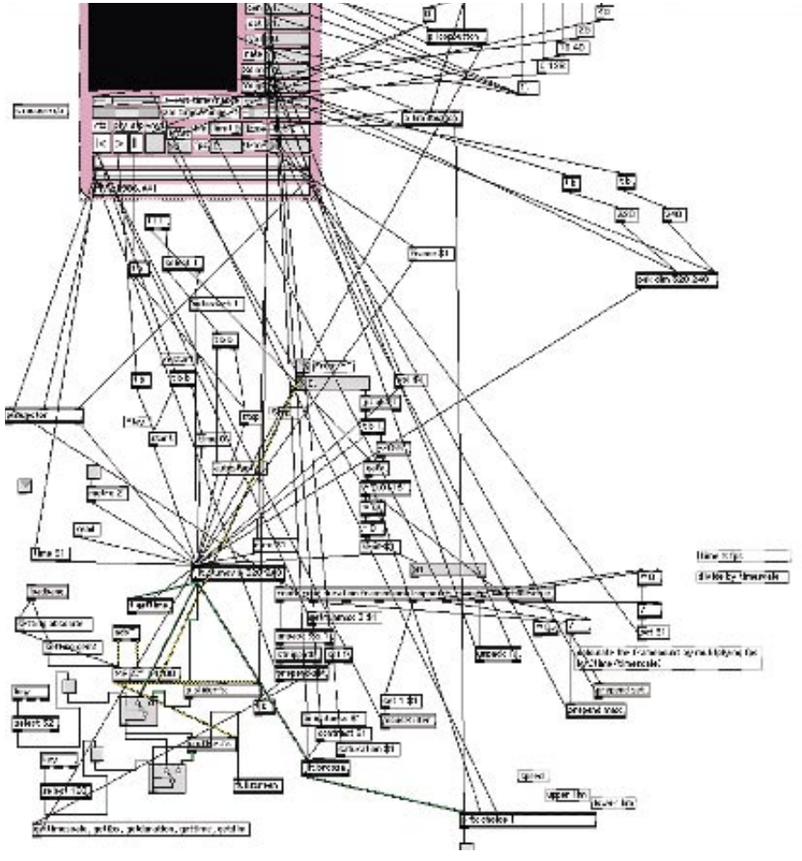
We seriously needed to solve our positional issues if this project was ever going to progress. We also still had issues with the fader. Any cutting of the Ms Pinky signal and the software wouldn't react quick enough. It was time to have a rethink of our whole approach.



The maxi-patch that Ms Pinky provides didn't seem to have any of the positional problems that we had been having. The vinyl seemed to synchronise perfectly with the Quicktime movie, even with severe scratch techniques – GKut found it always stayed in sync exactly as he intended – like a normal beat would. So I decided to rip apart the working of the maxi-patch and take out what we needed – namely the Quicktime control bits. After working out what were the bits I needed from the many different patches that go into making the maxi-patch I wired up a patch on to the back of one of our previous patches and gave it a go. It worked perfectly ! The Quicktime movie played perfectly in sync – without losing its position, no matter what GKUT threw at it. But we felt we weren't out of the woods yet. What about the fader cutting issue? Maybe we should re-look at how the mixer is set up with the computer.

So we did just that – looking again at the diagram on the mspinky.com site – the one that originally made no sense to either of us. We wired it up exactly as they suggested on the site, with the vinyl going straight into the computer bypassing the mixer completely and then the sound output from the computer going into the mixer. GKut fired up this new set-up and sure enough, this time there was no lag when he used the fader – because the sound from the vinyl was not going through the mixer and was therefore at a constant volume. And while it had taken away any kind of approach GKUT could have used to scratch video with the vinyl AND the fader, the performance was greatly improved. This is why Ms Pinky had suggested setting it up like this in the first place. The software needs a constant volume from the vinyl in order for it to work properly.

So this was all good. Except for just one thing. We were still getting an audible clicking when the Quicktime (and the vinyl) was just playing normally.



JUNE 8TH 2005 //

In the time before our last meeting and this one I had been on the Ms Pinky forum trying to ask if anybody had experienced the same problem we were getting with the sound when using video. Nobody had reported anything. It looked like we were on our own to try and solve the problem. Back in the studio we tried a few different sound compression variations and exported many different Quicktime movies to see if it improved our little sound bug. We found that Apple Lossless Compression seemed to make the problem less apparent, but it didn't completely go away. After a few hours we decided to move on and concentrate on some new effects and treatments to try on the video.

By far the most impressive was jit.slide. I created a patch that would add motion blur to the imagery as the vinyl accelerated. GKut could then create blurred imagery by quickly speeding up and slowing down the vinyl. We then also played with some split screen effects. As GKut moved the vinyl left and right, the video became splintered, moving into distinctive split screen columns, marching across the screen. I then added into the patch a toggle, triggered by the space bar that would allow GKut to switch between these effects as he wished.

CONCLUSION

That's the story so far. We've made progress, but nowhere near as much as we would have liked. The sound clicking issue is still to be resolved. Our only hope at this stage is for new Ms Pinky externals that have been released, which may or may not solve the problem. We also need to look at a performance system. How do we toggle various effects? How do we load in different movies? The plan is to use something like the Teleo system by Making Things – a USB serial input/output interface that easily allows you to attach switches and the like to Max/MSP/Jitter. We immediately thought of foot pedals, but could easily add proximity sensors, infrared sensors or anything else. And what about performance over the net ? Performances with more that one DJ ?

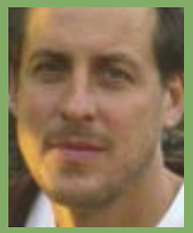
Because of the technical difficulties we'd had right from the start, the objective of 'mixing the media' – of spinning the media into other messages had not been achieved. But the foundations for such an outcome have now been laid.

The scope of using this approach to technology is immense – a non scary, fuzzy interface, as opposed to a keyboard and mouse. For GKut as an artist it could open up a whole new genre of turntable created art. We plan to continue with our adventures in vinyl at www.magneticn.co.uk/spin/. When we've shown friends and colleagues what we've achieved they truly love it. They're fascinated by the mix of the analog with the digital and can see the potential. Now we just need more time to explore where this thing can take us.

Quicktime movies of the results so far will be available at www.magneticn.co.uk/spin/

Now We Are Where

Simon Evans



Simon Evans
Born in Kingston-Upon-Thames, Simon trained as an artist at Nottingham Trent University, but spent the first part of his career working in television as a writer and director, working in documentary. In the late Nineties he undertook an MA in Hypermedia under Richard Barbrook and Andy Cameron at Westminster University. Graduating with distinction, he began working in multimedia, first as a producer at interactive pioneers Romandson, then as marketing director at tech company Datasphere.

Simon now runs his studio www.evans-studio.net on the west bank of the Severn in Gloucestershire. The studio mixes commercial and art projects; Simon remains fascinated by the cross fertilisation of the two – working with popular cultural forms and media technologies. A persistent objective has been to subvert these cultural forms – to smuggle philosophy into people minds as entertainment. He is currently working on an arcade version of his ITEM project *The One Pound Shop*. It will only cost a pound a go.

Iain Gray
Apsolute is the software development division of IT support company Nexus Data Solutions Ltd. Formed in 2001 to explore some of the development opportunities thrown up by Nexus Data's work with their support clients, they have branched out into a wide range of software applications.

Apsolute develop using Delphi, Java and C++, selecting the most appropriate platform on a case-by-case basis. They have extensive experience in developing distributed and web-based systems.

PROJECT DIARY

DECEMBER 2004 //

The project began with Iain Gray and I taking Paul Amery out for lunch. Paul was the Head of Partner Strategy for Orange at the time. I had met him when I chaired a panel discussion on mobile futures at the Science Museum in London and thought we approach him to get approval from Orange to use their location APIs (application programming interfaces). At the time I was a bit nervous about getting past all the levels of authorisation needed to access information on the API, let alone using it; mobile phone companies are extremely commercially minded, as you'd expect and we were proposing not profit, but art. Paul was cool though. He clearly couldn't see anything in it for Orange but if we were prepared to pay whatever it cost, why not?

JANUARY/FEBRUARY 2005 //

Seemed to spend ages sorting out the contract, dealing with the niceties of Intellectual Property (IP) and setting out who does what. Still, I have found out again and again that it pays to get this right with software development projects. I apply for Orange Premium Partner membership, a pre-requisite for access to the API.

MARCH 2005 //

I eventually pick up the contacts Paul has given us to commence the process to access the Orange API. I get through to Neil Patrick who runs the API service in the U.K. I discover to my horror two problems:

(i) The standing monthly charge that I thought Orange had replaced with a £500 minimum, was in fact still a monthly charge (in my defence the Orange partner website is vague on this fact). We have to pay that from the beginning, including any test phase. I had hoped I could simply pay £500 and use the several thousand lookups it buys to test the prototype.

(ii) Orange do not want to deal with people our size. There is some long drawn out vetting process and you need several million pounds liability insurance.

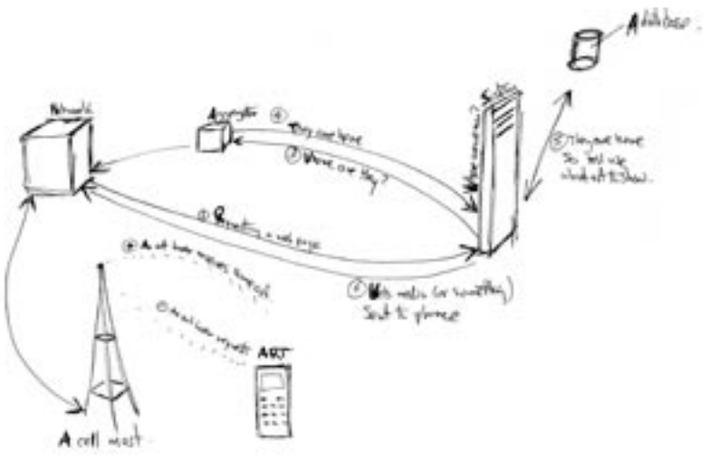
So – panic! However, Neil points us in the direction of mobile service aggregators. These are people who can supply you with bulk SMS, MMS gateways, reverse billing premium SMS and location data.

APRIL 2005 //

I start the process of picking an aggregator by going through the list on the Orange partner site. I pick three that supply location APIs and that look OK. I send the details to Iain to run a technical appraisal, then call them up and discuss commercial terms. We eventually pick MX Telecom for various reasons, the most important being their API looks mature and they offer us a cheap test deal – £100 per mobile number for 300 requests. We order two accounts, one for my number, one for James' (the head of development at Apsolute).

Iain hassles me to get started. I spend too much time getting the project website up and the discussion forum launched. The agreed project plan slips. I send a mailshot about the website launch to everyone I know who might be interested, plus various industry and art newsgroups and mailing lists. I want a deluge of opinions, ideas and enthusiasm for locative media on mobile telephones. I get three posts.

James, starts coding a demo to test the MX Telecom location API. One late night later and we have a thing to play with. James plumbs it into Streetmap (?) and we have such fun checking out where the other is ("I see you are not at your desk James..." etc). Then we get bored with it.



JUNE 2005 //

There is a show and tell day at FACT. Iain, James and I meet at the Apsolute office to discuss progress. I am a bit alarmed to see someone has got into their building and kicked the door of their offices in. They re-assure me the test server with the demo app on is safe. James cuts through my directionless philosophising by making a simple but insightful point. We are building a digital network, thus we are using computers, so the art must start with a computer file. What we have to do is come up with a process that links location coordinates to a file name. Obvious really.

Iain and I spend time thinking about how to find the nearest art work to a given location. We get side tracked into complex mathematics that calculates the nearest point to another point on a curved surface (i.e. the earth), but Iain has a mate who suggests a simple Cartesian grid and Pythagoras' theorem. It's GCSE level maths, which means even I can understand it. Apart from this obvious benefit, there is the advantage that the Ordnance Survey grid is a Cartesian grid. In fact it is a Mercator projection (like many atlases) and subject to distortion, but as England is tall and narrow, and not in high latitudes, the level of distortion is acceptable. Location APIs return OS grid references.

At FACT we give our presentation, show off our GCSE maths and walk through the demo. The Apsolute test server was fine but the web server hosting the project website went down. There I was thinking I was being terribly clever having all the presentation online.

JULY 2005 //

So, no one's interested in contributing ideas to what a mobile location service for artists might be like. I guess I was being a bit naive thinking people would send their ideas in for me to nick, or that they would even understand what I was on about. So, I come up with a bunch of project sketches, brief ideas for projects that use web media, mobile devices and location. I abstract the common factors and then James and I work on top level use case diagrams for the system. These are a way of expressing the user requirement and the first step, in UML (?), to designing software.

We write up what we have done so far and decide what to prototype. I get short-listed for a new media art festival commission with an idea based upon mapping GSM networks and collaborative game play. We are keen that the prototype we develop to show at FACT in October can also deliver some of the festival art project. I ask MX Telecom for the paperwork to apply for a live connection to their location gateway. I get sent ten documents, running into dozens of pages; turns out we have to apply to not only MX Telecom, but all the networks we wish to connect to. Blimey!

PROJECT REPORT

INTRODUCTION //

The mobile telephone is the most pervasive and successful communications technology of recent times, yet the technology and the networks over which this communication takes place are almost entirely proprietary and mostly inaccessible to non-corporate media creators. For this project we wanted to look at ways of opening up these networks to artists and encouraging them to use it. Specifically the project looked at enabling artists, and other non-corporate content creators, to work with mobile location finding technology. The vision was – and is – to offer a service that would be enable artists to create artworks based upon geographic location and publish it to mobile telephones. The goal was to create a bridge between proprietary, closed and poorly understood mobile telephone networks and the open, accessible and well understood internet.

Location based services (LBS) are a much hyped new mobile communication technology. The visions of how they might be used commercially are many and almost entirely banal – find your nearest MacDonald's and so forth. In recent years artists have also begun to work with the technologies of location and the form has a name: Locative Media. Briefly, this art form works with and on technologies that locate people in geographic space. A lot of this new work, however, uses specialist equipment such as GPS transceivers, so it has remained a niche interest. By contrast, mobile telephones are relatively cheap and widespread. They are a popular media platform; artists need to get involved.

The project was emphatically practical. The objective was to research and design a system that could be implemented within 3 months and that could be used by media creators with moderate technical ability. Our belief was that widening inclusion in the technologies of location would foster innovation, help shape uses that favour openness and free speech and enable art that challenges and illuminates.

RESEARCH OBJECTIVES //

From inception of the project it was clear that a wide number of areas of enquiry needed to be covered. Of course, there was a technical aspect to the project but that proved relatively easy to resolve; much documentation was online and standard web technologies were specified. What proved more challenging was dealing with the commercial and creative sides of the undertaking. As we proposed working with commercial networks there was the inevitable overhead of contractual paperwork along with sceptical network executives unfamiliar with discussing art. This led to questions as to the creative objectives of the system or service – how to balance a need to entertain commercial relationships with an imperative to facilitate a critique of those relationships and a critical engagement with the technology.

Early on we simplified our project to three core areas of enquiry:

1. **How the system might obtain the location data**
2. **How the system would associate location data with art work.**
3. **How the art work would be served to mobile telephones.**

Our research focused on these areas, with the objective of designing a simple, stable and effective tool. Of course, the proposed system would involve other areas such as account management and billing, but we felt that these were not new areas of inquiry; certainly, they are a familiar part of standard web development work.

HOW WE GOT LOCATION DATA //

Most of the main mobile networks now provide location application programming interfaces (APIs) to third parties. You can, subject to a lot of contractual stuff, request the location of a mobile telephone and in return for a few pence, the networks will give it to you. On the surface this sounds relatively easy. However, this location is not very accurate; all of the network APIs work on a similar principle, they simply return the location of the cell the phone is currently in. This means the latitude and longitude of the cell mast, plus the radius of the cell (what they call a degree of error). So, this means the location given is only accurate to between 500 metres and several kilometres. This is probably the main reason location based services (LBS) have not been a huge commercial success.

We have assumed that this inaccuracy would not last. Either mobile phone tracking would be abandoned (unlikely) or it would be supplemented or replaced by new technology. For this reason we have designed the system in a modular fashion, enabling us to replace the location API interface as required.

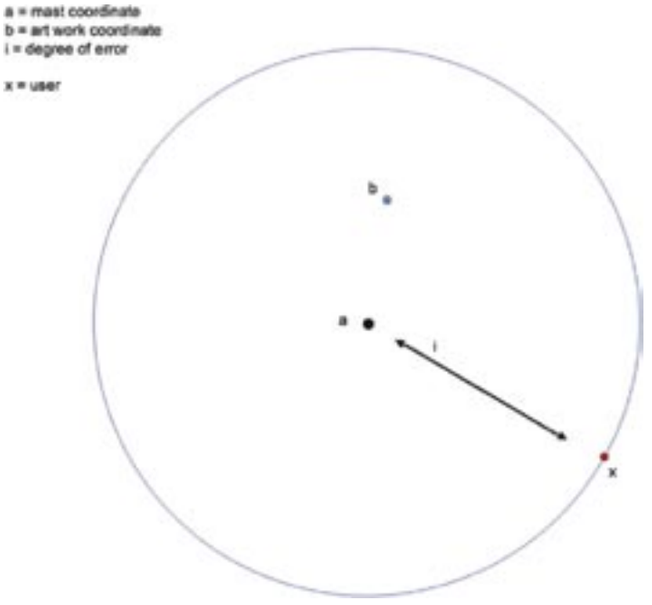
HOW WE ASSOCIATED ART WITH LOCATION //

Through using location APIs to return coordinates we established fairly quickly how the system may obtain location data. The next area of enquiry was how this location data could be associated with some kind of art activity.

As we are discussing digital systems we must take as given the fact that a computer or computers will create and/or deliver the some media in the form of computer files. Thus we can conjecture a simple correspondence between two values – one a geometric value, the other a computer file name – that could be set by the artist. This basic relationship can be extended to include a range of geometric values (i.e. an area) and a sequence of computer files, including executables.

The diagram below illustrates the anatomy of a cell as it is constituted in LBS. We have a cell mast coordinate ***a*** that we can assume is accurate and an location coordinate (or range of coordinates) ***b*** which we can also assume is accurate (in that this location is entirely a function of the system – i.e constitutes a part of the art). The location of the user *x*,

however, is less certain. The illustration here shows the user on the periphery of the cell but, in fact, the user could be anywhere within the blue circle.



In an empirical sense this lack of precision as to the location of the user represents a failure of the location APIs' technology. Certainly, alternative systems that use geo-stationary satellites deliver considerably higher accuracy.

However, we liked this inaccuracy; it is the sort of thing artists work on: teasing out contradictions and exposing the limits of a system.

Developing this, there are three points seemed significant. The first is that this configuration of location shifts what we understand a 'place' to mean. It is a commonplace of accounts of locative media to note how it transforms geographic space, linking, as it does, the individual to imminent but disembodied networks. However, what is rarely questioned is the quality of the location data and how that quality affects action. As I have pointed out, Mobile phone location APIs return an imprecise coordinate. These coordinates may be enhanced by information on where the user is 'near' and in the visions of mobile network executives, these landmarks tend to be goods or services to be consumed. But even with the increased 'granularity' of GPS systems, one's precise latitude and longitude are of limited value *in themselves*. What give these meaning is the total context of the user, not just the media or services to which a system may link the coordinates, but the political, economic, sociological or cultural systems that have brought that user to that place at that time, with those intentions. To be meaningful the location data must match the reach of human action – which is proportionate and a function of the individual's context. In order for artists to scrutinise this relationship the proposed system must allow artists to create alternative geometries, or at the least, translate the default system location data (i.e. OS Landranger or World Geodetic – WSG 84 etc) into alternative geometric systems.

