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Digital Research in the Humanities and Arts

31 August - 3 September 2014

**FULL PAPER PROCEEDINGS**

Communication futures:  
Connecting interdisciplinary design  
practices in arts/culture, academia  
and the creative industries.

Edited by Anastasios Maragiannis



DRHA2014 Conference

Digital Research in the Humanities and Arts

Theme: Communication Futures:  
Connecting interdisciplinary  
design practices in arts/culture,  
academia and the creative industries

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## ***Theme***

### ***Communication Futures: Connecting interdisciplinary design practices in arts/culture, academia and the creative industries***

Human beings, as users, have always been obsessed with finding new ways of communicating through various techniques and technologies.

The rapid technological changes that have occurred during the last two decades have allowed us – the users – to communicate through various social media platforms, providing us with more easily, faster and more frequently ways of communicating.

However, there are always concerns about other impacts those technologies might have on the communication processes.

The aim of the conference is to facilitate conversations on Design and collaborations between

- Digital Arts and Humanities,
- Creative Industries,
- Digital Libraries and Archives,

with an emphasis on communication futures and their impact to historical, theoretical, knowledge-transfer research processes.

For the first time the DRHA conference would like to support and bring together the Academic environment with that of the Creative industries under a conference that will affect the current interdisciplinary creative practices.

## About DRHA

For over 11 years DRHA: Digital Research in the Humanities and Arts (Previously named: Digital Resources in Humanities and the Arts) continues to be a key gathering for all those are influenced by the digitization of cultural activity, resources and heritage in the UK.

A series of annual conferences whose goal is to bring together the creators, users, distributors, and custodians of digital research and resources in the arts, design and humanities to explore the capture, archiving and communication of complex and creative research processes. This includes: Scholars, teachers, artists, publishers, librarians, curators or archivists who all wish to extend and develop access and preservation regarding digitized information rendered from contemporary culture and scholarship; the information scientist seeking to apply new scientific and technical developments to the creation, exploitation and management of digital resources.

DRHA provides intellectual and physical space for cross-disciplinary discussion and the generation of new ideas, resulting in many new networks and productive research relationships. The DRHA conference started at Dartington, and it was a development from the DRH conference series, which began at Oxford in 1997.

Every year the conference is moving to a different Academic Institution, which supports and successfully run the conference.

This book contains DRHA2014 selected peer reviewed proceedings / full papers.

Anastasios Maragiannis

Convenor and Programme Chair DRHA 2014

University of Greenwich, London, UK

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# Potential uses of NFC enabled mobile apps within UK tourist attractions

## Seyed Amir Mohsen Jazdarreh

University of Greenwich  
London, UK  
S.jazdarreh@greenwich.ac.uk  
Amir Shadmand  
SUPENTA Ltd  
London, UK  
Amir@supenta.com

## Ed de Quincey

University of Keele  
Keel, London  
Ed.de.quincey@keele.ac.uk  
Lachlan Mackinnon  
University of Greenwich  
London, UK  
L.Mackinnon@greenwich.ac.uk

### Abstract

**This study investigates the potential uses of Near Field Communication (NFC) contactless technology within popular UK tourist attractions, using Canterbury Cathedral as a case study. A mobile application is being developed for tourists to support interaction with electronic posters, in order to provide access to additional information about artefacts, custom guided tours and provide integration with related external services such as social networks. In this case, visitors in the Cathedral will be able to gain personalised and filtered contents through physical interaction by means of their smart NFC enabled devices. This combination of NFC technology and user interaction will aim to provide a dynamic and personalised online location-based service for tourists and provide enhanced usage data for attraction managers.**

### Keywords

**NFC; Smartdevices; Canterbury Cathedral; Tourism; mobile application; physical interaction.**

### Introduction

Tourism has been described as a hybrid industry [1]. Although focused upon the provision of information, it is essentially concerned with physical environments. The physical and digital worlds however are becoming inextricable due to the travellers' need to be connected anytime and anywhere [1]. With travel tools and applications becoming essential to their users, the number of tourist

activities supported on smart devices such as mobile phones and tablets has increased at a “phenomenal rate” [2]. Tourists are using these devices and applications before, during and after a trip, making this area increasingly more important from a tourism management perspective [2]. According to [3] one of the most important areas in technological innovation for the tourism industry is smartphones and wireless technologies. Therefore, understanding the technological capabilities of smartphones is a key factor [3] with [4] suggesting that, “smartphones have the potential to significantly influence the touristic experience.”

One such emerging technology, NFC is a close-range wireless technology for data transfer and information exchange [2]. Google's Android operating systems supports NFC on over 200 million devices [5], due Android's 85% share of the mobile market.

Recently, Apple has also decided to incorporate the use of NFC technology for payment, called “Apple Pay” [6]. This means that iPhone 6 users are now able to make payments in a private, secure and simple way built into their smart devices [6]. Initially this payment system is the only feature that will utilise NFC with the iPhone 6, whilst other manufacturers such as Samsung, Sony, HTC and LG allow NFC technology to be used to support an increasing number of usages. More than 30 million NFC enabled smartphones have been sold by vendors in 2011 and this is predicted to reach more than 700 million smart devices featuring NFC by 2016, according to a report from Berg Insight [7]. This level of uptake has led to NFC being predicted to be one of the next breakthroughs in technological progress [3] and provides considerable potential to open up new opportunities for various stakeholders in the tourism market.

Previous research has shown that NFC applications have the capability of offering value-added retail marketing services to mobile centric travellers [4] and increase a tourist's digital and physical engagement whilst visiting an attraction. This paper details the technologies used within these applications and the design of an NFC enabled mobile app that is being developed in collaboration with Canterbury Cathedral.

### Aims

Focusing upon two distinct target audiences, the main aims of this research are as follows:

- To investigate how technologies such as NFC could enhance a visitor's experience in popular tourist attractions in the UK.
- To investigate whether usage data can be analysed to determine the popularity of certain artefacts and events, enabling attraction managers to make informed decisions about future promotions and services.