The second point expands on the first to note how the topography of mobile networks is a model of human activity. The illustration below shows a journey from London to Gloucestershire one Friday evening, down the M4.

Location requests were run on a mobile telephone via the commercial tracking service FollowUs (www.followus.co.uk). Timings were irregular. What is immediately apparent is the wide variety of cell radius. As explained above, close to built up areas, where there is a high density of masts, the cells are relatively small and give higher accuracy. Away from urban areas, the cells get much larger. The reason for the distinction between rural and urban is that urban areas have a higher number of users. A cell mast has a finite number of frequencies assigned and therefore a finite number of users it can accommodate; to accommodate more users GSM networks create smaller cells – the denser the users in a given area, the denser the GSM cells. Through this pattern of base station distribution (and therefore LBS accuracy) are reflected patterns of economic activity.

The third point is that this combination of geographic space, geometric coordinates and media is a new sign in the semiological sense. The media that apparently comprises the art work does not contain it. Linking art media and geographic location forces us to extend the limits of the art work beyond the boundaries of media to include the physical space within which the work exists, or onto which it is mapped. The complex of space, geometrics and art media are the signifier, the signified is the art piece. Thus the art piece is implaccably immaterial.

This is beguiling, although it gives rise to further problems such as sustainability, curation and funding.

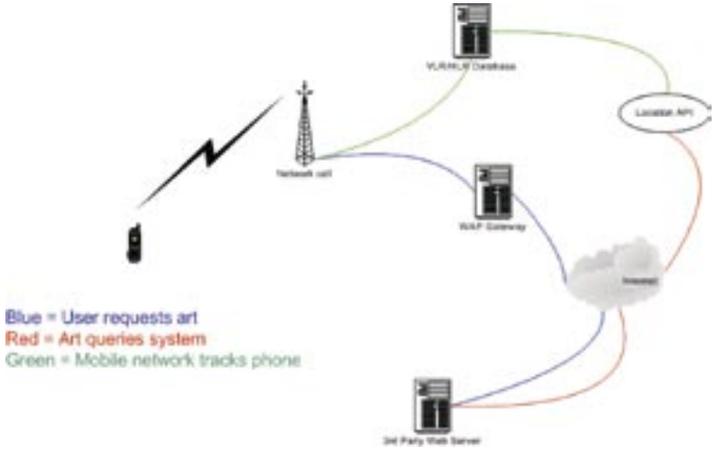
HOW WE DELIVERED SOME MEDIA //

The last objective was both easy and difficult – and our success mixed. How to turn the data we have obtained and processed into some sort of media to serve to the mobile phone.

Before I go any further it needs to be pointed out that we made some assumptions about the mobile telephones we would be developing the system for and the communications protocols used. Of course, the capabilities of most mobile telephones at the present time are limited, certainly compared to what we have come to expect from computers. Nonetheless, formats such as Multimedia Messaging are widely supported, with phones handling colour graphics, animation and polyphonic sound. A range of familiar media types are generally supported by mobile phones, such as jpgs, wav files and mpgs, and we have included these in the specification.

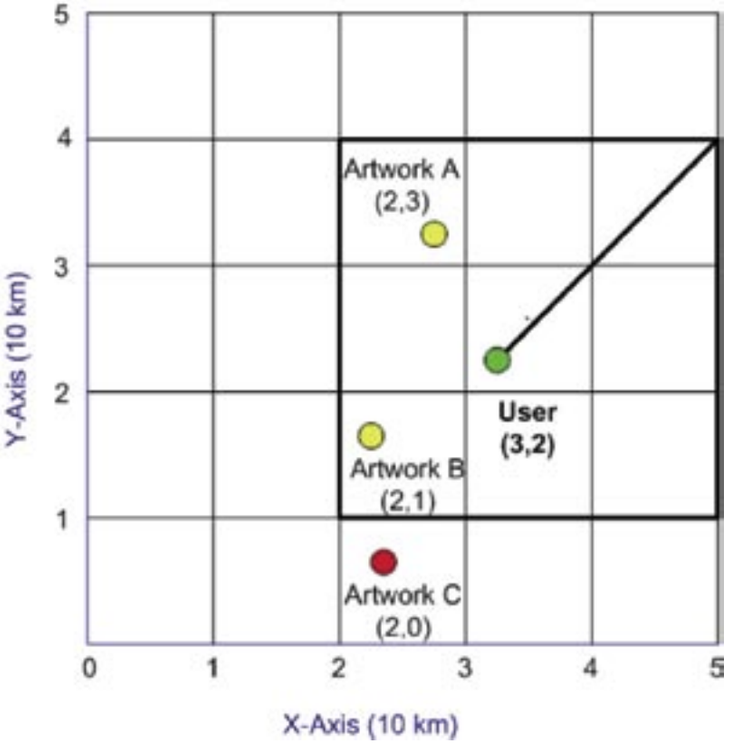
Most phones now come with some sort of internet browser that supports the WAP protocol. Some have WAP 1.* while many also support WAP 2.0 which specifies XHTML-MP as a mark-up language. In layman's terms this means web and wireless data standards have converged. The system we have designed uses the internet and web protocols. Using these protocols media can be hosted on a standard web server and content creation will only require web design and development methodologies, with minor accommodations for the limitations of mobile telephones (small screen size, narrow bandwidth and so forth). We have simultaneously excluded client side applications from the scope of the project as they are so device specific. However, Flash and Java content are usable on high-end phones; the embedding of these objects in webpages is consequently supported. The system design also makes provision for MMS and SMS media output.

The diagram below illustrates how our system will work.



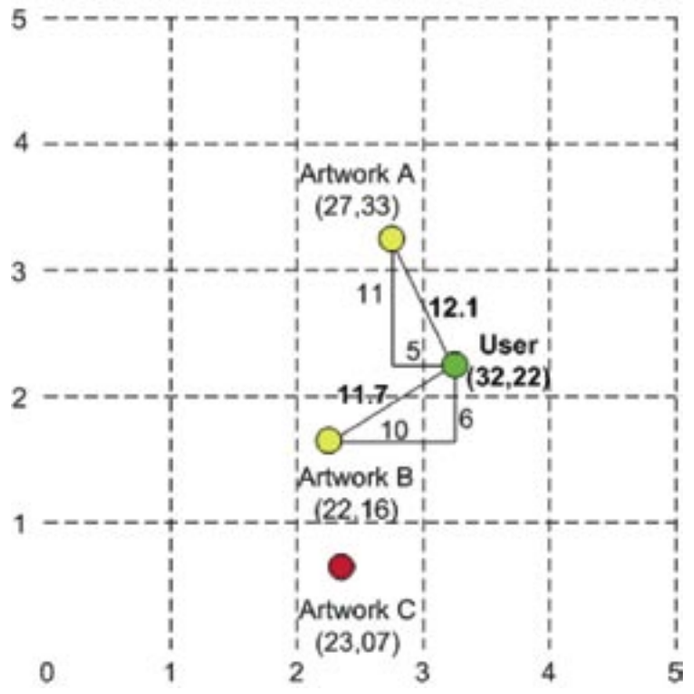
The key point is that users cannot request their location directly, they have to use a third party web service. This is what we have prototyped. The user requests art media by making an HTTP request to an artist's project URL. This triggers a request to the network location API, as explained, which returns some coordinates. The next task is to calculate which file to return based upon the artist's project, the project parameters and the users location.

The next part seems complex but, in fact relies on basic GCSE geometry. We use a 2 stage process. First we pre-process, cutting down the possible choices in a quick but imprecise way. This uses the Ordnance Survey grid system to return any locations that lie within grids that have X and Y coordinates between two parameters. Thus a user will be positioned within a grid square, so we check for art in the same grid square and adjacent squares.



To find artwork within approx 10km, simply select pieces where X is between 2 and 5, and Y is between 1 and 4

In theory this will return a list of possible art sites (although it may well return none). The next stage is to ascertain which of these possible choices is closest. This is done using Pythogoras' theorem; which states that for a right-angle triangle with short sides of length *a* and *b* and long side of length *c*, *a2+b2=c2*.



a and *b* are calculated by subtracting the *X* and *Y* co-ordinates of the user's location from the *X* and *Y* co- ordinates of the artworks' location (which is stored in the database), and the distance *c* is calculated from this. The shortest distance c is the closest art work. Whether this is the file served to the mobile phone, in response to the originating HTTP request, is down to the parameters the artist has set.

SYSTEM DESIGN & IMPLEMENTATION //

As the project diary explains, the market research conducted amongst possible users of the system didn't yield much info, so I conceived a series of sketches from which the team could create a user requirement. These sketches can be seen on the project website. The objective was to create as wide a range of projects as possible, in order that the system could accommodate widely differing art projects. Factors common to all projects were abstracted out and case diagrams were drawn – the first step in the software design process.

An important function of the system was the ability to allow artists to look-up location and upload media from the ground using a wireless device. As we have explained, the topography of GSM networks is not even and seamless. Probably the first task undertaken by an artist in an area (especially one that has had no previous projects conducted within it), would be to traverse the area, perhaps creating media as they went or perhaps simply logging location requests. This data could be stored and displayed as a graphic. In doing so the artist will be able to create a picture of the wireless space that sits on top of the physical space and therefore understand its form and extent. It seemed to us that this might be a necessary first step in using GSM networks to create locative media.

THE ONE POUND SHOP //

We took the system design so far, but we thought it would be more productive, at this stage, to illustrate the use of the system in the creation of art works. We have produced a piece called the One Pound Shop, which uses a rough protype of the system. As we are not able to launch a full service at present, other artists or the public cannot register their phones with us. To get round this we have reversed the conventional model and have the public track a single phone.

The work re-purposes commercial mapping and SMS services to look at the way the consumer model has absolutely informed technology and pervaded cultural forms. The One Pound Shop invites people to instruct, via a website, a performing artist to spend a pound, as close to his or her current geographic location as possible. The artist is then sent a text message containing the request, which he or she acts on, finally uploading media documentation to the One Pound Shop Map. The purchased piece is then sent to the purchaser.

The piece looks at the endlessness of consumption and tries to undermine the infantile reduction of life to needs met, appetites satiated. In its place I hope stories of the places and people the artist encounters, the absurdities or startling details, suggest another image of the land we live in.

Interwoven Motion: steps towards a semi-permanent outdoor self-powered video installation

Chris Meigh-Andrews
and
John Calderbank

Chris Meigh-Andrews
Working with video since 1977, his videotapes, installations and projections have been widely exhibited. Meigh-Andrews was Resident Artist in Electronic Imaging at Oxford Brookes University (1994), Artist in Residence at the Saw Contemporary Arts Centre in Ottawa, (1994), Video Artist in Residence at Middlesbrough Gallery, Cleveland (1995), Video Artist in Residence at Prema Arts Centre in Gloucestershire (1995) and Arts Council of England International Artist Fellow at Bunkier Sztuki, in Krakow (2003-04). In 2002, his solar-powered live web cast *For William Henry Fox Talbot* (The Pencil of Nature) was featured in "Digital Interventions" at the V&A, London. In 2003 he produced *Temporal View in Amsterdam* (After BB Turner) a digital projection for Huis Marseilles Foundation for Photography, Amsterdam.

Meigh-Andrews is Reader in Electronic & Digital Art, at the University of Central Lancashire, recently establishing The Electronic & Digital Art Unit (EDAU), a centre for post-graduate and staff research, within the Faculty of Design & Technology.

John Calderbank
A Chartered Mechanical Engineer who started his career in the mid-1970s as a student apprentice at GEC Traction. He graduated with first class honours in Mechanical Engineering and was awarded a Ph.D. for his work on the dynamics and control of 20,000 tonne freight trains. He worked as a Projects Engineer for GEC Transportation Projects Ltd and went on to further research on the dynamics and control of highly flexible marine structures with MarineTech NorthWest. During the mid 1980s he moved to Manchester Polytechnic as a lecturer in dynamics and control. He moved to the University of Central Lancashire after hearing of their reputation for the 'teaching' of design. During the early 1990s he worked with Chris Meigh-Andrews. He now leads three of the most successful Motor Sports courses in the UK.

PROJECT DIARY

JANUARY – FEBRUARY 2004 // PRELIMINARY DISCUSSIONS

We began with a series of meetings to discuss how we might achieve our goal – a working prototype of an outdoor "self-powered" video installation. In identifying and defining this goal, we had a lot of discussions about questions and issues such as; what was a video installation?, how would it function?, where would it be sited? and how would it respond to the environment? In the end we narrowed it down to two basic questions: What would it "do" and how would it do it?

John and I did have some common ground, as we had worked together on a feasibility study for an outdoor self-powered installation before – an Arts Council of England funded project called *Panorama* in 1993. Drawing on what we had learned from that project, we decided to opt for a simpler and less costly approach. *Panorama* had required an expensive purpose-built structure, whereas our approach to this project was to attach specially constructed elements to a pre-existing structure – a suitable tree in the middle of Grizedale Forest!

After a number of discussions we decided that the installation would comprise of the following elements:

- It would feature multiple "live" video cameras.
- It would use a combination of solar and wind power.
- The components would be mounted into large tree with the cameras encircling the trunk to provide a commanding view of surrounding area.
- The wind speed and direction and the ambient light levels would be interfaced with a camera switcher.
- We would mount an LCD display for the images at the base of the tree.

From this set of decisions we had a number of issues and problems to solve and explore.

- How many and what type of video cameras should there be ?
- What kind of image switching system would be best ?
- Renewable energy systems – what type and how many ?
- Type & location of batteries.
- Mounting systems: Cameras, wind turbine, solar panels, LCD screen.
- Methods of controlling camera switching speed & direction, light level interface.
- System/method of image relay from the camera/switcher to the LCD display.
- Issues about the weatherproofing, reliability, cost and vulnerability of the various technical components.

All of these questions would of course have to be considered in relation to our available budget, the time constraints, and the logistics of the site.

MARCH – JUNE 2004 // THE SITE

Given that the project was to be supported by Grizedale Arts, we were able to consider a number of suitable sites for the installation, but we eventually settled on a site at Lawson Park, on land that was part of the former estate of the art historian John Ruskin. This factor was of particular interest to me, because of the cultural and historical resonances that I considered such an important aspect of the project. Our chosen site also had a number of other important advantages, it was relatively accessible but not too public and it had a commanding view of Coniston Water and the surrounding mountains. As John Ruskin had noted in his diaries, the views from this aspect were particularly subject to rapid change – the weather systems, the cloud formations and the light were constantly variable.

We selected a suitable tree – tall and strong with plenty of large branches to mount the solar panels, and on the edge of a thickly forested wood. The view in one direction would be into the forest, and the other out over the lake and mountains.

APRIL – JUNE, 2004 // THE TEST RIG

A test rig was built in the technology workshops at the University of Central Lancashire to try out the various components. Solar panels, wind turbine, regulator and batteries were all selected based on their specifications and then linked together in the workshop (and tested out of doors) to ensure they would provide the necessary power and performance.

From these tests we determined that the installation would comprise of a 12 volt power system, with all components running on direct current.

- 4 solar panels, and one wind turbine.
- 2 interconnected "deep cycle" batteries with 2 regulators to control the charging rate.
- 4 weatherproof colour surveillance cameras
- 1 four channel video switcher with variable "dwell" time (length of time camera is "on".)
- 1 weatherproof LCD display.

Because of time and cost constraints we decided to relay the image from the camera switcher to the display via cables rather than to use 'bluetooth' or infrared technology as originally considered. (Later during August a decision was also taken to use a mains inverter to overcome performance problems with the 12 volt equipment regulators). We decided to mount the video switcher, the regulators and the mains inverter with the 2 batteries in weatherproof boxes which we planned to bury in the ground at the foot of the tree. Inexpensive outdoor colour surveillance cameras were chosen as they would be easily replaceable if stolen, damaged, or in case of malfunction.

The installation had a modular design with 4 main sub-assemblies:

- The wind turbine, the turbine mast and associated mounting structure
- The 4 solar panels, each with its own support arm
- The 4 cameras – mounted on a collar to be clamped around the tree trunk.
- The LCD display – clamped around the tree base.

During the period prior to assembling the installation at the Grizedale site, the work on building the interface between the camera switcher and the wind turbine was a particular challenge. Earlier in the planning stage, it was envisaged that we would use a modified anemometer to measure wind speed and the wind vane on the turbine to determine wind direction, and this information would be used to vary the dwell time on the camera switcher. This proved impractical and unreliable for a number of reasons, and for the prototype a device was constructed which tracked the rotational movement of the turbine assembly, and this information was used in combination with ambient light levels to affect the image dwell time. The ambient light levels were monitored using a number of light dependent resistors and connected in parallel with the wind direction sensor.

AUGUST – SEPTEMBER 2004 // BUILDING THE PROTOTYPE ON SITE

The prototype was scheduled to be completed by mid-September, and all the components were prepared in advance for that date. We made a preliminary site test of the turbine sub-assembly in late August to ensure the clamps designed to fit around the tree were suitable for their purpose, and planned to spend 3-4 days on site from Sept 4th. Professional tree climbers were enlisted to assist with the installation, as the turbine had to be installed at the top of the tree (approx 20 metres). Installing this proved to be the single most physically challenging aspect of the project. Once the turbine was in place, the four solar panels were arranged in a stepped arc, radiating

out from the trunk. The cameras were clamped in a ring immediately below the base of the turbine mast at a height of approximately 10 metres from the ground. All cables were bundled together, clamped to the trunk and brought to the control boxes placed near the base of the tree. The weatherproof boxes, housing the batteries, regulators and switcher were covered with pine branches, rather than buried, as first envisaged, as we felt the dampness level would have been too high. The weatherproofed LCD display was also clamped near the tree base, and mounted on the shady side of the tree.

The installation was switched on and left to operate. We planned to leave it up and running for two weeks, during which time we would monitor its operation and functioning, and troubleshoot as necessary. Weather conditions during the installation period (2.5 days) were ideal, but during the first week of operation, the weather changed dramatically and there were three days of gale force winds in the region. The structure withstood the challenging conditions – turbine, and solar panels remained in place throughout, but the high dampness levels caused major problems with the electronic components, and the inverter malfunctioned after a few days.

We plan to continue the development of the prototype, investigating alternative options for the less reliable components and ultimately installing an outdoor video installation based on what we have learned in building and installing the prototype.

REVIEW – CHRIS MEIGH-ANDREWS

DESCRIPTION //

At the edge of a wooded area in Grizedale Forest, Cumbria, overlooking Coniston Water a large tree has been temporarily equipped with four video surveillance cameras arranged in a circular formation around the trunk at height of approximately 10 metres. The images produced by the four cameras are relayed via a video switcher to a weatherproof LCD display mounted at the base of the tree. The speed and direction of the camera image flow is determined by the velocity and direction of the wind. The entire system is powered by a wind turbine and four solar panels which are also mounted within the tree.

BACKGROUND IDEAS & CONCERNS //

For some time I have wanted to make an outdoor video installation that responded to its environment.[1] Working with Catherine Elwes and John Calderbank in the early 1990's, I conducted a period of research into the feasibility of building a permanent outdoor video sculpture for the Chiltern Sculpture Trail at Cowleaze Wood in Oxfordshire.[2] Although this early project did not proceed beyond the report stage, I drew on this experience to produce a number of gallery-based video installations which utilised solar and wind power including *Perpetual Motion* (1994), *Fire, Ice & Steam* (1995) *Mothlight* (1998), *Mothlight II* (2001) and *For William Henry Fox Talbot (The Pencil of Nature)* 2002.[3]

The notion of constructing an outdoor video installation in the landscape contains many of the contrasting and contradictory aspects with which I enjoy working. It juxtaposes the natural and the artificial, making use of technology intended for interior use and placing it outdoors. I want the strength and fragility of the technology to be contrasted with the durability and vulnerability of the tree it is fused with and the landscape it is placed within. I am interested in highlighting and contrasting different notions of temporality, permanence and impermanence. The specific video images produced by the installation are in themselves of no direct consequence – they are simply part of a flow of very subtly changing ephemeral moments. For me, the relationship between the light and the wind is at the core of the work. The light and wind provide the source of the images both in terms of the generation of the electrical power which supports the video and electronic apparatus, and in terms of the direct physical and visual experience which become part of the work. (Day/night, ambient light and the movement of clouds, and foliage, the changing weather conditions, etc.)