In order to determine The best practice for the development of the mobile application that supports this investigation, research into the technological strengths and current uses of NFC technology within the tourism industry has been undertaken and is presented in the following section.

### Background

#### -NFC Technology-

NFC is a short-range wireless communication technology, based on Radio Frequency Identification (RFID) that supports the secure transfer of data between electronic devices [8].

NFC technology uses magnetic induction in order to transfer data between two devices [9]. A wire coil that generates a magnetic field when current flows through its coil. In this case by putting a secondary wire coil near its magnetic field, current is induced into it. This secondary wire coil, which is called NFC tag in this case, starts working by transmitting information [10]. By bringing two NFC enabled devices close together approximately 10 cm, a simple connection can be easily established and this connection can then be used to transfer data from one device to the other. When the two devices are parted from each other, the connection, and data exchange will stop [9] [10].

The Oyster Card supplied by London Transport, is a popular example of NFC technology. Passengers add funds to an NFC enabled card and tap it on an NFC reader (the yellow circle in Figure 1 below) to pay for their journey when entering a bus or other public transport system.

Similarly, contactless debit or credit cards utilise NFC technology which can then be used to make quick and secure payments for small purchases. For this kind of payment there is no need to enter a PIN number. Payment transactions are authorised by tapping the cards on contactless card readers.



Fig. 1. NFC oyster card. Source: TFL.co.uk

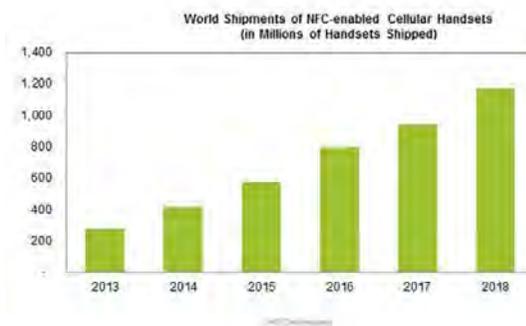


Fig. 2. Forecast for world shipments of NFC handsets, in millions per years. Source IHS

#### -Similar Technologies-

Bluetooth and Quick Response Codes, commonly known as QR codes, are two similar and comparable technologies to NFC. Bluetooth is a standard for wireless communication to transfer data among electronic devices. However, an initial set up is required to make a connection via Bluetooth as devices must be paired. The power energy consumption by Bluetooth is more than NFC technology as a Bluetooth connection can be stable at around 10 meters.

A QR code is a multi-dimensional barcode that contains information about an object. This optical readable pattern can be read by smart phones' camera through a QR code scanning application and the stored data can be extracted. For both of these technologies a basic technical knowledge is essential in order to use either [2].

### ***-Advantages and Disadvantages of NFC-***

Some advantages of NFC technology have been listed as below:

- Natural security. Due to the short transmission range of NFC contactless technology between two devices, NFC has an in-built high level of security [8]. Therefore, NFC is a suitable technology for crowded places.
- Easy to use. Users do not need to have knowledge of how the technology works, just how to use it [8].
- Compatibility. NFC technology is compatible with existing Radio Frequency Identification (RFID) structures, tags and contactless smart cards [8].
- Ubiquity. The number of mobile phones which have been equipped with NFC is increasing worldwide. One third of smartphones sold in 2013 support NFC technology [11]. According to [12], 416 million NFC enabled mobile phones had been shipped by February 2014 and this number is expected to increase to 1.2 billion by 2018. The percentage of NFC enabled mobile devices increased 5% in 2011 and is expected to rise 53% by the year 2019.

In general, NFC can store small amount of data. The total of NFC usable memory is less than 10 kilo bytes, it means NFC tag is not a suitable technology for storing large amount of data [13].



Fig. 3. NFC Smart Poster. Source:[http://smarttouch.net.in/buy\\_nfc\\_tag\\_stickers.php](http://smarttouch.net.in/buy_nfc_tag_stickers.php)

### ***-Uses of NFC technology in Tourism-***

Due to its high level of usability and support for object interaction, NFC has been highlighted as one of the most suitable technologies for use in mobile tourism applications [14]. Recently, a number of historical venues

have used NFC to enhance the visitor experience. For example, the Museum of London has recently adopted smart posters as a sustainable solution for self-guided tours [15]. A smart poster is nothing more than a traditional poster which is embedded with NFC tag [8]. These either visible or hidden NFC tags are programmable and able to keep small amount of data. For example as text for a timetable at a bus stop, numbers for discounted vouchers, a web address for booking a ticket and etc. Therefore, it can be used as posters, smart magazines or in a form of billboard advertising [13]. In fact an NFC poster is for interactive communication with users [8].

Visitors can directly receive information about an item through a web site simply by tapping their NFC supported device on an NFC tag placed next to the item [15]. Other features include being able to check in at the Museum, share, follow, like and make comments on social media all by touching programmed NFC tags at the museum.

Another example of the use of NFC technology in the tourism industry has been presented by [16]. After booking a room in the Clarion Hotel Stockholm in Sweden, guests will receive confirmation of booking on their smart devices and can then check in on-line before arriving at the hotel. Once checked-in, a unique digital is automatically sent to the visitor's smart phone via SMS [17]. A relevant mobile application has been also developed in order to then use this digital key by touching their NFC enabled mobile phone on their room door lock when they arrive at the hotel. With this system visitors do not need to wait at check in to receive their hotel room key [17].

### ***-Canterbury Cathedral Case Study-***

According to the latest statistics from the Association of Leading Visitor Attractions (AVLA), Canterbury Cathedral is among the top 10 visitor attractions in the UK [18]. Table I shows that between 2012 and 2014, around one million people have visited Canterbury Cathedral annually [18]. The Cathedral has a large number of artefacts and items and are keen to identify ways that technology can be used to deliver better services to visitors and to enhance interaction between visitors and exhibits and also between visitors themselves.

Currently the Cathedral does not have an electronic repository that stores information about artefacts within the Cathedral but do have an audio tour guide that contains some of this information Therefore a mechanism to collect, store and present information about artefacts is needed. The development of an application to support this process is detailed in the following sections.

TABLE 1

Number Of Visits To Visitor Attraction In Membership With ALVA		
Site	Total visits	Year
Canterbury Cathedral	1,091,684	2014
Canterbury Cathedral	1,001,266	2013
Canterbury Cathedral	969,088	2012

### Methodology

In order to identify the best technological solutions and relevant functionality to enhance the visitor experience, a review and analysis of global attractions and uses of technology within them has been conducted. This has included cognitive walkthroughs of a number of applications such as the British Museum’s mobile app. Key common features identified included usage of maps and guides with visitors being able to select floors and halls and then being able to find and view information about relevant items and objects.

In addition to this, managers and members of staff at the Cathedral have been interviewed to determine the requirements of the proposed system and the environment that it will be used within. To determine the types of artefact present within the Cathedral and the routes and content of existing tours, a tour guide was interviewed and observed and an audio tour that the Cathedral supplies was also reviewed.

Following these reviews and discussions, it was decided that the combination of NFC smart posters and a mobile application is a suitable technological solution to help visitors navigate around the Cathedral and to find out relevant information about the artefacts they are viewing.

### V.Design and Implementation

The first stage in creating the application was to design a suitable mechanism to collect and store information about the artefacts within the Cathedral. A database and online data entry form have been designed that relevant staff members at Canterbury can use to enter information about artefacts and upload related files e.g. audio clips, videos and photographs.

Following feedback from one of the staff members,

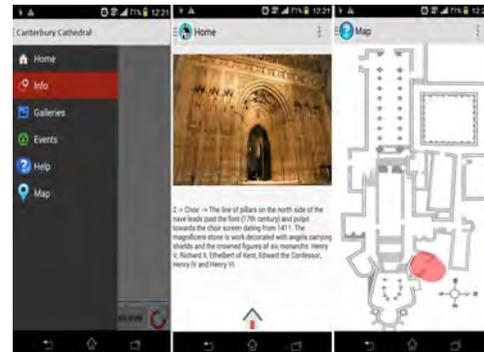


Fig. 4. The Canterbury Cathedral Mobile Application.

the importance of determining accurate coordinates of artefacts was highlighted as a potential issue and a number of different solutions for collecting and entering this data were explored. The final solution was to allow users to click on a map of the Cathedral to identify where an artefact was positioned in the Cathedral. The data entry form then automatically converts this click to an x, y co-ordinate which can then be used to plot the position on the map when shown to the user in the mobile application. A further enhancement was the addition of autocomplete tagging support (based on select2) which means that users can tag artefacts with words and phrases that they think describe the artefact [19]. This tagging system can then be used within the mobile application to help users find artefacts via a tag based navigation system.

Having created support for gathering data about artefacts within the Cathedral, the main use cases were then formalised and are detailed in the following section.

#### -Use cases-

- Visitors can install the application on their own device (via a smart poster at the entrance of the Cathedral).
- Visitors are able to access multimedia information about the artefacts.
- Visitors can view news or future events online.
- Visitors can leave feedback and make comments about artefacts that can be viewed by other users
- Visitors are able to define their area of interests.
- Visitors can navigate themselves around the Cathedral
- Visitors can find tagged artefacts.
- System Architecture

To support these use cases, a mobile application has been designed and a prototype developed for Android NFC enabled mobile phones such as the Samsung Nexus S, Galaxy S4, Sony Xperia, LG and etc.

The system architecture consists of:

- A mobile application: to allow visitors to interact with NFC tags, view related multimedia content, and interact with the system;
- The NFC tags embedded into smart posters;
- A database to store all information and addresses;
- A web service to retrieve information over the internet;
- Internet connection: to transfer the contents from the Canterbury Cathedral Data to the visitors' mobile devices;

The NFC tags contain a unique ID code that corresponds to the ID of an artefact that is stored within the database. A web service has been created to provide a bridge between the tags embedded in the smart posters and the database. When a visitor reads an NFC tag with the mobile application, a request is sent to the database, via a web service, to access the corresponding information about the artefact that the NFC tag relates to. This information from the database is then sent back to the mobile phone application via another web service. The returned contents is then read by the mobile application and the text, video, audio and etc, is then presented to the user. Later, by monitoring and collecting tapped NFC tags data in the data base, the Cathedral managers can make informed decision to deliver better services to visitors.

## Conclusion

This paper has detailed the potential uses of NFC technology within the tourism industry and described the initial stages of the development of a mobile application and storage system for artefacts within a popular UK tourist attraction. The implementation of this application is on going and a full evaluation and set of user studies are currently being planned.

The work so far though has shown that the combination of NFC enabled devices and smart posters embedded with NFC tags, can provide visitors with information and multimedia content about artefacts which can enhance the user experience. With the majority of new smart mobile handsets and devices being equipped with NFC, this provides tourist attractions with a number of new ways to interact with their visitors. The digital foot print that users create via their smart phones' interactions with the surrounding environment will allow for analysis of user behaviour and provide an insight into a visitor's area of interest and uses of this data are currently being explored.

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# Computational methods for matching records

## Stephen Brown

De Montfort University  
Leicester, UK  
sbrown@dmu.ac.uk

## Simon Coupland

De Montfort University  
Leicester, UK  
simonc@dmu.ac.uk

## David Croft

De Montfort University  
Leicester, UK  
david.croft@email.dmu.ac.uk

### Abstract

**While there is growing consensus among museum professionals and users about the importance of data integration, cross-collection searching remains a significant challenge. This paper describes a novel approach to interrogating different online collections to identify potential matches between them, using fuzzy logic based data mining algorithms**

### Keywords

**Cross searching; ontologies; semantic Web; linked data; photographic collections; matching records; resource discovery; data mining**

### Introduction

There is enormous potential for using information about objects from collections to enrich records in others and to reveal relationships between them not previously apparent. However, drawing together information from diverse collections is challenging [1]. Conventional search engines typically yield either too many hits for a particular query, or too few. If there are a great many, then most of them are often of little interest (false positives) while if there too few, it may be that the search has overlooked relevant data (false negatives). Even experienced arts and humanities researchers, typically use just one or two word searches [2], so getting the design right between precision (excluding false positives) and recall (excluding false negatives) is important. Additionally, much of the data on the Web lies

beyond the reach of search engines[3]. Either improved record linkage or more effective discovery tools are needed to facilitate better cross collection searching and filtering [4, 5]. In recent years some progress has been made towards improving record linkage using a variety of computational methods.