It should also be noted that the work itself, like the image-sequences it produces, was transient. The components which constitute the work were clamped to a living tree for a period of ten days. The various bits of inexpensive technology – wind turbine, solar panels, video cameras, image switcher, LCD video display, cabling, etc. were temporary modifications, which, once removed, left no trace. During

1 In this aspiration I have drawn on two artist's films made in the 1970's: Michael Snow's *La Region Centrale* and Chris Welsby's *Seven Days*. See www.meigh-andrews.com for more background information on my previous work.

2 See *Panorama*, a feasibility study, Meigh-Andrews, Elwes & Calderbank, Arts Council of Great Britain, 1993.

the period in which the prototype installation was functioning, it was left switched on, running night and day for as long as the technical systems remained operational. Designed to be self-powering as long as the weather conditions provided sustaining light and wind, the installation was equipped with two large capacity rechargeable batteries capable of powering the installation for approximately 72 hours. Located on Forestry Commission land, it was relatively remote, although accessible via an unpaved road. From a distance the solar panels and the wind turbine would certainly have aroused the attention of curious by-passers. However, the casual visitor coming across the installation would find no explanation or context for the piece, what it was, why it was there, or what purpose it might have. Visitors were free to respond (or not) and to offer up their own explanation for its existence.

3 See "Chris Meigh-Andrews, Sculptural Video Installations, 1989-95", *Experiments in Moving Image*, Jackie Hatfield, ed., Epigraph Publications, 2004, "Chris Meigh-Andrews, Video Tapes, Installations & Projections; 1978-2001", Art In-Sight, *Film Waves*, Issue 15, 2001 and "Mapping the Image", *Digital Creativity*, 2001.

THE SITE AND JOHN RUSKIN //

The location of the prototype outdoor video piece at Lawson Park was significant, as the site was on land once owned by John Ruskin, the influential Victorian English writer and critic. Ruskin's passionate enthusiasm for the landscape of this area is well documented, not least in his published lectures and prolific diaries. His detailed descriptions of the ceaselessly changing views of the 'Old Man' above Coniston Water, of cloud formations and vivid skies provide a compelling sense of this dynamic landscape.

"From the west the wind blows fiercely towards you out of the blue sky. Under the blue space is a flattened dome of earth-cloud clinging to, and altogether masquing the form of, the mountain, known as the Old Man of Coniston. The top of that dome of cloud is two thousand eight hundred feet above the sea, the mountain two thousand six hundred, the cloud lying two hundred feet deep on it. Behind it, westward and seaward, all's clear; but when the wind out of that blue clearness comes over the ridge of the earth-cloud, at that moment and that line, its own moisture congeals into these white – I believe, ice-clouds; threads, and meshes, and tresses, and tapestries, flying, failing, melting, reappearing; spinning and unspinning themselves, coiling and uncoiling, winding and unwinding, faster than eye or thought can follow: and through all their dazzling maze of frosty filaments shines a painted window in palpitation; its pulses of colour interwoven in motion, intermittent in fire, – emerald and ruby and pale purple and violet melting into a blue that is not of the sky, but of the sunbeam; – purer than the crystal, softer than the rainbow, and brighter than the snow..."[4]

4 John Ruskin, Lecture, 1876.

For me, a connection to the cultural history of the site is an important element to the context of the work and deeply connected to a sense of the location. My intentions in the long term are to create a landscape installation that is a part of the landscape in which it is sited, a work that responds directly to and in relation to its location.

CONCLUSION //

The goal of my project was to construct the prototype for a planned semi-permanent work, and as such it is subject to further experimentation and modification. The opportunity to make and install this prototype has given us the chance to uncover further creative challenges that have yet to be met. Making and installing the piece at Lawson Park and observing the problems that have emerged has moved us much closer to our final goal.

Suggested modifications to the installation based on the experience of building and installing the prototype:

Solar/Wind Power

The primary problem we encountered was the reliability of the power system with respect to the weather. A period of calm weather during the installation stage was helpful, especially whilst installing the turbine mast. However, a prolonged lack of wind would cause the installation to stop functioning as the four solar panels could not provide sufficient current to power the work. The installation was designed to operate continuously, but in any future version of the work it might be necessary to include either a timer, a movement detector, or a light sensor to switch the image system off overnight, in order to conserve energy. This would allow the batteries time to recharge.

Camera System

Low cost weatherproof surveillance cameras were selected for the prototype, both to keep costs down and as they would be easy and cheap to replace in the event of vandalism or technical malfunction. As the image produced by these cameras was of low resolution, with a wide image contrast, this decision will be reconsidered in future versions of the installation.

Environmental Responses

The installation was intended to respond to variations in wind speed and direction by affecting the rate of camera image switching. A direction sensor was connected to the wind turbine, as the turbine is designed to face the wind at all times. A mechanism to relate the image-switching rate to wind speed proved more elusive. The video switcher selected had a variable dwell control and this was modified and linked to a series of resistors mounted on the turbine, but variations in the switching speed remained undetectable. This aspect needs further consideration.

Electronic and Video Components

The availability of durable, weatherproof electronic components needs further research. The system we installed was designed to run on 12 volts DC, and a DC inverter was used to convert the voltage for the video switcher and the cameras, and this proved unreliable. The video switcher and the inverter were designed for fairly undemanding

indoor operation, and although installed in a weatherproof case, ambient conditions proved too extreme.

THE NEXT STAGE //

The goal of producing a semi-permanent self-sustaining outdoor video installation remains a challenge that I intend to meet. Building and installing this prototype has brought us several steps closer, although there are still obstacles to overcome. As briefly described above, we have identified a number of specific technical issues that will be the focus of the next stage.

Beyond the technical challenges there are a number of other significant aspects of the project that are important to me. Locating an installation away from the gallery context and allowing those who encounter it to make up their own minds about its purpose, function and context raises significant questions to me about the future direction of my own work. In previous video installations I have explored the complex relationship between site and context mainly within the gallery setting. The reasons for tackling the technical challenges of this project clearly extend beyond a desire to make public art. In many earlier video installations/sculpture I have sought to minimize the image content of the video component, reducing the visual significance of the representation on the screen in order to achieve a more harmonious balance with the other sculptural elements. Interwoven Motion attempts to take this a stage further by integrating the stream of images it produces with the function and operation of the sculpture and its relationship to the environment within which it is installed. Although the research supported through the ITEM project is now complete, the larger project will continue.

REVIEW – JOHN CALDERBANK

ENGINEERING A VIDEO INSTALLATION ENTITLED 'INTERWOVEN MOTION' //

'Interwoven Motion' was successfully installed on a tree overlooking Lake Coniston at the edge of Grizedale forest on Tuesday 7th September, 2004. As with most successful projects there is a period of satisfaction and then, after this brief moment, the view forwards into future developments, opportunities and refinement. The engineering challenge was comprised of combining a video system linked to the weather, a renewable energy power system and the provision of a suitable supporting structure. The chosen tree was situated on the edge of the forest and had the normal twists and bumps of a woodland tree rather than the straight-as-a-line characteristics of many of the Forestry Commission trees.

Figure 1 illustrates one of the early diagrams of the system. A number of diagrams were developed and these eventually formed the system specification. (The tree and the structural design are not included in figure 1)

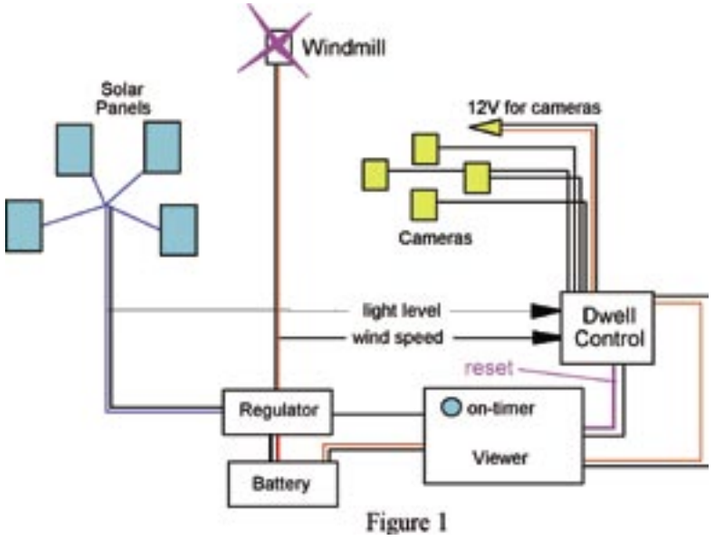


Figure 1

The 'on-timer' was originally intended as a means of saving energy. However, Chris decided early in the project that the piece should be continually 'on' with the screen permanently playing away to nature. (Irony in leaving the *tv* on). This would present a puzzle to any passers-by investigating the changing images on a screen in the woods. On occasion, it may also present frustration in being presented with a mechanism that doesn't have the energy to function to perhaps trigger a deeper reflection of the view of energy in the West? During

the installation and the following days there were very light easterly winds rather than the usual prevailing westerly winds. As a result the batteries discharged over a number of days with the solar panels only providing about a tenth of the daily energy. Achieving the necessary balance on the ratio of batteries to generators is achieved using statistics on long term projects. In our case we had sufficient batteries to provide two – three days power without any renewable energy. In a short term project like this there is always the possibility of running out of power as nature and statistics offer no guarantees. The first four-five windless days were followed by two days of gales and strong winds.

Control of the dwell on each image was achieved by using weather resistors in place of a manual control variable resistor on a security camera control box. The resistance could be varied from short-circuit to open-circuit to vary the dwell from about a second to over a minute. Initially the idea was to sense wind speed as a means of varying the dwell time. A wind anemometer had been developed with a circuit to change voltage into resistance through a number of relay controlled resistors. During a meeting to check the power systems Chris was intrigued by the motion of the wind-turbine as it changed direction to face into the wind. In that moment we had the weather input ~ wind direction and light levels. Figure 2 illustrates the manner in which, on a sunny day, the resistance of a light dependent resistor combined with the wind direction indicator (20kΩ constant wind direction, 10kΩ constant wind direction etc). This creates circumstances in which at midday on a sunny day there is little chance of seeing long dwell times. The overall resistance would be somewhere under the 20k ohm curve. The response was to have a potentiometer connected as a variable resistor in parallel with two light dependent resistors (LDRs). The direction of the wind turbine was sensed by having a small wheel on the continuously variable potentiometer which gave a random effect as the diameter of the wheel and the turbine swivel were not matched in any way. The LDRs were positioned just under the turbine so they might experience full sun.

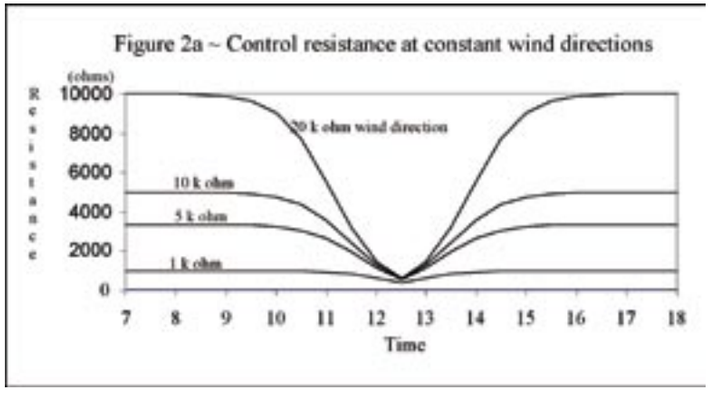


Figure 2b is a diagram of the connection of the two LDRs and the wind direction pot used on the installation. At the base of the installation there were two independent LDRs available, a pair connected in series, a pair connected in parallel and the independent connections for the 20kΩ wind direction potentiometer. There were a number of ways in which the resistors could be combined and a number of maximum values for the variable resistor indicating the direction of the turbine. The choice is wide – like Alice and the Cheshire cat. Which way to go?, subtle variation over a day or the *chaotic* movement of the wind turbine? This is an area where opinion and preference will be required to consider the impact.

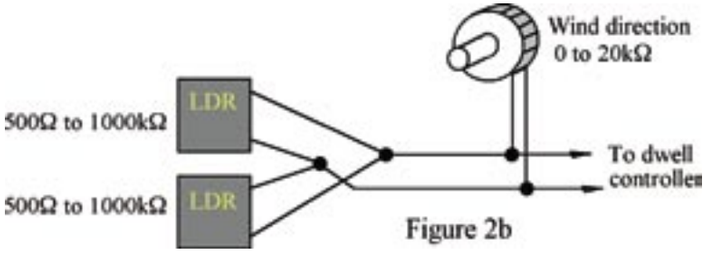


Figure 2b

We chose the broad area for the installation on our first visit. After a second visit Chris had chosen a tree on the edge of the forest near Ruskin's farm house. It was a wonderful site ~ for historical and creative reasons and also for personal reasons. The tree was also one of character and on the first visit we took photographs so that we could consider a variety of aspects. Figure 3 illustrates a picture of the tree stripped of the foliage and the canopy. The two triangles at the base represent my height of 1.5 metres. The tree was about 12 metres with the canopy. We felt we needed a structure to complement the tree. Comparative figures on a mild steel support tube to hold up the chosen turbine show that it is possible to achieve sufficient stiffness and strength without resisting the tree. The tree was much stiffer than the tube. The upper part of the tube supports the windmill. The lower of the tube does not fight the tree but supports the upper tube.

A much thicker, heavier and stiffer tube presents more of a problem with support and safety at installation and also from vandals. The product ED^4, where E is Young's modulus and D is a tree diameter, is related to the stiffness in bending. Using E_{wood}=10 GPa and a diameter D_{wood}=0.2metres gives $ED^4|_{wood}$=16MNm^2. The corresponding calculation for a tube uses $E(D_o^4-D_i^4)$ which has the ingredients $200GPa*(0.05^4-0.047^4)=0.27MNm^2$ giving a tree stiffness nearly 60 times that of the tube. The tube had enough strength to withstand the weight of the turbine and the wind force although it was important not to put holes near points of high stress. The position of the upper

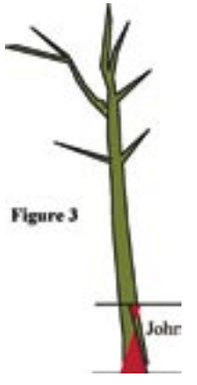
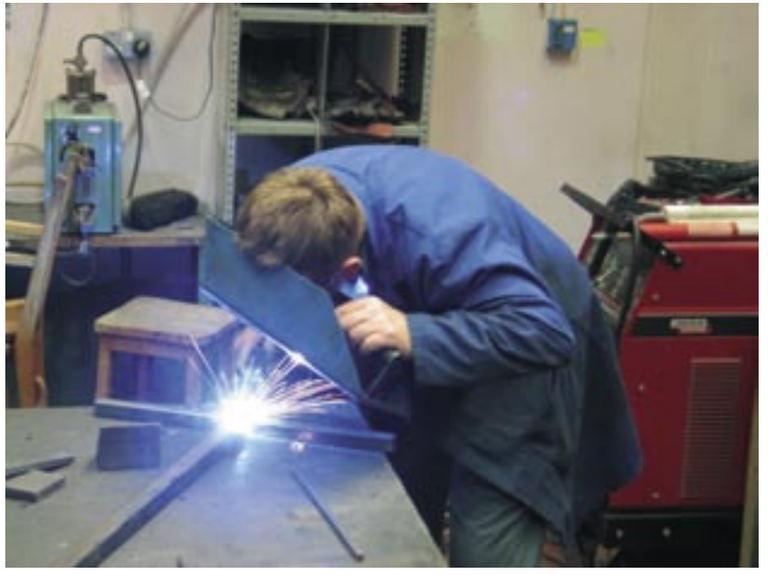


Figure 3

bracket determined the maximum bending stress. As it happened the tree climber managed to position the top bracket close to the top of the tree. Two more brackets were used for safety reasons. Appendix 1 gives some calculations. The other aspect is the weight. Most are surprised at the 10.97 kg tube mass. During installation care was taken to ensure that the tube was vertical to reduce bending loads. When taken down it appeared as straight as before we started. Mild steel was used for the structure, which is easier to buy than 'un-obtainium', and also considerably cheaper. I felt that should something buckle and bend it would have a higher chance of not snapping when out of the wind. Mild steel is ductile and can tolerate relatively large deformations. The clamps were developed using a tree outside the workshop in Preston and another trip to the tree over Coniston Water to check the dimensions. Changes to all the brackets were made in order to ensure there was good adjustability. Not many marks for beauty but good for function. All of these trips meant that the installation went very smoothly with no unnecessary trips for missed items.



The power system used a single unit to regulate the energy from the wind-turbine and the solar panels. These had separate circuits inside the unit which was bought direct from 'Wind & Sun'. I expected the turbine to produce about 50% of the rated power because it was positioned in the prevailing wind. As discussed above the prevailing wind went AWOL. The voltage regulators for the cameras did not give a nominal 12 volts and were changed for a 100 watt inverter close to the end of the project. The inverter had many safety devices installed and did not function at the start. In common with all such devices and regulators they do not work well with low voltages. In future it will be necessary to have a power controller to shut down an inverter when the battery voltage reaches a low level and restore the inverter when the battery reaches an acceptable level again. This would be a desirable feature in any such system whether using voltage regulators or an inverter.

The success of the project concludes initial work carried out over ten years ago and does indicate the very ambitious nature of that project. Having successfully concluded 'Interwoven Motion' it is intended to develop the systems and continue with these art works.

APPENDIX ~ STRUCTURAL CALCULATIONS //

The structural integrity depends on the bending str $\sigma = \frac{My}{I}$ where $\frac{I}{y} = \frac{d_o^4 - d_i^4}{32\pi d_o}$ and M is the bending moment which is a maximum (bF_w) at the upper support point giving the maximum stress as $\frac{I}{y} = \frac{d_o^4 - d_i^4}{32\pi d_o}$ indicating that the stress is not affected by the lower support length, a.

Spread sheet results (6m length of tube)

O/D=50mm : t=1.5mm			Max Stress (EN8) 500MPa			
I/D=	47	mm	Yield Stress (EN8) 280MPa			
I=	7.E+04	mm^4				
ymax=	25	mm				
Windforce	**250**	N	Dimensions	a=	3	m
Upper reaction	**500**	N		b=	3	m
Lower reaction	**250**	N		b/a=	1	
max bending stress 278.7MPa						
"Safety factor on yield" 1.0045 at the upper holding point (max bending) on the maximum load of 250N at galeforce						
Mass (6m)	10.97	kg				
Check using			278.7	MPa		

O/D=50mm : t=3.2mm			Max Stress (EN8) 500MPa			
I/D=	43.6	mm	Yield Stress (EN8) 280MPa			
I=	1.E+05	mm^4				
ymax=	25	mm				
Windforce	**250**	N	Dimensions	a=	3	m
Upper reaction	**500**	N		b=	3	m
Lower reaction	**250**	N		b/a=	1	
max bending stress 144.9 MPa						
"Safety factor on yield" 1.9325 at the upper holding point (max bending) on the maximum load of 250N at galeforce						
Mass (6m)	22.583	kg				
Check using			144.9	MPa		

On Screen View

1 Red box denotes what you see now.
2 Current country will continue to loop unless paused by using the navigator.
3 In pause mode, left or right arrows can be selected to move accross the themes.