### *-Text mining-*

Historically, Galleries, Libraries, Archives and Museums (GLAMs) records were created using natural language because they were intended to be read by human beings. Text mining tools can analyse natural language, however they have mostly been developed to analyse large volumes of text [6, 7]. While GLAMs item level records may amount to thousands of words, each individual record typically contains relatively few words, often just a person name, an object title, a date and a short description. Similarly, contactless debit or credit cards utilise NFC technology which can then be used to make quick and secure payments for small purchases. For this kind of payment there is no need to enter a PIN number. Payment transactions are authorised by tapping the cards on contactless card readers.

### *-Linked data-*

The concept of Linked Data was developed to address this challenge. Linked Data is machine readable and it defines the meaning of words that appear inside Web documents with reference to external data, to create a web of interconnected terms [8, 9]. Recently there have been a number of efforts to publish metadata about GLAMs

objects as Linked Open Data [1, 10, 11]. Notable examples include the Rijksmuseum [12] and the Linked Open Data in Libraries Archives and Museums (LODLAM) initiative. However, the majority of Web documents are not yet in this format and standardizing heterogeneous data from various source collections requires resources and technical expertise beyond the means of many GLAMs [13]. typically contains relatively few words, often just a person name, an object title, a date and a short description. Similarly, contactless debit or credit cards utilise NFC technology which can then be used to make quick and secure payments for small purchases. For this kind of payment there is no need to enter a PIN number. Payment transactions are authorised by tapping the cards on contactless card readers.

### *-Application Programming Interfaces-*

Application Programming Interfaces (APIs) aid cross-collection resource discovery by specifying how programs interact [14, 15, 16]. Many major Web data sources such as Google, eBay and Amazon provide access to their data through Web APIs. Their principal strengths are that APIs provide access to source data without having to copy or move the data itself. Once created, material can be published in a variety of forms and locations with little further effort. It also means that APIs are fast, delivering results “on the fly”. Some examples of successful API implementation are the Science Museum [16], the V&A [15], the Powerhouse, Brooklyn museum [14] and the Rijksmuseum [17]. Thus far, these support only in-house developments such as the V&A “Search the Collections” service and interactive exhibits throughout the galleries. Although aggregator services, notably the Culture Grid and Europeana can ingest records via APIs to create searchable databases spanning multiple institutions. Europeana provided access to 21.3 million object records from 33 countries as of 2012 [18].

As with Linked Data, records must again be consistently structured and encoded in a machine readable format. Yet GLAMs data are notoriously messy. They are held in a variety of different content management systems, structured, labelled and marked up in various and sometimes idiosyncratic ways [14, 13, 10]. Before APIs can be deployed these data quality issues must be addressed and this is an unlikely prospect for the majority of collections in the near future. Alternative approaches are needed that can work with the reality of messy GLAMs records now.

The remainder of this paper describes how techniques developed in the AHRC funded FuzzyPhoto project identified potential matches between GLAMs records where the data are incomplete, imprecise, inconsistently formatted and too fragmentary to be amenable to conventional text mining approaches. Section II describes the overall aims

and approach. Section III reports on the methods developed for comparing records. Section IV describes the results and section V presents some conclusions and suggestions for further work.

### **The Fuzzyphoto project**

FuzzyPhoto aimed to help researchers to quickly find information from among the already enormous volume of resources available on the Internet from GLAMs, in this case helping researchers to match photographs held in different archives with historical exhibition catalogue records. “Photographic Exhibitions in Britain 1839-1865” (PEIB) and “Exhibitions of the Royal Photographic Society 1870-1915” (ERPS) are online databases of photographic exhibitions that contain information about more than 65,000 exhibits from the earliest days of photography. While many researchers have commended PEIB and ERPS for their usefulness, a common criticism is that most of the pictures are missing. Only 1040 exhibit records have accompanying images, many of which are merely artists’ sketches of the originals.

### **Shape \\* Mergeformat**



*Example of an illustration of a photograph from the RPS exhibition catalogue of 1901.*

Mechanical reproduction of photographic images was technically difficult and costly at the time of the exhibitions, and anyway unnecessary since the pictures themselves were on view on the gallery walls. Since GLAMs collection objects are increasingly available online it should be possible to search them to locate the “missing images”. However searching thousands of records manually is impractical. FuzzyPhoto aimed to find computational methods to help researchers to match surviving historical photographs in GLAMs collections with records of exhibits in the PEIB and ERPS exhibition databases.

The approach adopted entails four stages:

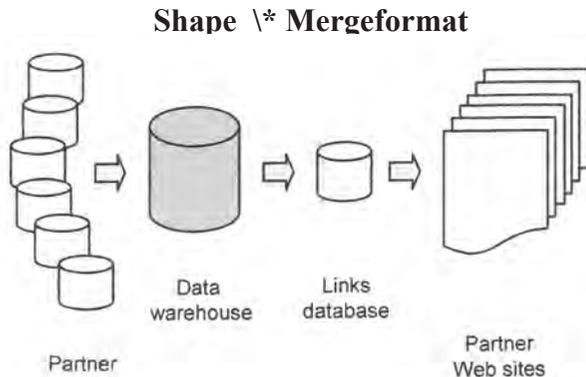
Data acquisition from partner archives

Data integration

Data interrogation to identify similarities

Publication of similarity information in an easily discoverable format via partner Web pages

Six GLAMs collections were initially selected for comparison with PEIB and ERPS: Birmingham City Library, the British Library, the Metropolitan Museum of Art, the Musée d'Orsay, the National Media Museum, the Victoria and Albert Museum and St. Andrews University library. Subsequently, data from other collections were added (Brooklyn museum, Culture Grid, the National Archives, and National Museums Scotland). Imported data were cleaned up and mapped to the ICOM Lightweight Information Describing Objects schema (LIDO). LIDO is an XML harvesting schema for exposing, connecting and aggregating information about museum objects on the Web, ideally suited to the task of standardizing the metadata provided by each of the contributors. Clean data were stored in a data warehouse where they were interrogated to identify similarities, as described in the next section. Identified matches were exported as links to a second separate database from which they are served up via a "widget" embedded in the partner's Web page whenever a visitor requests links to similar items held in other partners' collections.