Elsewhere In Between: The use of a non-linear content management system for the presentation of collaborative video

Julie Myers
with
BTexact

Julie Myers is an artist and lecturer at Middlesex University and currently lives in London. Since 1993 she has worked extensively with digital media including single screen projection, gallery based installation, publicly sited work and various on-line projects. The work she produces, and its presentation, is often derived from a collaborative process. The collaborator might be an on-line participant, a community group or the audience itself. The process may develop over a sustained period of time or be just a brief moment captured between strangers. Sometimes the material is assembled to form a completely new narrative as in the digital film's *Julie's Weekend* (2001) and *Love and Adventure* (2003). At other times it is produced to exist alongside the 'real world' as in *Hearsay* (1999) – an audio tour of memories that was installed at the Institute of Contemporary Art in London. The work can be viewed in both traditional cinema/gallery spaces and as web based environments where each exchange or intervention becomes an integral part of the work.
Julie has exhibited and screened work extensively, receiving a number of awards including an AHRB research award and an Erasmus Scholarship. Previous work has been commissioned by The Arts council of England, The Institute of Contemporary Art , South East Arts, BAA and The National Portrait Gallery.
http://www.julie9.org

Research & Venturing at BT's Adastral Park
Located near Ipswich in the east of England, BT's Adastral Park is the home base for more than 3,500 technologists, one of the highest concentrations in Europe. State-of-the-art facilities at the Park include one of the largest network testing facilities in the world. Adastral Park is located at one end of the UK's Cambridge-to-Ipswich high-technology corridor and forms a cornerstone of IP-City, an initiative aiming to draw high technology businesses to Ipswich and the surrounding area. The Park is home to a range of technology businesses and university faculties, including several other parts of the BT Group. The Media Tools used for this project have been produced using concepts and ideas from the Broadband Applications Research Centre's Future Content Group. The Media Tools represent more than 5 years of detailed media research by a team from the Future Content Group, and are at the leading edge of object-based media research. The development of the Media Tools has been a continual partnership with artists and media creators, and this continues to be a major driver for the work.
http://www.btplc.com

PROJECT DIARY

When the opportunity arose to work with BT Exact using their Media Tools software I decided to expand upon an existing collaboration and explore how their software might be used to facilitate the making and viewing of multiple narratives. The previous collaboration was funded by the Arts Council of England and the AHRB (Arts & Humanities Research Board) and resulted in the production of a 20 min DVD film and web site – Love and Adventure 03. In this collaboration participants from Central America, India, Europe and the Middle East shot a section of footage based on an on-line script and then sent their raw footage back to London to be edited into one narrative. The participants were not professional filmmakers but they had access to digital cameras and were prepared to use their friends, family and local environments to tell a story

JANUARY 2004 // CONTACTING THE COLLABORATORS

I contact the original participants by email and invited them to join a second phase of the collaboration. By using the same people I hope to integrate footage from both phases of the project and generate enough material to make a truly immersive environment.

FEBRUARY 2004 // UPDATING THE WEBSITE

The new script is placed on the project web site and the participants invited to choose a series of subjects they wish to shoot.

Later I will use the web site as a medium through which to establish the pattern of events in each location. When the raw footage arrives in London I will take a still image from each section and placed it on the site. This will provide me with a quick visual reference of what has been shot and give the visitor to the site a view of our progress.

APRIL 2004 // INTRODUCTION TO THE MEDIA TOOLS SOFTWARE

I am introduced to the Media Tool software by Doug Williams (Technical Group Leader) and Martin Russ (Future Content Researcher) at BT Exact. Initially the interface looks very similar to that of a CD-ROM, but it differs in that it relies upon the use of databases to inhabit a timeline rather than a set of navigational routes.

Commercially this system might be used to encourage viewers to select which, or how much of a TV program to watch. Each of the clips can exist as individual elements or within family groups. In a traditional storyline this might reference the cause and effect of the narrative. Within my structure it references subject and place.

MAY 2004 // WORKING PROMPTLY

A PC arrives at my house on loan. The Media Tools software has been developed using a PC, but my experience of computer technology is all Mac based and I don't really even know how to start a PC up. Fortunately I find out that by using DivX <www.divx.com> to compress the images I can edit as usual on Final Cut Pro and then export the footage into the Media Tools. When I require advise (which is quite frequently) I ring Tim Stevens (Senior Software Developer) or Martin Russ at BT who access both desktops remotely using VNC software <www.redstonesoftware.com>. This remote technical support is fantastic. But using the software on-line also means that the playback of images is often disrupted. I only have a few basic operating instructions for the software and I find my way around by trial and error.

JUNE 2004 – AUGUST 2004 // SHOOTING MY FOOTAGE

I take my camera everywhere with me and capture random events. Obviously (as is the way with cameras) I miss all the really good things that happened. But some themes do start to emerge and I begin to lace details from my personal life into the larger framework of the city. I also discover that a childs push chair provides a good form of transport for a tripod and video camera, but if the child wakes up they can ruin your sound track.

My shoot progresses in this haphazard manner, an eclectic mix of everyday observations and organised events, until I have either shot, or given up on, the subjects I selected.

OCTOBER 2004 // CATALOGUING THE FOOTAGE

I am still waiting for most of the footage to arrive in London, but I get start to get the material that I do have translated by various friends and contacts.

I time-code all the raw material including the off camera comments and asides.

Over the past few months I have learnt how to use the Media Tools software and have created some small test demos. At first the labeling system seems quite restrictive but I discover that I can ignore the standard formats and make my own database headings. My indexes reflect the existing script structure – ACTION, DIALOGUE, CHARACTER, EXTERIOR LOCATION etc.

Unexpectedly one of the collaborators drops out. I am in the middle of deliberating about whether or not to get another participant when a carpenter who is working on our flat says he thinks his wife knows someone who has a friend who lives in Tehran who works in film. This seems like as good a way as any of finding participants, so I email him and by December we are joined by Amir Nedaei from Tehran (a friend of a man who knows the wife of a man who is a carpenter in London).

NOVEMBER 2004 // THE VOICE-OVER SCRIPT

I search the footage and the emails for moments when the different places seem to echo or contradict each other. I email the participants again asking them for personal details and information about the things I see and hear on their tapes. I hope to establish some sense of the individual person and reveal the similarities and differences between the various locations.

JANUARY 2005 // FIRST EDIT

I have received a huge amount of footage of varying qualities and styles. To understand the footage and how it might work together I make a linear

edit for each country. This will allow me to attach the voice-over recordings and to decide upon the length and the rhythm of each section.

Later this first edit will be dismantled into the subject headings and inserted into an interactive structure. In retrospect this was too much work for something that in the end I will not use, but at the time it helped me define each persons contribution and understand where the points of crossover might be.

MARCH/APRIL 2005 // RECORDING THE VOICE-OVERS.

I need to find people who can read and speak English but still retained the accent of their homeland. I ask around friends and work colleagues and place adverts on university web sites for voices. I interview the people that respond over the telephone to see how their voices sound. I wanted imperfection in my voices. My difficulty is that some of the voices are too good. But by insisting that the grammatical mistakes are integral to the script I make my recordings.

MAY 2005 // 2ND EDIT

With the help of Matt White (an artist/editor) I place the voice-overs and additional sound extracts into the footage. We tweak some of the images and sounds, but never add anything that was not from the original tape.

JUNE/ JULY 2005 // 3RD AND 4TH EDIT

I dismantle the linear edit into long and short clips of SUBJECT and PLACE and save them into the appropriate databases.

SEPTEMBER / OCTOBER 2005 // DATA BASES AND MARK UP

As I mark up all the clips into SUBJECT and PLACE an unexpected numerical system develops. Inside every folder are clips numbered from 1- 5. These numbers seem to form a different pattern of cross-referenced clips. If, for instance you select all the number three clips from each folder you can see a short movie of the third option subject. This numerical system introduces a completely new way of viewing the clips and I fragment this pattern even more by using the Funnel tool to limit the number of clips on the timeline.

As the footage begins to lose its linear structure it seems to offer up a more poetic or abstract view of the material. The disjointed voice-over and visual disharmony give a much truer sense of the original video footage. These accidental moments make the footage look fresh and new again.

NOVEMBER – DECEMBER 2005 // THE CONTROLLERS

If all the participants had shot every subject there would have been 250 clips. But on average we shot about 30 clips each. So there are about 150 long clips, plus 300 short clips, equaling 450 clips in total.

The intention is to enable the user to view the footage in as many ways as possible without losing a sense of the whole story.

JANUARY 2006 // THE INTERFACE

Making the interface has become very difficult. It's the old problem of Mac verses PC's, plus the fact that the software is still in development and not available for end users yet. A good compromise would be to record a number of viewing options onto a DVD to give the sense of what is possibly. This would need a Flash interface to bridge the gap between the PC infrastructure and a cross-platform environment. But, as I write this, I don't know if we have enough time or money to finish it.

PROJECT REPORT

THE COLLABORATION //

In some instances the second phase of the collaboration was much more successful. The questions of – Why me? or What does she want from me? had mostly been resolved through participation in the first project – Love and Adventure. An element of trust had developed between the group which influenced how each person revealed themselves to camera.

Happily, the inclusion of a new participant did not seem to have effected the overall balance of the footage. The flexible nature of the software allowed for source material to be added into the project at any time during the process. Unlike a conventional editing package material does not have to be gathered or edited at the same time. The amount of footage shot was never restricted. Some of the participants shot six hours of tape and others shot one hour

In my opinion the natural development for the Media Tools is as some form of open source software. If a cut-down version of the tools had been available on-line during this project the working infrastructure could have been extended to include more instant contribution from the participants, In this instance, although a spirit of collaboration existed between us, I made all the editorial decisions.

THE FOOTAGE //

The increasing accessibility of the digital video camera greatly informed the personal and subjective style of the footage shot. Almost akin to the early days of moving image when the Lumier Brothers made their "actualities" this footage documents the everyday lives of the participants. We see them eat, talk, dance, sing, argue, get washed, get drunk. Each vignette offers us an insight into both the external location and the character of the person behind the camera.

In the footage there are obvious safe environments where the camera can shoot unhindered, and there are situations where the camera becomes intrusive and we feel the tension as the camera (person) turns away from confrontation. All the participants found ingenious ways of gathering their footage. Some used friends to act as decoys, others used busy public spaces and became like tourists in their own cities. Some re-enacted events, others captured footage "on the hoof", stopping and starting the camera abruptly to avoid detection.

As we see the different styles and techniques develop the viewer begins to understand the diverse relationships that exist between the observer and their subjects.

The audience, although able to distinguish some of the social and economic detail of each country will not always be able to locate themselves precisely. The intention is that they become immersed in a mixed global landscape with almost accidental associations informing their journey.

THE WEBSITE //

As I received the footage in London I took a still from each section and placed it on the web site. This matrix provided a quick visual reference for the project and became the blueprint for the final edit. Initially my intention was that the web site would become the focal point between the group. But, in reality, we became much more reliant on email and international parcel post than on the web site. The participants all had different levels of access to technical support. And the low budget nature of the project (each participants received £250.00) meant that the work had to fitted in around other things.

Perhaps if we had been able to embed some of the database structures into the website the participants would have taken more control of their contribution but still the technical limitations would have restricted what we could have achieved. Some of the participants worked in remote rural areas, miles away from any internet connection. This is what made the footage so diverse..

In retrospect the email communication should have been more like a blogg. This would have gone some way towards making the web site more vibrant and provided a text based document of our process.

THE MEDIA TOOLS SOFTWARE //

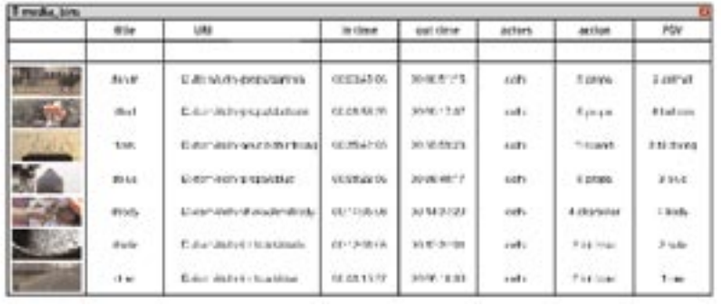
Within the Media Tools software there are two elements. The Media Bins which hold the clips and the Templates that controls how those clips are used. Within the Templates there are various options or filters that dictate how much of, or in which way a clip might be used

The first level of mark up I defined was PLACE and SUBJECT.

So, for instance, if you selected DRIVING you would see a random view of all the DRIVING clips. Or, if you selected one of the PLACES, say DELHI, you would see a linear playback of one clip from each of the script heading. One ACTION – one DIALOGUE – one CHARACTER – one INTERIOR – one SOUND etc.

In addition to each of these mark ups I also added another option of CROSS REFERENCE. This level would allow the user to move between the different databases to create sequences from their own associations or accidental connections.

I also added the option of long clip or short clip. By cutting the longer clips into two shorter sections the user could choose to watch a sequence made up of either 6 second or 25 second clips, depending on how long they wished to engage with the material. The introduction of these two shorter clips meant that even if the same selection was made twice in a row a set of different clips might appear.



THE INTERFACE //

The interface is four drop down menus – PLACE, SUBJECT, CROSS and REFERENCE. Designed very much like a web interface I hoped its familiarity would make the selection easier for the viewer.

The danger of being the artist/editor is that you know the footage too well. When offered the possibility of presenting the footage in multiple ways the trick is not to fragment it too much.

By using a simple interface I hoped that the viewer would feel able to roam around the footage, dipping into certain bits and leaving out others, without losing a sense of the whole narrative.

THE VIEWING EXPERIENCE //

This project attempts to explore new structures of production and consumption. The traditional assumption that we learn through the insight of an authors understanding is being questioned. By creating an interactive framework the audience can respond to the work on many different levels and through many different voices.

There is no beginning, middle and end. The audience are invited to join the narrative at any point and view it through a series of cross-connected stories. By encountering a film without a fixed narrative the audience are invited to use their own mental habits to interpret the environment. The best experience might be accidental, where a personal memory is triggered, or a place comes to life as we glimpse into a parallel world.

A-Cycles

Gregory K. Byatt
and **Alexander Wendt**
with **FeONIC plc**

Gregory K. Byatt
I am an experienced practitioner of electro-acupuncture. I run group relaxation classes and use sound as an integral part of my therapeutic approach to treatment. For long periods of childhood my life was dominated by illness and pain. My inner ears were the focus for infection and a regular feature in the frequent prolonged absences from school life. One method that I discovered to stop the pain was to rub some modeling clay up and down the side of a bamboo bookcase. The rub, rub, rub, noise would fall into a regular pattern and I would drift away into a dream. It worked nearly every time. I was always aware of how suitable the proper use of music and sound would be, to ease the passage of time spent waiting for treatment and during prolonged treatment sessions. Not just random radio station diatribe and pop 'wallpaper' music but music whose purpose was to relax and act as a balm to the troubled. I came across the work of Dr. Jeffrey Thompson through his use of NASA planetary recordings and brain wave frequency processed tapes. Eventually I studied on his Bio-Sonics Course in California. (www.neuroacoustic.org.) During the time that I was running the alpha palace in nightclubs, one of my aims was to create an (alpha) state of relaxation by setting up a low frequency signal that the brain could lock onto. Not an easy task when trying to modify the pervasive hard bass pulse from the DJ's decks pumped out through the house P.A. system. Headphones and sub woofers helped to deal with the difficulties. We created the opportunity to work in a quieter environment with this project and not have to compete with a dominant driving bass signal and could test ultrasonic binaural signals. Most of my involvement with sound, music and mood state had been in a therapeutic setting, but the Alpha-Cycles/ITEM Project would be with the general public in gallery spaces. We had the support of FeONIC and their innovative new sound delivery technology which would provide a unique opportunity to explore new technology in an innovative way.

Alexander Wendt
I am a German New Contemporary who utilizes an extremely wide range of frequencies to compose sound design for radio, film and theatre. I produce audio visual content for the live performance space, and lecture part-time in media. I am interested in stretching what is defined as music and how to enhance musical composition by the use of the full spectrum of what we are actually able to hear. Popular music totally dismisses the potential 20 - 20,000 Hz capability. Music in general is dominant at a mid range and bass spectrum, and I am interested to incorporate sounds of far higher and even lower range than what is common and turn music into an electro- acoustic experience. I believe the fusion of acoustic- and computer assisted music composition can be the key to creating the future music. In 2004 I produced the Frequenzen DVD-Rom for the International Centre for Digital Content in Liverpool. That is when I came across the principle of binaural beats; I tested these and believed to encounter a beneficial soothing effect, though I could not yet explain why. At almost the final stage for the ICDC project I got to know Greg, who was willing to answer my questions and give me an insight to his experiences researching the deployment of frequencies for therapy, relaxation and general. This confirmed much of what I had been studying and I experienced first hand what Greg was talking about. Our meetings made me realize that embracing the world of frequencies with the Frequenzen project could only be slightly better than what is called a humble attempt. I was happy to finish the DVD, but was intrigued to go further and start a new project and utilize the walking Byatt Research Library. The sources were vast and seemed chaotic at the start, but narrowing down what we both were interested to work on has lead to what is now the A-cycles Research.

FeONIC
FeONIC (formerly Newlands Scientific plc) was formed as a co-operative spin-off from the University of Hull in 1994. FeONIC specialises in the development of products based on Smart Materials. These materials, like Terfenol-D, display extreme magnetostrictive properties and can expand and contract at high speeds, creating great forces. Magnetostrictive materials transduce or convert magnetic energy to mechanical energy and vice versa. As a magnetostrictive material is magnetized, it strains; that is it exhibits a change in length per unit length. Conversely, if an external force produces a strain in a magnetostrictive material, the material's magnetic state will change. This bi-directional coupling between the magnetic and mechanical states of a magnetostrictive material provides a transduction capability that is used for both actuation and sensing devices. Magnetostriction is an inherent material property that will not degrade with time. The project was also had the support of Aerotech Projects Ltd. www.globall.com A company with expertise in product design incorporating programmable LED technology. They developed the drawings and aluminum support design for the Blue Moon Sounders, our ultrasonic delivery system and supplied LED's.

Thanks toWibke Hott (FACT), Chloe Byatt (assist), John (assist), Clare Gabbott (Video),Barry Preedy, Brenda Hopkins and Brian Smith and Dr. Kamlesh Prajapti at FeONIC, Markus Soukup (graphics), Lucy Byatt (graphics), Lian Harter (voice), The women at the WEB, Birkenhead.(Pre Testing) Everyone at Prenton Day Centre.(Pre-Testing) Frank Usher and Andrew Robinson (pre-testing).

PROJECT DIARY

GREG BYATT //

"I first met Alexander when he came to ask advice about his DVD-ROM that he was submitting for his course at the ICDC. When the opportunity to create a project for the ITEM was presented to me, it seemed appropriate to work together and to synthesize our creative talents and different abilities and find an application use of potentially mood changing audio frequencies in an artistic gallery setting rather than a therapeutic environment. My experience with audio therapeutics and educational group work and Alexander's design skills would be a powerful combination.

In some circumstances it would be inappropriate for the audio to interfere with artwork. Our intention was rather to enhance the work. Thus the idea of using an ultrasonic carrier frequency as a non-perceptive signal was built into the project. I had been interested in FeONIC sonic transducer technology and its potential since purchasing the 'Soundbug' – an application of smart materials – to turn electrical signals into sound. They offered technology and technical support. Their transducers were capable of delivering ultrasonic frequencies. The project was born."

ALEXANDER WENDT //

"When thinking of a target for the a-cycles project I immediately had an image of the busy Tate Modern in London and its interior buzz caused by the thousands of visitors wandering the halls. Ideas to influence how art is experienced in this relatively 'noise polluted' environment led to a concept to make a non-audible sound installation that becomes an integral part of architecture – an installation that calms the visitors and generally benefits the communication of the artwork with its spectators and thus enhances the artistic intent. It was important to test whether binaural beat information can be created with non audible means, as this project was meant to be of benefit for exhibition spaces and art galleries and therefore should not interfere with exhibits and leave the artistic intent untouched. FeONIC, as technology partner provided technical expertise and supplied transducers that gave way for a new approach to bring sound into architecture and create a discreet acoustic interior design. The a-cycles installation and research was an experiment to test the application of a new technology developed by them."

PROJECT REPORT

Ultra low frequency audio information has been the subject of exploration for the last thirty years, initially building on the work of Heinrich Wilhelm Dove in 1839, but latterly Oster's definitive 1973 paper on binaural beat information which revealed the ability of the mammalian brain to create vibrational frequencies below our normal level of hearing. The normal range of human hearing is between 20 and 20,000 Hz (cycles per second). The ability to place sounds in space is vital for survival in a hostile environment. Hearing a predatory animal in the undergrowth and being able to localize that sound and detecting where the potential danger originates from, long before it becomes visible is a distinct advantage. An extension of this survival ability is to be able to create frequencies from audio information fed separately to each ear (ideally via headphones). The facility to take two separate tones and create another tone or frequency in our brain, means that frequencies below our hearing threshold can be perceived and have an effect on our physiology. Our brains have regions of neural activity where pulsed electrical signals or vibrations can be detected electrically. Known as 'brainwave frequencies' these states of mind have been arbitrarily grouped into various bandwidths according to the observed behaviour. Brainwave frequencies in the alpha range (so called because they were the most prominent electrical frequency signal and were the first to be found) are detected at 8 to 13 Hz (cycles per second). They are more evident when we are in a calm contented state. Daydreaming, drifting into a trance like state while lying on a beach, or while passively watching television. How often can you remember your teacher at school asking you: "What did I just say? We are immediately alert and fully conscious when another stimulus enters our attention domain, in this case a question about content. This is one of the normal mood states, the alpha state. Many studies have shown that this alpha state is present when we are relaxed, calm and in a non-stressed frame of mind.[2]

2

ENTRAINMENT.

The language of the brain is frequency

There is a natural tendency of all objects in the universe to resonate (or vibrate) at their natural frequency. The spiral galaxy in andromeda, the planets round the sun and the moon round the earth. Here on earth, it is the same. Huygens famous experiment with two pendulums of equal length, starting off at different rates of swing and synchronizing without any intervention; then continuing to swing for a longer time than would be expected, demonstrates the phenomena of entrainment and resonance. Mammalian brains are no different. Listen and watch your feet tap in time to music, feel the pulse in your body after a night out at a techno club. Mood follows also the beat. The sadness of blues and the buoyancy we experience after listening to Mozart. These are all examples of entrainment. Sound or frequency can achieve the

Frequency Following Response (FFR) or the Zeitgeber (lit. Time Giver) and entrain the predominant brainwave frequency. In this case the alpha frequency which is below the level of our auditory perception.

Binaural Beat

The Brainwave frequency range we were attempting to access is between 8 and13 Hz. By using a binaural beat we can set up an entrainment frequency to encourage an alpha state. Even though we are unable to 'hear' below 20Hz, if we set up a tone in the right ear of e.g 50Hz and in the left e.g 60Hz our brains will create the binaural beat of10Hz. This scenario is purported to be true up to 1000Hz whereafter, according to some sources, we lose the ability to create a natural binaural signal. The bony structure of our skulls is our internal echo chamber in which the size and curvature of our skull can accommodate the wavelength of frequencies from 1KHz and below as a carrier frequency for binaural information. (Oster 1973). For this project we wanted to try using a carrier signal above the top end of the perceptible audio spectrum i.e greater than 20,000Hz. If this signal is above our hearing range then we could have almost imperceptible entrainment signals and not then require music to mask the sound frequency. Different music or sound could be played locally, for example at the site of each piece of art within an exhibition and then have a global effect in the Ultrasonic range throughout the gallery or installation. We opted for a carrier signal of 22,005Hz with a binaural beat created at 10Hz by using 22,015Hz on the other side.

To encourage the alpha state in audio relaxation recordings, headphones are used to ensure even frequency signal strength (though individuals with hearing that is deficient or one sided have no lessening of the ability to create the Binaural beat) and greater control of the audio environment. Headphones are much less practical in a gallery. Our initial intention was to use a surround sound recording but time and practical difficulties meant that that will have to be part of a future project. After a great deal of discussion and deliberating, we decided that our best method of testing our theories with an audience would be to construct a series of short 10- 30 second factoids, brief sequences that could contain information to be recalled in a novel and exciting format. The sequence would be about ten minutes long. We would use a factual recall questionnaire and a mood assessment diagram with image recall as a visual rather than factual test device.

Initially we intended to play the sequence with the binaural entrainment frequency and randomize the images and then play it again without the binaural entrainment frequency. It was decided that this had too many variables to ensure a meaningful conclusion. Mood is a difficult factor to quantify meaningfully and a change in mood even more so. We then decided that we would have three versions of the Factoid video. Visually they would be identical, but the soundtrack would significantly differ.

These would be ;

1) The stereo soundtrack with no binaural frequency information. One of the same frequencies used would be presented as a monophonic signal (22,005Hz.) and 58Hz at the lower end of the audio spectrum.
2) A Low frequency binaural signal created with 53Hz and 63Hz also with the monophonic 22,005Hz.
3) An Ultrasonic High Frequency Binaural signal with 22,005 and 22,015Hz mix also with a monophonic 58Hz bass frequency

Working in partnership with FeONIC plc allowed us to access a range of materials that could be capable of producing the required frequency outputs in a discrete and simple arrangement that might be appropriate for the gallery situation.

FeONIC plc www.feonic.com is an innovative company specializing in the application of smart materials, such as Terfenol-D (a blend of iron and rare earth metals), which is a magnetostrictive material that can change its shape at very high speed. The actuators convert electromagnetic signals into a form that will vibrate any flat surface and turn windows, tables, sculptures and paintings into loudspeakers.

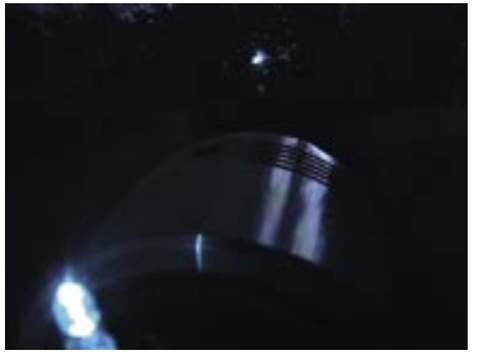
Terfenol-D is an intermetallic alloy of the lanthanide elements terbium (Te) and dysprosium combined with iron (Fe). The name combines the symbols for the elements with NOL, the abbreviation for Naval Ordnance Laboratories. Originally developed by the American Navy as a sonar device for underwater detection of submarines, the material was later licensed for commercial use. Sonar equipment is the classic application for transducers, which are used to create sound signals underwater. Mounted in an oil-filled housing, they can produce sound beams across wide frequencies.

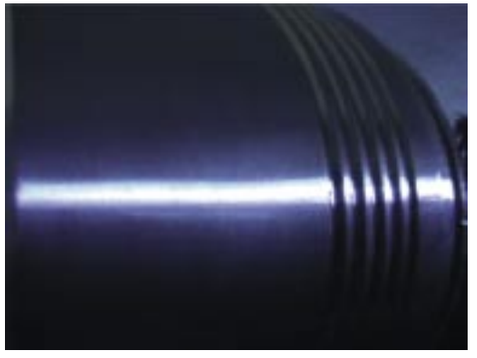
During the second world war, the dominant transduction material for sonar was nickel. This was later supplanted by piezoelectric ceramic materials. However, in the 1970s, the Washington-based Naval Ordnance Laboratories (NOL) wanted a material that would provide reliable higher-power sonar that worked over a greater range of frequencies. On its own, in a magnetic field iron expands by 70 parts per million, but Terfenol-D has 'giant' magnetostrictive properties of about 1,000ppm. It can operate at up to 20,000Hz, expanding in direct proportion to the magnetic field, and will not deteriorate over time or the number of cycles unlike piezoceramic rivals.

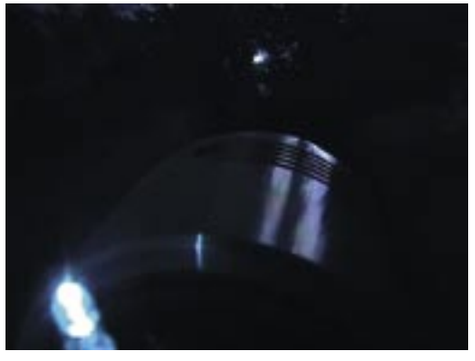
FeONIC's popular soundbug is a portable gizmo based on the Terfenol-D technology that is able to turn any flat surface or even your skull into a sounding board for mp3 players, laptops or mobile phones. Whispering Windows is a similar device for commercial application to enable a shop window to talk to potential customers passing by. We utilised these for frequency delivery to drive two different audio devices to project the binaural frequency information.

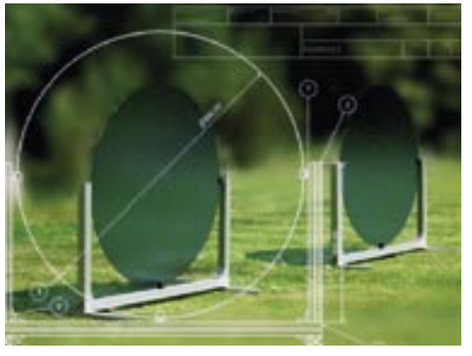
High Frequency Delivery

Tests at the FeONIC base in Hull convinced us to work with glass as the best medium for the high frequency delivery. Sufficient levels of sound pressure (75dB) were measured by Dr.Kamlesh Prajapti (FeONIC's Director of Technology) using the ultrasonic frequencies. Two 900mm blue circular toughened glass discs were held in a specially designed aluminium frame as the high frequency panels. These would project binaural information (22,015 / 22,005 Hz) using the D-70 High Frequency Drivers mounted on the centre of the discs.





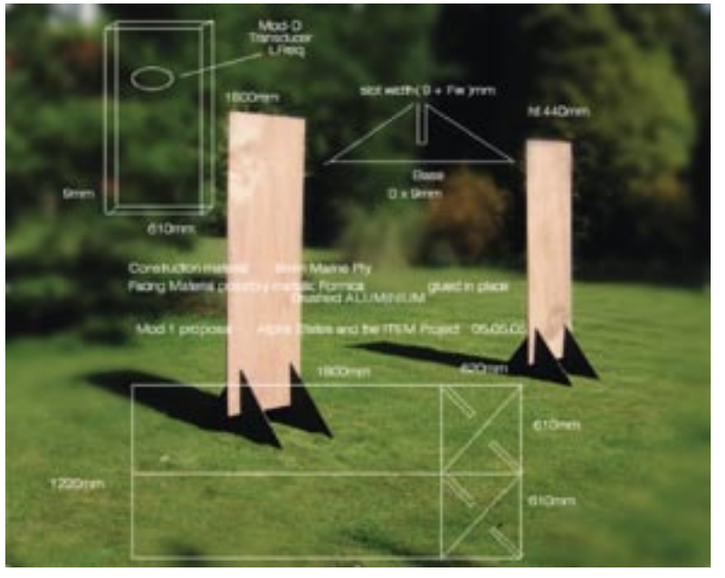




The use of glass in a public environment brings its own difficulties; concerns about safety and fragility being paramount. Various designs and suitable components were attempted, costed and discarded before finalising on the design used.

Low Frequency Delivery

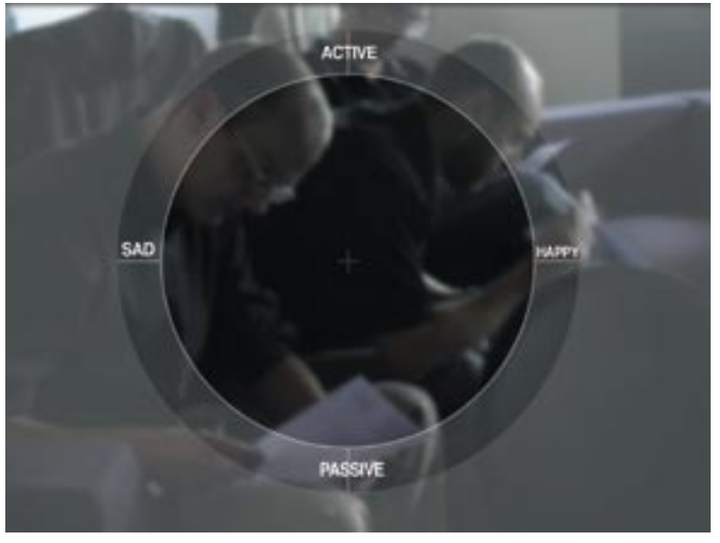
From small sample testing and clinical experience it was decided to use 53 Hz and 63 Hz, as the low frequency binaural component. The low frequency delivery panel was built from 9mm Marine plywood. We designed the two sounders from one sheet of 8 x 4 ft with minimal wastage and clad the facing with Brushed Aluminum Panels in keeping with the design aesthetic. The bass frequency delivery was made using specially modified FeONIC X-30 sounders. The sounders were attached to the surface with adhesive pads to ensure the best possible transfer of sound as a planar wave resonates through the substrate of the material. At least one square metre of material is necessary to ensure an optimum sound delivery. The sounders can be driven by any stereo amplifier in the same manner as conventional speakers. The ability to turn any object into a sound system surely has an appeal for artists, sculptors and sound artists to enhance their art work by adding sound to the piece. Work has already been made using glass bathtubs, sculptures and conventional paintings.



PROCEDURE

Each participant was asked to record their current mood state before the installation run. Adapted versions of Russell Mood Assessment (RMA) diagrams were used for this purpose. In a circular diagram

with four coordinates labeled happy, sad, active and relaxed each of the participants were asked to mark a position with a cross that they believed would best describe their mood at that moment. The second RMA-diagram was based on a similar idea but presented opposites in a linear way. On a gradient scale the participants were asked to evaluate their mood state in terms of the following criteria: alarmed/astonished, afraid/excited, annoyed/delighted, distressed/happy, sad/glad, depressed/content, bored/relaxed and droopy/calm. All criteria that did not apply to the individual's mood state was to be left blank. Following this the participants watched a movie, the showreel. The showreel is supposed to run accompanied by alpha transducing devices. For the research purposes a questionnaire was handed out and the participants were asked to answer a few probing questions about the film's content and give information again about their mood states while they watched it. Afterwards a voluntary hearing test was done for each individual.



Biophysical Parameters

Two cardiac rate monitors were used to record the pulse rate before, during and after watching the video presentation. These were the exercise type that strapped round the chest with a lead connecting them to a display of the cardiac rate. They were awkward and time consuming to use in public as partial undressing was necessary. The fingertip recorders and earlobe clip devices would be more suitable for group work. We would have liked to have been able to measure a greater range of biophysical parameters activity, but project time and funding was limited. We were fortunate enough to have the use of two rooms in the FACT building and we had the excellent assistance of the ITEM staff from 10 – 13 June 2005. The Medialab was converted to a mini cinema with the new audio technology on display and a conference room was used to fill in the questionnaires and assess the upper limits of audio frequency that could be perceived.

192 participants took part over this four-day period.

FACTOID FILM AND SOUNDTRACK

The Factoid film consisted of a 10 minute collage. Similar to zapping through TV channels in which the viewer is confronted with a whole range of visual stimuli. Short narratives intermingled with abstract imagery; plain designs conveying information, famous quotes and seemingly random footage were used to produce a sensual tidal wave. The video was a vehicle for an overload of information; text, sound, color schemes and subliminal flash imagery. Furthermore it supplied the frequency information and served as carrier medium for all data that would later inform the questionnaire. The cinema system's surround sound channels were utilized and supplied the low and high frequency stereophonic signals and the movie's soundtrack. Two glass panels were used to project the ultra high frequency information and two wooden panels for the low frequencies.

QUESTIONNAIRE + INDIVIDUAL TEST

After viewing the factoid film all spectators were asked to take part in an assessment and complete a questionnaire. This was structured into four blocks. A three-part questionnaire and a hearing test. In the questionnaire each spectator's mood, before and after being exposed to the installations acoustic environment was recorded; multiple choice questions were set to test the spectators information recall and finally the participants were confronted with chart of pictures, some of which had appeared in the factoid film. Some of these pictures appeared on screen for just a fraction of a second, and projected information in an almost subliminal manner. After completing these three stages each spectator had a voluntarily hearing test. This test determined the individual's hearing threshold and served as an interactive part of the public event.

However we learned from the audio tests was that five individuals with exceptionally good hearing and a hearing threshold of over 20 kHz were amongst the audience. In the test they described their acoustic experience of similar ultra high frequencies in different ways –

descriptions ranging from an electricity-like humming, tiny crackling or piercing internal sounds to a mere wind or pressure that could be felt. We felt that the crackling was actually either a digital artifact from the soundcard or due to the 'aliasing' occurring from 20 kHz upwards when using a sampling rate of just 44,100 kHz. This was amended in subsequent tests by using a 48 kHz sample rate for the sound files.

QUESTIONNAIRE //

Information Retrieval Device

We devised a factual recall questionnaire with 21 multiple-choice questions and scored the replies to give an overall percentage score in each group. To try and assess visual information recall we included two other questions concerning background colour and not factual recall.

Flash Images

To assess visual information retrieval 11 images were inserted into the factoid film. These were either between factoids or inserted during a factoid sequence.

Their frame rate was between one frame (1/25 or 0.04 sec) up to five frames (1/5, or 0.2 sec). A scoring system was devised based on these factors and analyzed accordingly.

Mood Diagrams

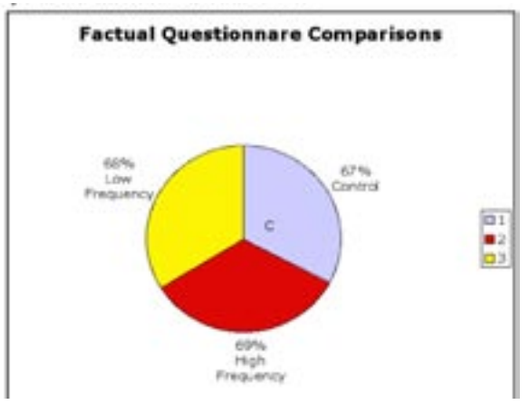
In an attempt to gauge a self perceived change of mood. We adapted Russell's Mood Assessment diagram. Three field trials with various groups were assessed before we decided on the final version. Participants were asked to place a cross at the point that best described their mood state at that time and then repeat the exercise after they had seen the film. The first set of charts were collected immediately so as they could not be compared with the original.

CONCLUSION, OUTCOME AND EVALUATION //

All the data was collated and sorted into the three different groups L, H and N. The responses to the multiple-choice questions were analysed for three aspects (factual information recall, image recall and self assessment of mood).

Particular facts from the film were asked to be recalled; (Who said.. ? When was..?) Multiple choice options were provided. Evaluation has shown little difference in the scores for each group in the multiple choice factual data recall.