Overview of the FuzzyPhoto data work flow.

### **-Record comparison-**

Similarities were identified by firstly comparing pairs of records with respect to individual fields. Four key fields were used: person name, date, title, date and process. Individual field similarity metrics were combined to produce an overall similarity metric for each pair of records. Finally overall metrics were ranked in order of most to least similar.

### **-Dates-**

The key factor in relation to date is the amount of time between the dates or date spans described in the fields. The greater this value, the less similar they are.

### **-Person names-**

Names may be surname first or otherwise and include titles, initials and nicknames. We used established edit distance techniques that measure similarity in terms of the number of changes that are required in order to convert one string into another [21], allowing for typographical errors and spelling variations.

### **-Processes-**

The various photographic processes were organised into an ontology in which those sharing specific traits are clustered together, on the same branch. Once a record was matched to a specific locus in the ontology it was compared to others by finding the shortest path between them. The shorter the distance between the processes, the more similar they were considered to be.

### **-Titles-**

The title similarity metric was particularly challenging because titles are brief and do not follow normal grammatical rules for sentences. This ruled out corpus analysis tools. Short text semantic similarity tools such as Latent Semantic Analysis (LSA) and Sentence Similarity (STASIS), overcome this problem but cannot easily process large numbers of records [22]. We had to deal with 1.4 million records so we developed a simplified semantic similarity measure (Lightweight Semantic Similarity) which significantly lowered the computational overhead without significantly reducing the accuracy of results [19]. LSS is based on standard statistical cosine similarity metrics [23], but additionally takes into account the semantic similarity between words, using WordNet.

### **Combined similarity metric**

The final step was to combine the individual field metrics into an overall record similarity metric. A series of rules describe how to combine and weight the individual metrics, based on the programmed knowledge of domain experts [21]. Rule based systems function poorly when faced with imprecise information (eg. "circa 1890"). The solution to this difficulty was to use a fuzzy rule-based approach that allows an object to simultaneously belong to more than one category to various degrees. The full set of fuzzy rules used draws on the individual field similarity metrics to ascertain if the match between any pair of fields is good and then combines that comparison with other field comparisons as follows:

If bad\_title AND bad\_person THEN terrible\_match

If bad\_title OR bad\_person THEN bad\_match

If good\_title OR good\_person OR (good\_process AND good\_date) THEN good\_match

If good\_title AND good\_person THEN excellent\_match

In order to reduce the time taken by this final stage of the comparison process, a novel defuzzification algorithm was developed [24].

## Results

Good quality matches have been identified for over half (57%) the records. Figure 3 shows an example that is the result of a search relating to ERPS record erps28409. The starting record is a portrait of George Meredith, exhibited by Fred Hollyer in 1909, and in this case the exhibition catalogue includes a copy of the photograph. The other two images were matches suggested by the FuzzyPhoto algorithms. Examining the metadata for all three, an intriguing story emerges. Erps28409 was not the original study. Frederick's brother Samuel made a similar etching in 1900, (Library of Congress record loc92512466). A plausible explanation is suggested by V&A exhibit vaO75248. It seems likely that the other images derive from this larger study made by Frederick Hollyer in 1886. What is remarkable about these results is that while the images are similar, the metadata are different. For example "Fred Hollyer", Hollyer Samuel" and

			
ID	erps28409	loc92512466	vaO75248
Title	George Meredith	George Meredith	George Meredith, Portraits of many persons of note photographed by Frederick Hollyer
Person	Fred Hollyer	Hollyer, Samuel, 1826-1919	Hollyer, Frederick
Process	[Not Listed]	1 print, etching	
Date	1909	c1900	1886

Comparison of results of search for seed record erps 28409

"Hollyer, Frederick" are quite different computationally, even though their similarities are obvious to a human reader.

Thus far we have tested a sample of the outcomes on a panel of subject experts, to compare speed and accuracy of co-reference identification between expert human beings and FuzzyPhoto. The results indicate our new approach is at

least as accurate as experts and considerably faster.

Notwithstanding these encouraging results, the FuzzyPhoto approach is not without limitations. Scalability is an issue firstly because of the messiness of the data. Data cleaning and standardization of 1.4 million records required 70 person days of effort. Adding other collections would increase this. Further limitations are imposed by the time required to search the records for matches and the amount of memory this requires. Although the time required to process a single record is measured in seconds, additional records increase the time linearly.

## Conclusions

There is a growing need to find ways of sharing and connecting data held by GLAMs. There are significant benefits to be gained from being able to make such connections and customers are increasingly likely to expect to be able to navigate seamlessly across separate collections. Computational approaches such as linked data, application programming interfaces and text mining promise significant progress but are currently constrained by the messiness of much GLAMs record data. Records that are not machine-readable are not amenable to such approaches and the level of investment required to convert millions of messy, inconsistent and incomplete records is likely to continue to outstrip the ability of institutions to carry out such work in the foreseeable future.