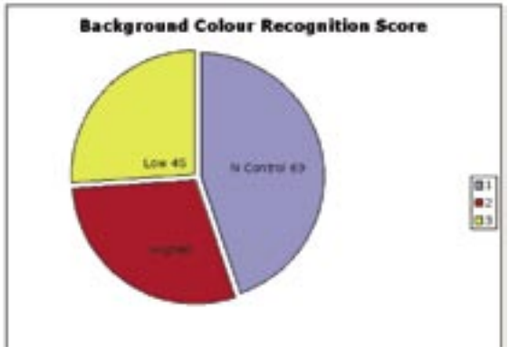
1) Factual Iformation Data Recall



Conclusion

Binaural frequencies either for the ultrasonic (H 69%) or for the low frequency group (L 68%) did not affect the ability to recall factual information, compared with the control group (N 67%) . No clouding or dulling of consciousness was instigated by the binaural frequencies and there was perhaps some percentage difference due to the slightly larger numbers in the binaural frequency groups (L 68 and H69, Control N 57)

2) Image recall



A) REGARDING COLOUR VISUAL (INCIDENTAL) //

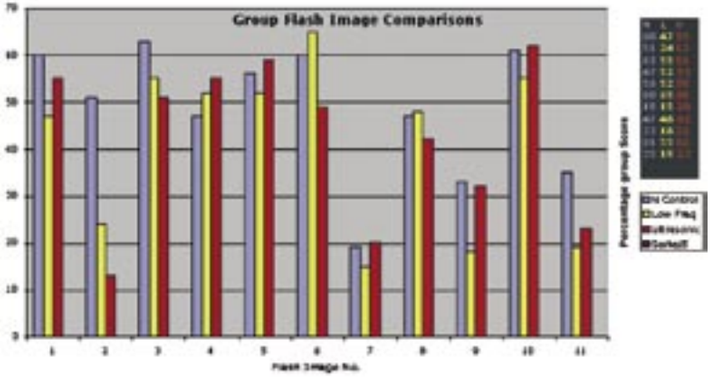
In this section the participants were asked to recall the background colour of two sequences, a relatively unimportant part of the presentation. The score for the control group was significantly higher (69%), almost as much as the other two groups combined. The two binaural groups scored low (L 45%) (H 40%).

Conclusion

The binaural beat appears to affect the ability to recall secondary visual information. Assuming they are in a state of increased alpha activity this poses the question whether the ability to recall peripheral as opposed to core information is reduced ?. Further investigation is needed into the defining and demonstrating of an alpha state. Perhaps this could be achieved with concurrent brainwave monitoring and then only testing parameters when the brainwave state is clearly demonstrated. Two questions are insufficient to make any definitive statement about this unexpected finding but we seemed to have a clearly defined difference between the groups and further investigation of this aspect of the research would be needed to assess what implications could be inferred.

B) REGARDING FLASH IMAGES – VISUAL (SUBLIMINAL) //

Data from the flash images was collated; each frame was given a numerical value and a value for its duration in order to assist the analysis. There were 5 images of 3 frames (0.12seconds) duration, 3 images of 2 frames duration (0.8sec) and 1 image of each 1 frame (0.04sec), 4 frames (0.16sec) and 5 frames (0.20sec) in duration. In total 11 images of different length could potentially be recalled.



From the above graph it can be seen that the control group once again scored highest in recalling flash images. Some interesting observations can be made. Image 7 was a red parrot that appeared just before a factoid sequence on bird song. It was shown for 0.12seconds, ie. 3 frames. It appeared in context of the sequence and yet, was one of the least seen of all images.

Conclusion

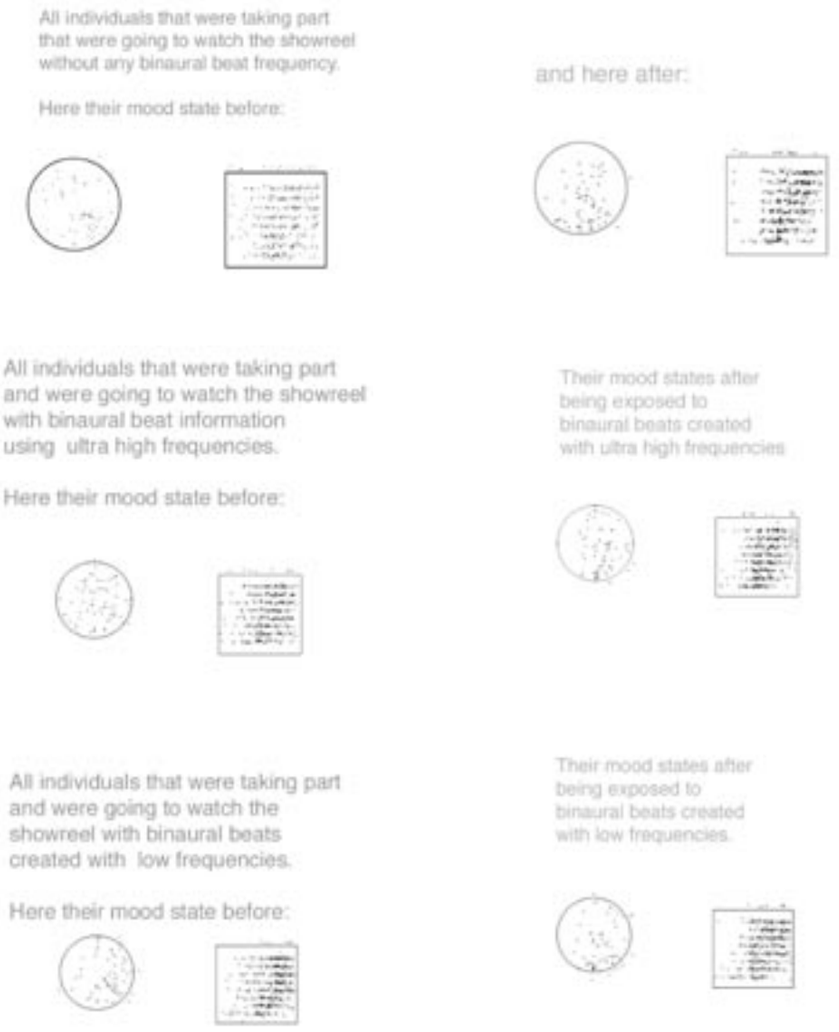
The difference between control group and binaural beat groups was not overtly obvious. A larger sample and some means of assessing the trend for the low frequency group to be the least observant or most affected, would be prudent before any definitive statement could be made.

The ability to see and recall an image at 1 frame (1/25 or 0.04sec) screen time amongst the plethora of other audio and visual data is worthy of comment and could be investigated by further study.

3) Russell Mood Assessment (RMA-)Diagram

The participants were asked to fill in a mood diagram before and after watching the films. We discovered that the results could be more accurate and the process create less anxiety if the second recordings were made immediately after watching the film, before leaving the screening room. Presenting the questionnaire created responses similar to exam anxiety in some people (cardiac rate increased dramatically) .

However we amended the procedure while the public research was already ongoing so that the mood diagram was completed immediately after the film showing and prior to moving next door for the hearing test and the rest of the questionnaire.



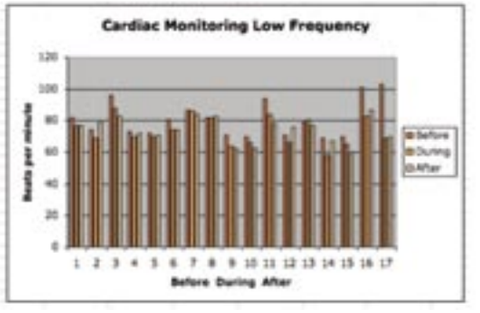
Conclusion

The self-assessment of mood using (RMA) diagrams did not show a significant change across the group; though significantly more participants of the L and the H frequency groups indicated their mood being more in a relaxed state than before. It seems that about 20 participants clearly wanted to indicate their mood state as being relaxed by placing their cross close to the outer ring of the RMA-diagram or even outside.(about 11 for the L-cycle and10 for the H-cycle compared to only 5 of the N-cycle) . We may have been succeeded inducing an alpha state using audible as well as non-audible frequencies. However, further research would be needed to make this claim this with any certainty.

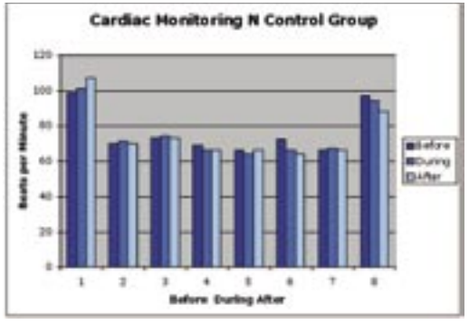
FREQUENCY THRESHOLD / HEARING TEST

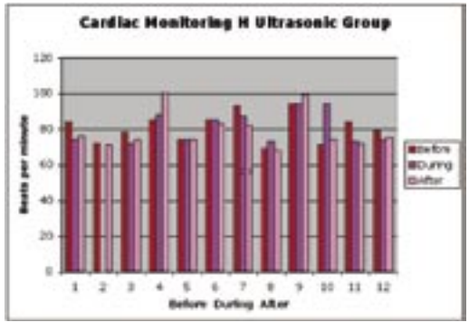
To assess the participants' upper frequency threshold limit of hearing we used a software based frequency generator and offered a hearing test to anyone who took part in the research. This was to assess the upper limits of hearing within the sample. It also allowed us to determine if the frequencies that created the binaural tone in the (H) group were indeed in the ultrasonic range and thus not able to be perceived. Further it was felt to offer some return for the participants for assisting us in our project. We found the average hearing of a 30 year old is 14-17 kHz.

Cardiac Rate Measurement – Biophysical Data change



The only biophysical parameter that was recorded, showed some interesting results too. The control group's (N) heart rate remained steady in the sample taken before, during and immediately after watching the sequence. The Ultrasonic group (H) had little change overall in the cardiac rate before during and after viewing the Factoid film. However the low frequency group (L) demonstrated a trend towards cardiac rate decrease during the factoids film.





Conclusion

Some demonstrable decrease in cardiac rate is evident in the low frequency group and would suggest that an area of research could be useful in learning more about this phenomenon. However we observed during the four days that some people's cardiac rate increased significantly when handed the questionnaires. Exam anxiety cannot be dismissed in studies of this nature that use charts and questionnaires. Perhaps using others means of drawing out information, collating and assessing the participant's answers could reduce the anxiety of examination and lessen the time spent on collecting and in analysis of the gathered data.

Biophysical measurement (heart rate change) showed the low frequency group were most affected. A larger cardiac rate sample would be needed to have a more objective result. Brainwave measurement would also be useful and an exciting way to integrate more clearly defined biophysical data such as fingertip temperature change, galvanic skin response, and a less intrusive method of recording cardiac rate change. More recordable biophysical parameters would of course be advantageous in giving a more complete picture of mind/body state. An opportunity to record personal comments was not made explicit in the questionnaire and perhaps some interesting comments about mood and perception of the event were missed. Experiential learning is the most profound teacher and the opportunity to feed back direct experience can yield some fascinating information. This could also be rectified in future studies.

The other point of interest involves group function. Would the results be the same if each individual were tested alone in a laboratory environment ?. How much does the group influence the change of mood state amongst participant members ?. With relaxation groups there is a specific intent to relax as deeply as the situation allows: in a gallery we are there to appreciate, learn and be entranced by the work on show. If we are relaxed this may be good but the prime purpose is to see or experience the artwork. Are we already moving to an alpha state as the house lights go down and the screen springs into life ?. These questions will have to answered in future projects involving this fascinating aspect of our biological relationship to sound, and how it affects or mood and behaviour.

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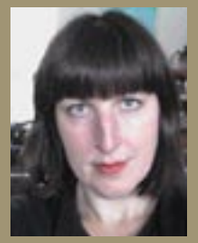
Investigating aspects of presence through responsive 3D audio environments

Susan Collins with
Paul Gillieron
Acoustic Design (surroundAV)



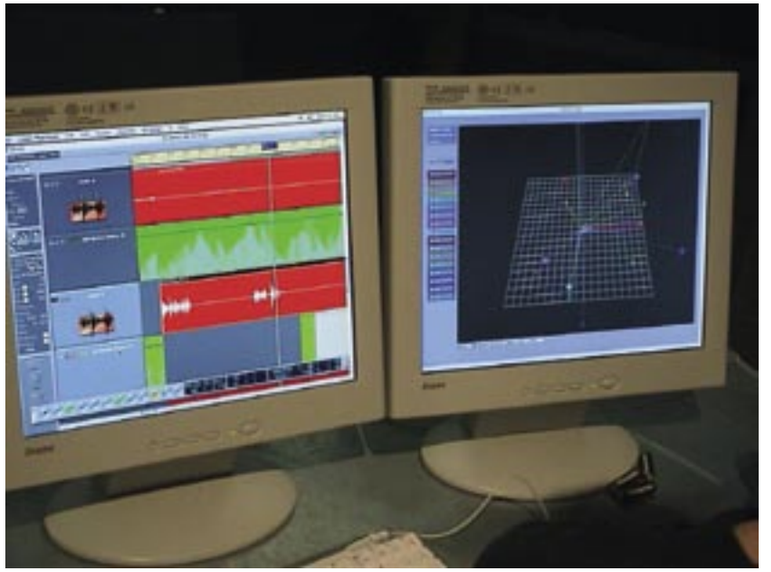
Susan Collins
Susan Collins has been working with computer and electronic media since the 1980's, working across a range of media including sound, internet, video and interactive installation, often in public and site-specific locations. Recent works employ transmission, networking and time as primary materials, often exploring the role of illusion or belief in their construction and interpretation. Recent works include *Tate in Space*, a Tate netart commission (nominated for a BAFTA interactive 2004); *Transporting Skies*, a solo show which transported sky (and other phenomena) live between Newlyn Art Gallery Penzance and Site Gallery Sheffield; *Fenlandia/ Glenlandia* an ongoing distributable networked landscape project and *The Spectrascope* a live pixel by pixel transmission from a haunted house.

Recently completed commissions include a wildlife surveillance system for Sarah Wigglesworth Architects's award winning *Classroom of the Future*, and *Underglow*, a network of illuminated drains for the Corporation of London for winter 2005/6. Susan Collins has been Head of the Slade Centre for Electronic Media at the Slade School of Fine Art, University College London since 1995, completing a PhD on *The role of the viewer in the realisation of In Conversation and other works* in 2001.
http://www.susan-collins.net

Paul Gillieron
worked at Arup Acoustics from 1980 – 84 and has lectured in acoustics at The Architectural Association, The Bartlett School of Architecture, University College London and Portsmouth School of Architecture. Since 1984, he has given acoustic advice to Architects, Engineers and Developers on building acoustics and noise and vibration control. PG Acoustic Design specialise in computer aided auditorium design, resiliently mounted structures and environmental acoustic design. Over the past few years, they have been developing through a sister company, SurroundAV, the leading UK company using Ambisonics – a multi-channel surround audio system which enables individual sounds to be located within a 3D soundscape.

surroundAV
manufactures and supplies hardware and software for the control of sound in all three dimensions,based on the lakeDSP HURON processor and custom software, and develops purpose built fully interactive products for sound designers, lighting engineers, musicians, AV producers and directors, digital artists, choreographers, art installation designers, architects and specific environments. Recently completed a native version of 3D ambisonic software to run on laptops, with VISUALISER manipulation software.
http://www.surroundAV.org

PROJECT DIARY



PROJECT BACKGROUND //

I first worked with 3D audio as part of an earlier work, *AudioZone* (1994)[1]. Working with infra-red cordless headsets, *AudioZone* used binaural 3D audio to create a parallel world of experience inside viewers heads. 3D audio is capable of objectifying sound, and giving it a specific spatial location. The nature of 3D audio is such that the viewer may really feel the audio (for instance kissing – as in the case of *AudioZone*) as an apparently first hand experience, thus creating an audio trompe l'œil, an illusion of a parallel reality. The cordless headsets added an extra layer, creating virtual walls of acoustic noise as viewers passed from one audio 'zone' and into the next.

I had been looking for an appropriate opportunity to take this interest further for a long time – both in terms of the potential for developing interactivity/responsiveness and in terms of creating an immersive 3D audio environment without headsets. An artwork, *Touched* (1996) projected images onto viewers to the gallery while using 10 channels of audio to create a non-interactive soundscape, and *Transporting Skies* (2002), whilst transporting images of the sky between Newlyn in Cornwall and Sheffield, simultaneously swapped (via intermittent, lo-tech streaming technology) the ambient sounds of each gallery, layering both galleries acoustics over each other in an endless feedback loop. For both these works I had an (unrealised) interest in seeing if it was possible to create a soundscape that was not only convincing in 3 dimensions, but also responsive to viewers or participants within the space.

1 AudioZone was comissioned by FACT (moviola), Film and Video Umbrella and Tramway for the exhibition "V-topia – visions of a virtual world", and first shown in Tramway, Glasgow in 1994

MARCH 2003 //

In discussion with Site Gallery about a possible piece of work for a forthcoming 'Haunted' exhibition that would involve moving sounds in space in response to viewers' movements. Received an email out of the blue from Paul Segar who had found me through the Slade School of Art online as he was researching for Paul Gillieron (PG Acoustic Design) into linking the surround audio experience with digital art in an interactive way....

Although it was clear that they were really looking for an artist to provide visuals, and I was solely interested in working with the audio, I responded by return email, outlining my interest and a meeting was set up at the Slade for the end of the month. I also set up a meeting for the three of us with the CAVE (virtual reality environment) at University College London which utilises a 3D audio system with part of it using the same (Lake Huron) processor as surroundAV.

APRIL 2003 //

Met with Paul and Paul at Paul Gillieron's Brixton studios. Met also with Tim Scott – the audio engineer for the surroundAV system. Experience the system for the first time, and realise that establishing the location of the audio works particularly well while it is in motion, and less well when it is static (unless near one of the speakers). This is apparently affected by the resolution of the system, but also by the frequency of the actual sound (higher frequency sounds more discernible to locate than low frequency),

We discuss the viability of making a research proposal in relation to tracking, ghosting and spatialisation of sound in relation to viewer choreography and trompe l'oeil. We also discuss the viability of portable kit, a way of being able to use the system outside of the sound studio (imperative if I were to be able to use it for an exhibition). Find out that it works through a MIDI interface, so that any tracking device will be likely to 'speak' to the 3D audio system via the MIDI interface. Am very excited about the possibilities of creating parallel fictional worlds mapped or collaged onto/into existing ones through audio. Submit application for small research grant to the Arts and Humanities Research Board for initial research *exploring aspects of presence and absence through responsive 3d audio environments*. Proposed start date September 2003.

MAY 2003 //

Receive information about the ITEM R&D programme aimed at exploring new media tools for exhibition. Realise that even if the AHRB bid is successful further research into portability/mobility/affordability will be needed to enable the system/inferface/resulting work for exhibition and touring. Visit Janet Cardiff's *40 Part Motet* at Tate Liverpool (I later also visit her show at the Whitechapel). Instead of using sophisticated 3D audio technology each chorister is recorded individually and played back through individual speakers at the same (head?) height in a large oval. This makes me want to attach microphones to individual people and/or objects and simply have them move through space...

JULY 2003 //

Submit ITEM proposal.

Receive notification of both AHRB and ITEM funding.

Tracking is a big subject in relation to virtual environments, and exploring the options available (and possibly coming up with new ones) forms a core aspect of this proposal. My preference is for the least cumbersome or least visible devices, preferably a way of tracking in which the viewers/participants are unaware of any device. I begin to realise what a huge challenge I have taken on (described as the 'holy grail' in some circles).

Discussion with Adrian Fogarty (a technical wizard who has worked with artists including myself on developing technically complex electronic audio and video projects) about a number of things including 3D audio tracking. One thought he had was to explore underfoot switching runners. These are pressure sensitive pads on long rolls (cut to size) that when installed can give grid references according to where a viewer stands on the runner. This has pros and cons attached. The pros are that it is relatively cheap and can be cut to fit a range of venues, and most systems can interpret a 2D grid (not too complicated). The cons are that these generally need to be covered by a carpet and won't then work in many spaces that may have wood/lino/other flooring. It also only works with 2 dimensions and doesn't take height into account (unless interfaced/combined with an additional tracking system ie. video tracking).

We also had a discussion about sound resolution – the lower the frequency the less directional the sound, with higher frequencies easier to position accurately.

SEPTEMBER 2003 //

Speak with Terry Braun (Braunarts) who turns out also to be working with surroundAV for his and Gabi's new project *The Dark*. Also coincidentally this project involves ghosts and interactivity. We compare notes. Terry and Gabi already well into development working with a writer and a timed scripted immersive interactive experience. They are also researching types of tracking for their interactive interface.

OCTOBER 2003 //

Meet with Adrian (Fogarty) to discuss a number of projects. Have realised that the Haunted Media exhibition is opening very soon (February 04) and the 3D audio research is unlikely to be ready in time to be part of this particular show – so am working on an alternative piece of work including a pixel by pixel live transmission from a camera placed in a Haunted House. On the 16th October I saw an article in the Guardian describing the 'fear frequency' – a frequency of 19hz in the range of infrasound (below the range of human hearing which begins at 20hz) which can cause discomfort, dizziness, blurred vision,

hyperventilation and fear. An engineer (Vic Tandy) had uncovered this frequency in sites which were allegedly haunted. I was keen to find out how I might produce this frequency for the Haunted Media exhibition to accompany my live data projection.

NOVEMBER 2003 //

First proper day in the surroundAV studio with Tim Scott.

Discuss basics – i.e. how best to record sounds to use with the system (which microphones etc – mono best for spot effects) what formats would work best, and also to find out a bit more about how it all works, how to interface to it, and where they have got to so far...

Apparently Braunarts' *The Dark* are exploring the use of thermal imaging for interactivity (necessary as the work will be experienced in pitch black). I realise that most people (musicians in particular) use the 3D-ness and spatialisation of the system to be able to compose in time AND space, and use the system to animate the audio around the space. The results can be a very rich immersive, often theatrical, soundscape, however I realise I am more interested in providing an illusion that the sound exists in reality, that it hasn't been composed, and that the overarching sense is that of an alternative, parallel yet invisible presence. Discover they are thinking of purchasing a B format soundfield microphone – which is a microphone that records in 3D. It records to 4 tracks simultaneously – X, Y, Z and omni – recording the location of the sound in 3D space at the same time as the sound itself. It works in conjunction with a recording box and logic audio software. This is really exciting. I am immediately interested in the notion of live transmission – transporting a 3D soundscape live and mapping it onto a 'real' space in realtime.

I find a reference to a Keith Sonnier piece, *Air to Air* (1975) which transmitted sound between two galleries in the U.S. , Leo Castelli's in New York and ACE Gallery in LA. It used Just two mics on stands and two speakers on the wall.

DECEMBER 2003 //

Meet with Stan Wijnans, a research assistant for PGAD who is working on developing a tracking system for the 3D surround sound studio, and hoping to develop a versatile enough system that it may be adapted for my purposes as well. Stan works a lot with dance and performance and has done a lot of work with video tracking. Whilst video tracking is very good at tracking the movement of people through space apparently it has to be recalibrated (slow process) for every venue, and tricky to use with natural (day) light as needs recalibrating with every change of light.

Look into Global Positioning Systems (GPS) as a possible tracking option, however not developed to a high enough resolution (yet) to be useful for my/this purpose.

FEBRUARY 2004 //

Haunted Media show opens at Site Gallery Sheffield. My work *The Spectrascope* installs the 'fear frequency' into the gallery to accompany a pixel by pixel live link up to Sheffield's most haunted pub. Whilst not technically 3D audio in the surroundAV sense, the low frequency of this infrasound makes it, if not an immersive experience, certainly a pervasive one. No sightings of spectral presences were reported either in the gallery or the Pub.

ITEM project officially starts (contracts exchanged)

MARCH 2004 //

Visit Terry and Gabi at the pre-launch tests of *The Dark* in the Methodist church on Brixton Hill. They have created a pitch black environment that you enter and there is an approx 12 minute programme. The pitch black really works with 3D audio (and the idea of ghosts), when you are moving about a completely black space with your eyes open, you conjure up spectres out of specks. Without any physical/visual clues you are thrown back to your own senses and the 3D audio creates its own architectural space within the space. At one moment waves were crashing and one got a sense of a deck overhead. The Dark is a scripted experience and so one was not so much exploring a fictitious space as taking part in an immersive experience which developed over time. All the time the space was changing and reorienting during the session. The interactivity (not yet implemented at this early stage) was to define a response should someone stay still for too long and not explore the space – to encourage the visitors to move around. The interface solution that was to be implemented was a version of David Rokeby's VNS software (Very Nervous System) using thermal imaging cameras.

On my next visit to Paul we discussed more tracking options. We discussed Ultrasonic tracking – however the catch is that it only really works with one person at a time (and my parameters were for a multiuser environment). Paul has now got Stan working with V2 in Rotterdam on tracking options. He has had a tracking idea – going back to basic physics – of using magnetic tape along walls to create a cylindrical magnetic field, and to get users to wear small magnetic tags (each tag a different frequency). The tape could form a grid which would be calibrated for each space, and one could design a tag for an exhibition and embed it in a badge or other type of device. While this would be completely genius if it works this still doesn't quite solve my possibly unrealisable ambition of having an unencumbered 3D audio experience with a (perhaps even unwitting) participant.

SurroundAV have purchased a Soundfield Microphone. Whilst interested in it as a recording device I also wonder whether the Soundfield Mic itself might have potential as an interactive interface/trigger. For instance it is aware of different levels and frequencies of sound in the X, Y and Z axis, and this perhaps could act as a trigger for other events.....(I then immediately realise that this wouldn't work if triggering events in the same audio space as would be an eternal feedback loop, but has potential in relation to mirrored or other spaces.)

APRIL 2004 //

Borrow Soundfield Microphone equipment and take to Whitby, Yorkshire to do some location specific recordings. Am still thinking about the

context for the audio whether live or recorded. What it means to record a sound in one space and map it onto the other – what and where would these two spaces need to be? I am also wondering if the audio were to be pre-recorded and played back what then would be the rationale for the composition. I am interested in the viewer/listener somehow having an influence over the audio that they experience – and if this were possible, how might this (a) alter their overall experience and (b) be able to inform them that they had in some way influenced the outcome – and how relevant this might be to the experience itself.

We have the first of the three ITEM meetings at FACT, Liverpool. I am really interested in the overlaps of some of the projects. One of the projects exploring the use of RFID tags using radio frequencies to track visitors to a museum is very similar to the tracking route that Paul is exploring with magnetic tags.

MAY 2004 //

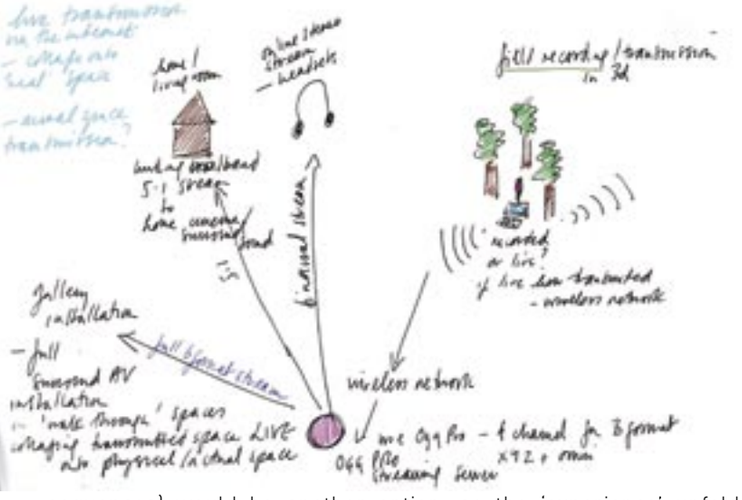
Work out/revise some core questions:

- Will it be possible to stream B format sound live, online? And if not, whether it could be done locally using direct wiring rather than internet for more local transmission....
- If so, is it possible to have either the sound system (speakers etc) and/or the microphone outdoors?
- Where might I test out with a portable kit in 'real' space not in the studio?

Begin to think about contexts and locations. Most of my previous works have responded to specific contexts, and this is usually where the alchemy happens, the transformation....this current research is still at the more abstract exploration stage...a context will bring it to life and help focus the research. I am thinking of domestic environments...not just my own, but also of possibly contacting a curator I know who presents work in her home, including her kitchen, bathroom, living room etc. I am not quite sure yet if this is the context I am searching for, so I hold off making an approach and sit on it, ruminating some more....I realise that whilst the core of the research is still centred on tracking and interactivity, my own interest is veering off on another path, that of live transmission.

JUNE 2004 //

Listen to the Whitby sounds in the surroundAV studio with Tim (Scott). They are incredibly vivid. I thought I wouldn't be so interested in pre-recorded (as opposed to live) sound, but I am, I've been transported, I am there. It takes a while for Tim to calibrate the sound for the studio. Making sense of the orientation of the microphone's position relative to the speakers seems to be an occupational hazard. One possibility for creating a sense of 'presence' would be for viewers/listeners to trigger different sequences of audio 'narrative' depending on where they go in the room (using simple sensor trigger devices) – this would be much easier than tracking, very do-able, and probably as effective in terms of the 'user experience'. Randomising sequences (or parts of



sequences) would be another option, so the 'experience' unfolds in an infinite variety of ways. Finding a context or contexts will be crucial to determining these kinds of choices. Not only from a viewer choreography perspective (ie. physical characteristics of a location) but also in terms of form/content (ie. which of these options makes the most sense for the subject of the situation).

Mick Ritchie – one of the co-founders of resonance fm – is at the surroundAV studio. His ears are very finely tuned. When listening to the playback he can actually distinguish quite accurately the architecture of the recorded space – he could tell where the street was relative to the running water and both relative to the staircase. I am very impressed (both by the quality of the recording and also Mick's audio-perceptual skills). We talk about the possibility of encoding the 4 channels into a live stream which could be sent to another location via the internet and whether this might be possible in any of the streaming formats that I have already worked with (ie. realplayer, Quicktime). The thinking expands to consider whether it might be possible to distribute the audio live over the net as well as just point-to-point from one space to another, whether we might simultaneously create a binaural and/or 5:1 stream for home cinema surround sound systems.....almost an audio variation on the display software developed for a live online visual piece I am working on currently, *fenlandia* http://www.susan-collins.net/fenlandia.

We discuss some technical options for a while, and what would be needed at both ends (to send and receive). I also tell Mick about my 3D audio (binaural) kissing recordings I made for AudioZone back in 1994, and we discuss whether I might have a graveyard overnight slot to broadcast it (binaurally) on resonance fm...

JULY 2004 //

Meet with Paul G for an update on tracking research. Now discussing the possibility of combining ultrasonic and RF to get around the problem

of occlusion (ie. when one participant blocks the signal by moving in front of another participant). Using two systems combined give greater accuracy. They are also working on improving the resolution of the sound. Currently the audio resolution makes most sense when using a high frequency sound, and when in motion – or when 'situated' nearer the edges (ie the speakers) of the space. My original proposal in relation to creating a sense of presence was to see if one could get a sound to 'follow' a viewer round a room. In the words of Stan (who is researching into tracking for surroundAV) "the only sure way to make a sound follow you round a room is by putting a speaker on wheels". I take the point, and am also painfully aware that having put this tracking research monster into motion, that my own interest in it has been almost completely diverted to a much greater interest in seeing whether it is possible to transmit 3D audio live via the internet...

Second ITEM meeting, this time at BT exact, Ipswich

AUGUST 2004 //

I am up in Whitby, North Yorkshire. Most people on holiday so things slow down.

I am contacted by a researcher at University College London who is working on physiological interfaces for the CAVE (virtual environment) and 'mind tracking' (ie. EEG). I am not sure how this might fit with my idea of a transparent or invisible interface, but am curious and arrange to meet him in September. I had a conversation with Helen Sloan (SCAN) which triggered thinking about Boulby Mine in Cleveland, a Potash Mine just north of Whitby. I have been interested in Boulby Mine for some time as this potash mine also houses the Boulby Underground Laboratory for Dark Matter Research. It is a very deep mine, more than 1km deep, which makes it perfect for research of this nature as it screens out cosmic rays and has low natural radioactivity. Helen is researching the possibility of artists working with places of particular scientific interest, including Boulby, and I am very very keen. I am wondering what the search for Dark (invisible) Matter would sound like, and am thinking that this would be such a perfect reason to transmit spatial audio live, and map it onto another space as a 'parallel world'. Trying to work out how to get in there and find out.

SEPTEMBER 2004 //

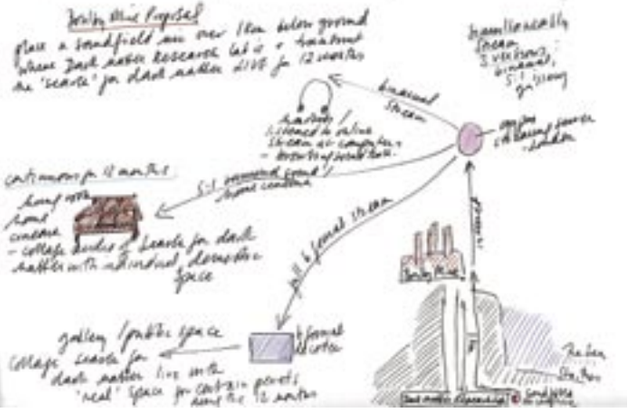
Third ITEM day at Grizedale forest.

All the meetings have been very interesting in terms of sharing information on projects etc. Did a GPS 'walk' with Jen and Jen – a highlight.....Realise that I have nothing new of substance to report since the last meeting beyond my own search for the search for dark matter. I realise that I am really interested in somehow puncturing the romanticism of the idea of this search, exposing its everyday activities (office interior, chair scraping, sniffles, keys tapping, random mundane conversation etc). I borrow the soundfield microphone from Paul to make some more field recordings, hoping to do some recordings outside, on the North York moors, on the beach etc (if it stops raining long enough). Paul said that Mick was making good progress re: B format streaming, and having had broadband installed (and a wireless network) I am hoping that we might even be able to trial the first live 3D webcast transmission from my studio in Whitby.

Mick emailed me to say that he had figured out which format would work with the multiple streams, and suggested the 'Ogg Vorbis' format with 'Oggcast', which sounds very Star Trek. Then the Logic programme on the small Vaio laptop computer (which is used as the recording device for the Soundformat Microphone) seems to have become corrupted and won't load....so no recordings – let alone live transmissions – will be possible until back in London, and reconfigured...

OCTOBER 2004 //

Regular updates from Mick. He has the streaming working, but in order for it to work with the surroundAV studio they need to restructure their office server, as firewalls and other obstacles may cause problems – and it needs the best bandwidth it can get. It looks like I should be able to do it all (eventually) from my Mac laptop.....which seems amazing.....Every week an update with an 'almost there' message.....In the meantime I pick up again my conversations with Helen (Sloan) re; Boulby Mine and send her a proper outline...it is probably a long shot but quite exciting, and definitely worth pursuing. Finally an email from the brilliant (and persistent) Mick who managed to get a B format stream travelling round London and back for the first time.....during which he encountered a new challenge, that of buffering. This is quite interesting – and although I haven't heard it myself yet I am quite curious as to whether the buffering is staccato, a constant disruptive interruption to the stream, or whether it just hangs and picks up occasionally, catching up with itself. I am interested to see whether this could become part of the material or sound fabric of an eventual installation. This buffering....exposing the form of the sound in some way.....and what that might mean in relation to this sense of presence or aural trompe l'oeil.....



To be continued...

REVIEW

To explore how to create a sense of presence in an immersive 3D (virtual) audio environment, through the research and development of a viewer responsive interface.

The original aims:

- To create a system sensitive enough for a sound to be able to physically follow a viewer through a space.
- To investigate a range of viewer tracking options from magnetic (with radio transmission), infrared, pressure pad and video to sonic rulers, range detectors and GPS (global positioning system).
- To explore the potential for incorporating live audio (from microphones, radio, samples etc) into the 3D audio environment.

The original objectives:

- To develop a method for this interface to work with and respond to multiple users simultaneously.
- To develop a transparent, invisible, interactive interface devoid of headsets or tracking wands.
- To develop a portable, reproducible working model of this interface by the end of the research period

These aims and objectives were evolved and reviewed throughout the course of the project. A series of discrete outcomes emerged;

SENSE OF PRESENCE //

The initial focus of the research was on how to create a sense of presence through an immersive 3D audio environment by creating a form of viewer tracking that could enable a sound to follow a viewer (or more than one viewer) through space.

We surveyed existing methods of viewer tracking to see which (or which combination) may be appropriate in relation to the 3D audio environment.

These included:

- Underfloor switching runners (two dimensional, doesn't track height and relatively low resolution)
- David Rokeby's Very Nervous System (software version) in conjunction with thermal imaging as evidenced in Braunart's 'The Dark' (2004)
- Video tracking (very good at tracking people moving through space, however in a daylight situation has to be recalibrated for every change in light)
- Ultrasonic (only works with one person at a time – occlusion)
- RFID tags (user has to wear a tag)
- GPS (too low resolution currently for this purpose)

It soon became very clear through the initial research that the question of multi-user tracking is a large research project in itself and one often described as a 'holy grail' for those working with interactivity, so it was very important to focus the tracking research in relation to the core research perceptual questions.

VIEWER PERCEPTION //

We also investigated viewer perception in relation to the 3D audio environment at PG acoustics. It was apparent that high frequency sounds – ie. birdsong – were easier to 'place' than low frequency sounds (less directional). We also tested the movement of audio through space in the surroundAV Studio. Locating the sound worked well whilst the sound was in transit, but much harder to place or 'locate' when static.

The resolution of the 3D audio system itself is also critical in realising precise placement of audio (the level of precision is still limited technically as well as subject to the viewers individual perceptual skills). It became apparent through this process that the individual aural perception of the viewer is critical when interpreting the audio. Not all listeners have the aural sensitivity to interpret the placement of a sound in space in a precise or consistent way. It also became clear that 'tracking' the viewer will not necessarily a) be perceived as so by the viewer and b) be the most important element in creating a sense of presence.

The two points above each raised critical research questions and also suggested revisions to the initial aims and objectives. For instance – in creating a sense of presence through 3D audio is it necessary for the audio to actually track the viewer?

We investigated other ways of creating presence within an immersive audio environment.

a) the 'fear' frequency – introducing a 19hz (low frequency, infrasound) to the gallery, to create an overall sense, or experience (Susan Collins installed this at Site Gallery Sheffield as part of *Haunted Media* February 2004), this frequency is reputed to have a direct physiological impact on the listener (ie. dread, fear, occasional hallucinations)

b) Paul Gillieron acquired an instrument known as a soundfield microphone (which records sounds and their placement in 3 dimensions over 4 tracks using b-format encoding). This line of investigation expanded to include researching the potential for 'live' transmission of 3D audio environments using a soundfield mic in conjunction with the surroundAV studio.

Two parallel research strands emerged for the research – viewer tracking, and live transmission.

In terms of the core research question it became apparent that the live transmission of an existing (3D audio) space and the mapping of it (live) into another location was closer to realising the original desired intention ie. creating a (transparent/invisible) sense of presence in an immersive audio environment – only with the potential for viewer response or input coming instead from the remote (transmitted/recorded) location.

REVIEW SUMMARY //

Viewer tracking

After much research and testing of various tracking devices and combinations of devices, PG acoustics engineers led by Paul Gillieron have developed an interface which is a hybrid ultrasonic/inertial system (so avoiding issues of participant occlusion present with ultrasonics alone) with input from V2 organisation in Rotterdam. It answers most of the initial (practical, tracking) aims inasmuch as it tracks the viewer, and can cope with more than one viewer at a time, however the participants will have to wear a small metal tag to enable the tracking to work.