FuzzyPhoto identified similarities between 1.4 million records, based on lexical and semantic similarities, even where the data are messy. The results will be of immediate use through the widget interfaces embedded in project partner's Web sites and the approach is potentially extensible in terms of both more records and different domains. Although developed to address a specific problem of finding pictures to match photographic exhibition records surviving from the late 19th century, the approach described here is potentially applicable to other contexts where it is necessary to find matches between incomplete and imprecise data held by various agencies in different formats and to differing standards of consistency. These could be other types of cultural heritage records, for example looted art, or people, such as concentration camp victims, refugees from conflicts or major natural disasters. However, in order to open up this approach more widely to other institutions and other subjects, further work is needed to automate the labor-intensive data preparation stages and to reduce the memory demands of the processing algorithms.

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- Based on a sample of 100 records.
- Image reproduced with permission, Library of Congress.
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# “Cut me to pieces”

## Shakespeare, fandom, and the fractured narrative

**Daisy Abbott**

Digital Design Studio  
Glasgow School of Art  
Glasgow, UK  
d.abbott@gsa.ac.uk

### Abstract

**This paper considers the tensions and interactions between a classic play, its modern staging and live broadcast, and its playful reinterpretation by fans via social media platforms such as Tumblr. In the context of cultural theory and organizational policy, the live broadcast of Shakespeare’s Coriolanus is shown to be a complex, fractured, transmedial cultural experience with significant implications for its live theatrical and broadcast audiences, as well as online audiences drawn from the fan base of its lead actor. Examples of fan production are shown to extend and reinterpret the core narrative, further fracturing the narrative across unofficial platforms and creating new, interactive cultural experiences.**

### Keywords

**theatre, live broadcast, NT Live, Shakespeare, digital, interactive, narrative, fandom**

### Introduction

Towards the end of the Donmar Warehouse theatrical production of Shakespeare’s Coriolanus, the title character, outnumbered by enemies, throws down his sword and exclaims “Cut me to pieces!” REF\_Ref404070030 \r \h [1] (A5:Sc6:L3953). Across the world, that’s exactly what happened. National Theatre Live (NT Live) broadcast this performance live to cinemas where fans not only watched but recorded it on handheld devices, extracted clips and silent animated gifs, recaptioned and reinterpreted them,

shared them on social networking sites, and reposted them, often without context.

Coriolanus REF\_Ref404070046 \r \h [2] starred Tom Hiddleston in the title role, an actor with a particularly enthusiastic and active online fan community. Despite a legacy of Shakespearean roles both on stage and screen, it is clear from usernames that the majority of Hiddleston’s twitter and Tumblr fans were introduced to him via his role as Loki in blockbuster films Thor (2011), The Avengers (2012), and Thor: The Dark World (2013). Coriolanus was of interest to these audience members precisely because of Hiddleston’s involvement and the fandom demonstrated clear demand for cultural consumption of this actor in this role before the performance opened, throughout its run, and after the live performances ended. Pre-performance activity focussed around sharing, remixing, and producing original content from official posters and videos released by Donmar and NT Live as teasers for the play; sharing enthusiasm or jealousy around access to tickets (tickets sold out on the first day); and, as it was many fans’ first exposure to NT Live, understanding the mechanism for the wider delivery of the live broadcast (e.g. one commenter asked “What channel will it be aired on?” REF\_Ref404070058 \r \h [3]). As the run progressed, fan activity included reviews both of the play and of the experience of seeing Hiddleston (onstage or at the stage door), sharing of photos taken during the play, reflexive debate and criticism of some fan behaviour which breached rules of etiquette, and a building anticipation and excitement of the live broadcast (including the incredible lengths that some fans were willing to travel to their nearest participating cinema, seemingly worn as a badge of honour). Immediately following the NT Live

broadcast on 30th January 2014, fan production focussed on reactions and reviews of the play itself, alongside remixing and reimagining images and clips from the high quality live stream which had been shared illegally online and, later, original fiction inspired by the play.

In the past five years, NT Live has broadcast over twenty theatrical productions live, and ‘as-live’, into cinemas around the world. Research into the NT Live experimental pilots notes the importance of social media as discovery platforms for creative content and acknowledges that the “experiential goods” produced by live performance are complex to translate digitally REF\_Ref404070067 \r \h [4] (p.1). NT Live swiftly moved from thinking of live broadcasts as a surrogate for the theatre experience to understanding them as a separate and different cultural product REF\_Ref404070079 \r \h [5] (pp.8-9). I attended two NT Live broadcasts of *Coriolanus*, one in Glasgow (UK) on 30th January 2014 and the ‘as live’ Encore screening in Falkirk on 11th March. Encore screenings are broadcast exactly the same as the live version and therefore contain all the same interviews and extras, however the advertising and surrounding context can change.

Both screenings opened with a looped series of adverts for other NT Live screenings and other (non-broadcast) productions upcoming from the Donmar Warehouse. These were intercut with written snippets of information about the play and the cast alongside rehearsal and production photos of the play we were about to see, as well as live footage from the Donmar of the audience assembling for the live production. Showing footage of the audience is becoming a standard aesthetic choice for screen directors of live broadcasts REF\_Ref404070092 \r \h [6]. There followed an interactive advert and a superlative-laden onstage speech from NT Live presenter Emma Freud. It primarily consisted of describing upcoming NT Live shows before introducing a short film introducing the Donmar Warehouse and their production of *Coriolanus* REF\_Ref404070046 \r \h [2].

This information, advertising, and interactivity blurs the borders of *Coriolanus* as a narrative. The play is placed firmly in its context as a Donmar production, an NT Live broadcast, and a ‘cultural experience’. Although less emphasis was placed on the delivery mechanism of the broadcast than in previous NT Live productions, the screening was also clearly established as an innovative technical experience.

The short film which preceded the play further blurred the boundaries of the discrete narrative. It mixed archive footage with behind the scenes footage of makeup being applied to Hiddleston to introduce the title “The people must have their voices” REF\_Ref404070030 \r \h [1] (A:2, Sc2, L:1395) and included interviews with actors, the director, and set designer to reflect on their decisions

about staging the play and its relevance to modern times. Some of this footage had already been released in the trailers available from the NT Live website REF\_Ref404070002 \r \h [7] and the documentary enhances an understanding of *Coriolanus* as a play and the context of its production, whilst, again, using images of the set and actors the audience is about to see in the play itself.