Live transmission

The audio environment reproduced from a space recorded using a soundfield microphone is exceptional. It creates the aural trompe l'oeil (l'oreille) and achieved the sense of presence that was a core research goal. The new/innovative aspect of this research is defined as the ability to actually transmit this audio environment live, in real time, using the internet as the conduit for the 4 simultaneous tracks. Mick Ritchie (founder Resonance fm) in conjunction with the surroundAV studio subsequently developed a method of achieving this using the Oggcast encoding technology. This works for point-to-point live transmission for installation/environments where there is a 3D audio environment and decoder for presentation at the receiving end. The research is continuing to explore a method of wider online distribution for home users either using home cinema (ie. translated into 5:1 surround sound) or binaural (3D audio through stereo headphones) encoding – or both. Although live transmission using a soundfield microphone was not conceived as part of the original proposal, this technology achieves many of the key aims and objectives of the original proposal ie. It creates the possibility for incorporating live audio into 3D environments. It supports the ability to work with multiple users simultaneously; and helps support a transparent, invisible, interactive interface devoid of headsets or tracking wands. It also offers portability, reproducibility.

As outlined above the majority of the stated aims and objectives have been achieved.

In some respects the research developing beyond its initial remit, specifically in relation to the work with the soundfield microphone and live transmission. The project has adapted according to discoveries made in the course of the exploration, whilst the core question "how to create a sense of presence in an immersive audio environment through developing a viewer responsive interface?" has remained central throughout.

CONCLUSIONS/POSSIBLE FUTURE DIRECTIONS //

The work on the development of tracking devices is ongoing, and will remain ongoing as these technologies become more sophisticated and as 3D audio systems become higher resolution (in terms of placing sounds in space). Tracking can be interfaced with a broad range of installation/interactive technologies and some of the knowledge gained through this research may be utilised in a range of interactive installation situations beyond this particular 3D audio system. The work on b-format live transmission using the soundfield microphone will have more immediate results, with discussions already underway in relation to potential contexts for transmission using this technology. Further work will also be done to enable a range of outputs with the potential of simultaneous transmission from a single source location, enabling a version of the 3D audio space or sense of presence to be 'collaged' into any environments that have broadband internet access and a home cinema (surround sound) system. This takes the potential for access to – and the application of – 3D audio well beyond the gallery/specialist sound studio into a very distributable, portable format for a range of domestic or public situations.

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Low Tech Sensors and Actuators: for artists and architects

Usman Haque
and
Adam Somlai-Fischer

Usman Haque
Usman has created responsive environments, interactive installations, digital interface devices and choreographed performances. His skills include the design of both physical spaces and the software and systems that bring them to life. He has been an invited researcher at the Interaction Design Institute Ivrea, Italy, artist-in-residence at the International Academy of Media Arts and Sciences, Japan and has also worked in USA, UK and Malaysia. As well as directing the work of Haque Design + Research, he has also been a member of the Interactive Architecture Workshop at the Bartlett School of Architecture, London. He is a recipient of a Wellcome Trust Sciart Award, a grant from the Daniel Langlois Foundation for Art, Science and Technology, the Swiss Creation Prize, Belluard Bollwerk International, the Japan Media Arts Festival Excellence prize and the Grand Prize Asia Digital Art Award. His work has appeared at the Institute of Contemporary Arts (London), Ars Electronica, Transmediale, Hillside Gallery (Tokyo), The National Maritime Museum Greenwich and the Tokyo Metropolitan Museum of Photography. His work has also been presented at international conferences including Siggraph, VSMM (International Society on Virtual Systems and Multimedia), Art Futura and Doors of Perception. www.haque.co.uk

Adam Somlai-Fischer
Adam is an architect and interaction researcher, and a founding partner of Aether Architecture, an adventurous practice working on interactive architectural projects. Aether's work has been recently exhibited both at ISEA 2004 in Helsinki and at the Venice Biennale of Architecture, and published in various design magazines. Graduated from the Architecture + Urban Research Laboratory, KTH, Stockholm, Adam has been teaching at the Architecture and Media technology departments at KTH, working as a guest researcher at the Smart Studio, Interactive Institute in Stockholm, and currently collaborating with the Media Research Center at the Department of Sociology and Communications, BUTE, Budapest. His thesis, Mediated Spaces, looking into how new technologies of connectivity have altered architecture, has received international publicity. www.aether.hu

PROJECT REPORT

This report describes the results of a collaborative research project to develop a suite of low-tech sensors and actuators that might be useful for artists and architects working with interactive environments. With this project we hoped to consolidate a number of different approaches we had found ourselves taking in our own work and develop both a 'kit-of-parts' and a more conceptual framework for producing such works.

We had often found during design development in the past that ideas had to be prototyped both quickly and cheaply; it was more important that such prototypes were functionally efficient rather than aesthetically perfect. Like many other artists and architects working in the field of interactive environments, in cutting costs and development time we often had to resort to a 'low-tech' approach, rewiring keyboards to get pressure-pad input into computers, or using the monitor with light sensors and relays to get physical output from computers. We also found ourselves taking apart and reassembling (i.e. 'hacking') bits of technology that were not connected to computers (for example the flashing stickers attached to mobile phones could be used to trigger light sensors when a phone call arrived).

We were certainly not alone in hacking technology to suit our purposes and we realised that it would be very useful for others in our fields to have a good outline of this approach and indication of the types of devices they might use. It also seemed important to describe ways that such things might be reassembled in a coherent interactive system. At the same time we wanted to align our approach with a general interest in 'open source' design in art and architecture and to draw particularly on the application of 'low-tech' hacking strategies to high-tech, but inexpensive, objects, toys and devices.

The original intention with the research project was to develop four prototypes. Although we weren't sure at the time precisely what we meant by these four categories, for the purposes of having a starting point we were hoping to develop a 'sensor', an 'actuator', a 'power source' and a 'wireless communicator'. As we proceeded with the design development, however, it soon became clear that, depending on circumstance, 'sensors' might also be considered 'actuators'; 'actuators' could in some cases be considered 'power sources'; a 'power source' with a switch was actually a type of 'sensor'; and that many devices are considered 'wireless' even though their wireless aspect might be the least interesting.

We had to develop, for ourselves as well as for the project, a conceptual framework within which we could define 'inputs' and 'outputs' to a system as well as the 'comparator' that sits between them (drawing heavily on second-order cybernetic principles). Using such an approach, we were no longer limited to defining things solely in terms of single use (as the sensor/actuator approach tended to force us to do) but were able instead to define things based on whether we were looking at what was going in, or what was coming out of any particular device. Our aim in each case was to develop a precise set of instructions so that lay people could replicate the experiments with devices easily available at low cost.

By the end of the research we discovered that we had developed not four, but perhaps closer to forty different devices or arrangements (what we came to call 'compound systems') and had a difficult time finally selecting which were the most important for the purposes of noting in detail in this report. In the process we had also clarified for ourselves the types of interaction and system that we tended to prefer which gave us good indication of ways to assemble and choreograph our subsystems as a whole system.

We hope now to release the contents of this report to a wider audience so that the ideas can be used, amended and redistributed.

LOW TECH //

Artists and architects who want to experiment with interactive spaces and responsive systems, particularly on large, urban-scale projects, are often prevented from doing so because of the complexity, logistics or costs involved with such systems. Prototype research seems prohibitively expensive and the most interesting concepts and approaches remain on the drafting board until a suitable client/investor/sponsor is found. Alternative channels for financing and development need to be found; one solution is found in the combination of reusability and 'low-tech'.

New media artists and architects don't necessarily need the precision and accuracy that scientists might require in order to explore the poetries of interaction. They therefore often do not require such sophisticated equipment in order to develop truly interesting interactive projects. They work well with the 'making-the-best-of-what-we-have' approach, using artefacts at hand, and are comfortable with the idea of 'hacking' existing technology (in the sense of taking it apart to understand how it works and putting it back together again, usually with improvements). In this way, it is possible to design interfaces, sensors, bio-feedback devices and actuators all using relatively simple technology that might even already exist in people's homes. In particular, inexpensive remote control toys are these days ripe for dismantling and reworking; kids walkie-talkies can be used to set up a simple wireless network while an energy source for a simple interactive device could be generated from the movements and footsteps of people within a space.

One way to pursue this line of work is to develop a suite of low-tech sensors and interactive actuators that can be produced inexpensively from off-the-shelf toys and devices. These 'hacked' devices can form part of 'kit-of-parts' that new media artists and interactive architects could use for their interactive design projects.

As a first step towards a comprehensive set of such tools, we are presenting here an outline of devices we have hacked and techniques we have explored using off-the-shelf devices, gadgets and toys in simple responsive systems. Recently, such devices have become much cheaper. They often contain a range of sensors and actuators that are directly relevant and certainly useful for the development of interactive systems that artists and architects may be interested in. We explain what these devices are, how they can be deconstructed and reconstructed and why this might be useful. In most cases the gadgets can be bought for less than £5; in some cases they are under £10; we have also included a couple of particularly useful devices that can usually be found for under £25. We also outline a conceptual system for understanding how to put together these instruments into an interactive environment.

CONTEXT //

It is important to be aware of the context in which these toys exist and in which they are dismantled and re-appropriated.

Current movements in design, art and architecture explore the application of open source principles learned in software development to the collaborative creation of environments, experiences or objects. In computers there are different kinds of operating systems, ranging from Windows, thru Mac OS X and Unix to Linux. These operating systems differ not only in having different features and interfaces, they are also based on different ideas of openness. Linux is a type of operating system that falls under the category of 'open source' – unlike other operating systems, the source code at the heart of the Linux system is open to anyone to view, modify and upgrade as necessary, with the requirement that any such revisions be equally 'open' and available to all. To apply such a notion of 'openness' to the design of spaces and objects requires two main strategies. The first is that such spaces and objects must somehow be open to all to be interpreted, inhabited, appropriated and redesigned. The second is that the tools for making these interpretations, inhabitations, appropriations and redesigns must be equally open.

Operating with low tech interfaces, sensors and actuators as we advocate here is one step closer to opening up the tools for appropriation and recombination to a wider audience and a wider production base. The advantage of working with low tech toys and devices is that very little specialist knowledge is required. It is perfect for a design process where imagination is in abundance but budgets are not!

It is important to be aware, however, that these inexpensive devices do come at a price, and it is not necessarily a price that we, in the West, have to pay. Most of them are manufactured in China, in anonymous factories about which we know very little. The fact that it is possible to construct toys packed with sensors for relatively small amounts of money should give us cause for concern. It is clearly the factory worker him or herself who is bearing the brunt of this cost-reduction. From another socio-political perspective, it is relevant to note that the appropriation of low tech devices has also featured in recent well-publicised terrorist action. For example, in the Madrid bombings of 2004, it has been determined that at least some explosives were detonated by remote triggering of a mobile phone, using a technique that is familiar to many artists working with mobile devices.

As such, any invention using these devices will necessarily have a political dimension. We leave it to the readers of this publication to determine how much they want the knowledge of this to affect the work that they actually produce.

A CONCEPTUAL FRAMEWORK FOR PLANNING YOUR SYSTEM //

For the purposes of this document, the SYSTEM refers to what you are building. A SUB-SYSTEM refers to a part of that system, perhaps just one or two components that have been attached together. The system you are building exists in an ENVIRONMENT.

Its components can be described in terms of the following categories:

- SENSORS receive input from the environment
- ACTUATORS send output back into the environment
- COMPARATORS sit between sensors and actuators, computing output variables according to single or (usually) multiple input variables
- FEEDBACK is the process by which output data re-enters a system through its sensors in such a way that this new input data is re-computed by the comparator

Your SYSTEM can be described as having a 'goal' – this goal may be fluctuating according to any number of INPUT variables (e.g. time, sensor activity, randomness, etc.).

We like SYSTEMS that exhibit relatively complex behaviour. By this we mean that their goals appear to change over time relative to the state of the SYSTEM and may often change because of the presence or actions of people in the ENVIRONMENT. Their behaviour may at first seem a little unpredictable; we try to discern a pattern in the OUTPUTS, but just as we think we are getting close to understanding, the SYSTEM changes again, keeping us always intrigued. Finally, in our list of definitions, if a goal is fixed throughout a fixed loop then we call it a 'first order system'; if the action of a loop changes the goal of another loop (usually recursively) then we call it a 'second order system'. Obviously, we like second order systems!

You will find that all the toys and gadgets we describe can be thought of on their own as SUBSYSTEMS – they each have INPUTS, OUTPUTS and COMPARATORS. However, when they are hacked to sit in the SYSTEM that you are designing, they themselves function as SENSORS, ACTUATORS or COMPARATORS. Therefore, in our description of each toy or gadget, we also describe the various possible INPUTS and OUTPUTS that each one has, enabling you to interface it at whatever position you decide is best in your SYSTEM.

So that you can more easily navigate the various components we describe, whenever an entry refers to another entry, it will be noted in CAPITAL letters. For example, in the SOUNDRESPONSIVE CAT entry, we refer to both a LASER and a WALKIE-TALKIE. For more on how to connect those components through their own INPUTS and OUTPUTS simply navigate to their respective entries.

The following section describes specific procedures for two individual devices, stripped for their basic inputs and outputs. Further details of other toys and devices can be found on the accompanying DVD, together with details of how to construct COMPOUND SYSTEMS using elements from these individual toys and gadgets.

RELAY //

Description

The RELAY is one of the most important interface devices we use – it allows disparate devices to be connected without disrupting their respective power supplies and signals. A RELAY is essentially a powered 'switch'; when it receives power at its INPUT, it closes a switch at its OUTPUT. This is the best way to trigger a device through another one because devices often have quite sensitive analogue electronics and connecting them directly to each other can have unpredictable (and at times destructive) effects. Relays are used in almost every COMPOUND SYSTEM.

Method

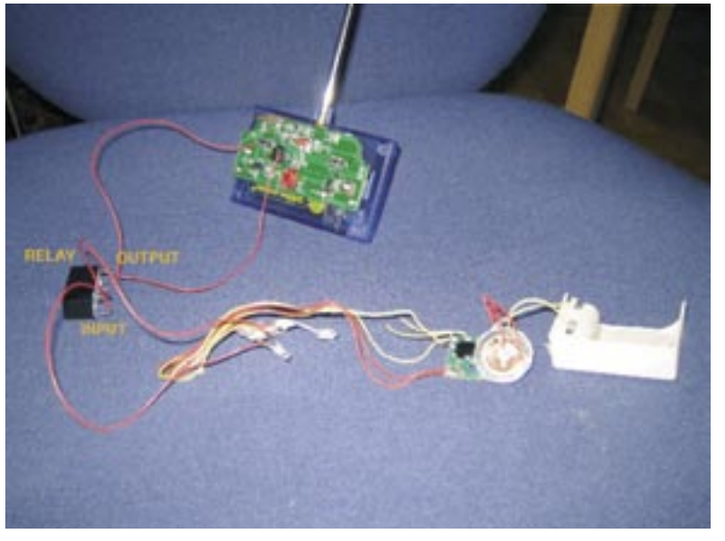
Connect the OUTPUT of your triggering device to the INPUT of the RELAY. Connect the INPUT of your triggered device (either in series with the power supply; by replacing its on-off switch; or by replacing any other action buttons – see for example MP3 PLAYER) to the OUTPUT of the RELAY. You may have to try several different arrangements of pin connections – some relays have 3 output pins, with a ground and 2 other that are alternately open and closed depending on input signal; others have 4 output pins and each pair is either open or closed (opposite to the other pair) when power is supplied to the input. You will generally need a low-power, low-voltage relay.

Input

electricity (digital) – usually 3v – 24v.

Output

switch (digital) – on-off output.



SOUND RESPONSIVE CAT ALSO KNOWN AS CAT

Description

This toy is useful in creating something that responds to sound or light touch. You might want to build something that switches on when you clap, or which triggers something else when loud footsteps sound through a room or which lights up when you stroke it.

Method

You require anything that does something else in response to sound; for example, a ball that rolls when you talk to it or a flower that dances in time to music. In our example, we have chosen a very cheap SOUND RESPONSIVE CAT, which flashes its eyes and makes a loud 'meow' sound when there is a sound nearby or when it is stroked. You will take apart the toy, keeping the microphone intact, and use the electrical output of its LEDs (or motors depending on what your toy is) to trigger something else.

Input

sound (analogue) – clapping, loud voice, furniture movement
touch (analogue) – stroking, jostling, footsteps

Output

light (digital) – LED eyes light up
sound – loud 'meow' sound
electricity (digital) – a positive voltage across the wires leading to the eye LEDs



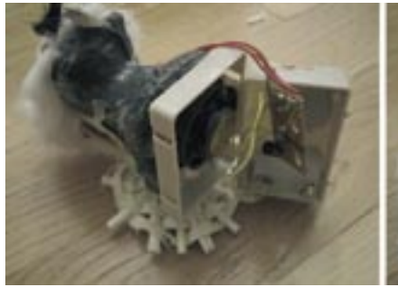
Procedure

1. As with all toys, the packaging should be removed. Lifting the CAT out of its basket and raising its tail will reveal a plastic box at the back of the cat which contains the electronic components.

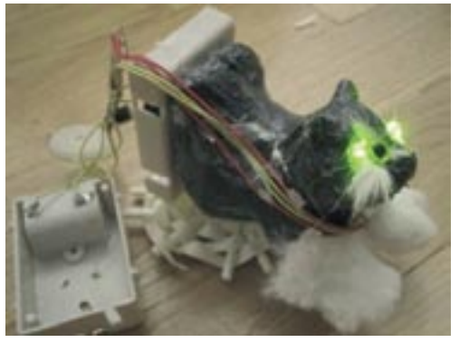
2. As you begin to skin the CAT, you will notice that it is built on a plastic core. Wires lead out of the plastic box. Be careful not to break them as you peel back the fur !

3. Remember to check repeatedly throughout any deconstruction process that you haven't mistakenly broken something or detached any wires. (This makes debugging a lot easier). Clap your hands! (If it still meows and lights up, then it's still working).

4. Carefully open the electronics housing.



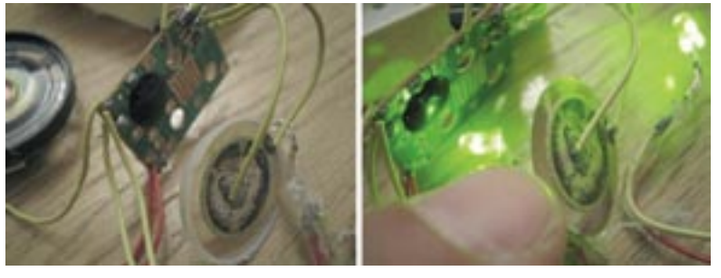

5. And check again that everything is still working !



6. Once you have peeled off the LEDs from the head and completely removed the electronics from the bits of the cat that you don't need you can begin to identify the various components. Check again to make sure it's still working...

a battery, **b** speakers, **c** LEDs, **d** microphone

7. Look closely and you will see the little integrated circuit that controls the CAT. It's the green board that all the wires and parts are attached to. What we are calling a microphone is not really a microphone – it's more of a vibration sensor. Since it is quite sensitive, it even picks up air vibrations (i.e. sound). Now, there are a few different things you can do with the components you have. On the INPUT side, either you can use it to pick up sound in the environment or you can use it to pick up sound directly from other devices. On the OUTPUT side either you can use it to create a flashing light output; or you can use it to create a meowing sound or, most interesting to us, you can use the voltage of the LED to trigger something else.



Usage

The CAT, another one of our most useful devices, can be found in:

- SOUND ACTIVATED SPACE DEFINER using CAT + RC CAR + LASER
- PROXIMITY DEPENDENT LASER using TANK + CAT + LASER
- WIRELESS SELF-POWERED PRESSURE PAD using TORCH + WALKIE-TALKIE + CAT
- VOICE ACTIVATED REMOTE LASER using WALKIE-TALKIE + CAT + LASER