The transition from this (pre-recorded) documentary into the (live) play is particularly interesting. The end of the documentary showed the large window shutters of the Donmar being closed, this blackness faded up to an image of the stage, onto which a boy begins to paint a red line. Partly due to the pre-empting of images of the stage, and also that the scene is accompanied by the same non-diegetic music that was used in the documentary, it was not immediately clear that the screening had now moved from pre-recorded content to the live broadcast. This particular directorial choice reinforces the impression that this performance event was not just about *Coriolanus* the play, but about the overall experience of cultural consumption. The trailers, previous work by the actors, historical research, and identity of the venue are all brought together in the short documentary, pre-empting, analysing, and contextualising the play, which then seamlessly morphs into the live broadcast itself. NT Live broadcasts are a deeply hypermedial experience, mixing elements of theatre, cinema, television, and computing in a “post-cinematic mediasphere” REF\_Ref404070199 \r \h [8] (p.67) which, surprisingly, did not appear to privilege the theatrical content. The wide reach of the live broadcast, and the fan reactions, create a truly post-cinematic “vast, open performative space, carnivalesque, participatory, and overtly self-reflexive” REF\_Ref404070199 \r \h [8] (p.68). However, it is clear that the fracturing and remixing of the core narrative is not only the domain of fan sharing and production but is also deliberately featured in the authorised narrative of the experience.

At the interval, the cinema audience saw repeats of the pre-show adverts, again intercut with live footage of the stage and Donmar audience with an onscreen countdown to the “interval feature”. This was an interview with director Josie Rourke where Freud focussed on her decision to cast MTV’s “sexiest man in the world” as *Coriolanus*. The casting of big name ‘celebrity’ stars in a number of recent Shakespeare productions has been widely discussed in newspapers and blogs since the broadcast. In immediate reactions to the show, Freud’s comments were widely criticised by journalists and fans. One reviewer stated that the ‘DVD extras’ “evoked neither theatre nor cinema but bad arts television” REF\_Ref404070315 \r \h [9] and one Hiddleston fan expressed an opinion prevalent in many blogs and comments about the mid-show interview: “I was disgusted. This is one of the world’s greatest living actors, who is turning in the performance of a lifetime, and all

you talk about is his sexiness? HAVE SOME RESPECT” REF\_Ref404070420 \r \h [10]. It is clear that the presence of Hiddleston was a large contributing factor to the huge popularity of the production and during the interview Rourke acknowledged the legacy of her cast’s previous film and TV work in bringing new audiences to the narrative. Other articles note the negative side of overwhelming popularity due to Hiddleston’s fans. By this point in the theatrical run, the venue had begun to have problems with fan behaviour at the stage door where expectations of direct contact with the actors caused a disrespectful and threatening atmosphere REF\_Ref404070482 \r \h [11]. Hiddleston fans were beginning to be quoted as explicitly only attending the play to see him (“One girl who has seen the show says: ‘I don’t much care for Coriolanus as a play, so I spent my time admiring the curve of Tom Hiddleston’s arse again.’” REF\_Ref404070588 \r \h [12]) whilst theatre aficionados demonstrated anger in reaction to what they saw as the undermining of their rights to access Shakespeare as ‘real’ fans: “One of the things I hate about fangirls is they go to shows to fantasize and don’t care about the play. Their selfish buying up of more than 1 show means Shakespeare fans can’t buy tickets” REF\_Ref404070482 \r \h [11]. Some audience members also caused tension between different fan groups by using handheld devices to take photographs and tweet during the onstage action, a serious breach of theatre etiquette and clash of the cultures of (theatrical) dedicated attention and (Internet) ubiquitous connectivity.

The popularity and reach of *Coriolanus* as a live broadcast quickly led to demand for a DVD of the production REF\_Ref404070668 \r \h [13]. Like the production of *Frankenstein* before it (notable for also featuring an actor, Benedict Cumberbatch, with a very enthusiastic and prolific fandom attracted to the play via a different character: Sherlock), there quickly arose considerable tension between fans demonstrating a firm expectation that they should be allowed access to recordings and those who want to preserve the ephemerality and liveness of theatre. The debate raged on social media, particularly when fans shared links to illegal copies of a full recording of the show, with many questioning (with widely varying levels of both eloquence and entitlement, e.g. REF\_Ref404070804 \r \h [14]) the NT Live mission to “create greater access to the productions on our stage” REF\_Ref404070871 \r \h [15]. Since February 2014, NT Live has begun to include a blanket statement in every autoreply to an enquiry:

“currently National Theatre Live does not produce DVDs. This is because National Theatre Live is filmed with the specific intent of it being shown on cinema screens and although it doesn’t replace the theatrical experience it tries to emulate it as much as possible. We very much appreciate your desire to see the release of DVDs of our broadcasts but

unfortunately there are no immediate plans to do this due to our rights agreements we hold with our artists. We will, however, continue to evaluate this decision.” REF\_Ref404070925 \r \h [16]

The people must have their voices, and despite NT Live efforts, illegal clips and full recordings from *Coriolanus* were shared widely throughout some fandoms and many fans remain unconvinced by the official position on recordings; a demand which directly challenges the notion of “limits to the ‘anytime, anywhere’ attitude to the consumption of cultural content” asserted by NT Live REF\_Ref404070079 \r \h [5] (p.41). Furthermore, although NT Live appears to be in support of “digital technology’s ability to encourage participation and interaction and to promote new co-created content” REF\_Ref404070079 \r \h [5] (p.10), it is clear that many of the creative responses to *Coriolanus* (particularly animated gifs) have been sampled directly from illegally shared files, making them particularly ethically complex as transformative, derivative works.

In the same way that fans (of various types) sought to enact a form of ownership over this play before and during its performance by expressing entitlement to tickets or tweeting photos and comments from theatre seats, post-event behaviours again exert ownership over the content of the play. The very mechanism that allowed the play to become so widely accessed (through both official screenings and illegal recordings) has an effect on the ways in which the play has been received and interpreted, and creatively reimaged by fans. The convenience of a digital copy lends itself to sampling in the form of still images and animated gifs, which are then edited and captioned without the requirement for great technical skill. But it is clear that the digitised form of the broadcast itself goes further than mere technical convenience. Wade notes: “What has thus emerged in articulations of mediatization is the notion of a passive and malleable viewer, a position that highlights the power of systems and the diminishment of individual autonomy. And it is not surprising that certain critical discussion has chafed at this kind of materialist methodology, as this outlook decenters and shortchanges the notion of the human (and aspects of agency and nonmaterial dimension)” REF\_Ref404071047 \r \h [17] (p.57). It is clear from the following examples of fan production that human agency is very much present in the digital materialism of transformative works produced from *Coriolanus* and its surrounding context.

A playful series of images (clearly sampled from the high quality live broadcast file) effectively sum up and interpret the central relationship between *Coriolanus* and his mother, *Volumnia* REF\_Ref404071463 \r \h [18]. The sequence consists of four images, the first is a still image that directly quote dialogue from the play: “I will not do it lest I surcease to honour mine own truth” (A3, Sc2, L2309) as *Coriolanus* refuses to pander to the

people in the marketplace. The second and third images are animated gifs showing a short sequence of frames from the broadcast, sequentially captioned with the thought processes of the characters. In the first animated gif, Coriolanus is thinking "...I'm a strong warrior... I am fearless... I CAN CONTRADICT MUM". Volumnia is simply captioned with ellipses as she considers her response while Menenius (in the background) is "\*waiting for it\*". The third panel shows Volumnia's strong reaction – she throws up her arms in anger and is captioned with "ASFGHJKL!!!" to replace her Shakespearean dialogue while Coriolanus, realising his mistake, is captioned with "oh shit... shiiiiit... Aufidius help me.... really scared btw". The final, still, panel shows a placatory Coriolanus with a direct quote "Pray, be content mother, I am going to the market-place. Chide me no more." (A:3, Sc:2, L:2320-22)

SHAPE \\* MERGEFORMAT



Series of images from Coriolanus, REF\_Ref404071463 \r \h [18]

Series of images from Coriolanus, REF\_Ref404071463 \r \h [18]

This image sequence very effectively captures the meaning and humour of the scene whilst partially translating it into the type of language used on social media. The post has nearly 6,000 ‘notes’ (Tumblr’s terminology for activity such as liking and reblogging).

Another Tumblr post provides a 23-line summary

of Coriolanus, preceded by a tongue-in-cheek warning that the post “Contains spoilers for a 400-year-old play” REF\_Ref404071581 \r \h [19]. The dialogue (in modern, informal English) wittily and accurately describes the narrative and the contextualising sentence is a clear, deadpan reaction to the annoyance of many fans that others were giving away spoilers for Coriolanus on social media before they had chance to see the broadcast content.

“CAIUS MARTIUS:

Hi Aufidius. I know we’re sworn enemies, but Rome banished me. Wanna kill them all?

AUFIDIUS:

I love you. I mean... okay, sure, sounds good.” REF\_Ref404071581 \r \h [19].

These examples demonstrate clear engagement with and understanding of the themes of Coriolanus, alongside interpretations and retellings appropriate to the social media context of their presentation.

Another commonly sampled scene was a kiss between Coriolanus and Aufidius. However, unlike the previous examples, this particular clip was often taken out of context and widely misunderstood. Fractured from its textual context (including the spoken dialogue and the performed reaction of Coriolanus to the kiss), the clip took on a new identity, bringing new meanings to its source text that were not present in the scene. Fans requested further information (“Does anyone know what this live play was about that prompted Tom and Hardley [sic] to kiss during one of the scenes? Like can you summarize the play for me?”) or had strong reactions against other fans who they felt were demeaning the play and its actors by overly focussing on the kiss (“People need to understand that Coriolanus isn’t just two guys kissing. Get over it” (Anonymous Tumblr users, quoted in REF\_Ref404071720 \r \h [20])). Unlike the Volumnia image series, the kiss appropriations do not accurately communicate the sense of the scene – the trepidation and awkward humour of the scene as broadcast is misread as more overtly sexual – and the animated gifs take on their own identity as purely visual entertainment. Interestingly, there is evidence that even where fans are completely aware of the original sense of the scene, this short clip is still deliberately consumed as a separate, independent cultural product, alongside original fiction and art which focusses on the Coriolanus/Aufidius relationship. Kirwan criticises the ‘extras’ broadcast alongside the live production of Coriolanus as “an attempt to ensure interpretation is as homogenous as possible” REF\_Ref404071882 \r \h [21] (p.276), however the re-fracturing of content (in lieu of ubiquitous access to the original or as a deliberate and self-aware fan choice) opens up these interpretations once again,

creatively reinterpreting the theatrical experience a second time.

Fan theory emphasises the importance of fan production as a way of meaningfully engaging with cultural texts and the common insistence by fans that they have the right to become full participants in making meaning from cultural products, rather than passive consumers REF \_Ref404071939 \r \h [22] (p.135, p.175). This is highlighted in the case of a cultural experience that, despite a highly complex process of development and mediatisation, remains ephemeral in its authorised form. The NT Live model of extending access through digital broadcasts but retaining a “current focus on building the live, communal experience in cinemas” REF \_Ref404071999 \r \h [23] by restricting that access to a limited number of screenings creates a huge demand for a cultural product which would not otherwise have been felt so keenly by fans, and, ironically, drives the demand for unauthorised access. Speaking specifically about Coriolanus, one academic fan states:

“There is a group at the top doling out culture, and there are those who receive it. I think it’s in the distinction between ‘getting’ and ‘making’ that you feel a kind of restlessness in the fandom. For those without access to the live performance or the broadcast, making .gifs and spreading them around is a way to assert access to the cultural thing and participate in its transport.” REF \_Ref404072077 \r \h [24]

Consequently, it is not only the passion and active engagement of the fandom that creates a demand for consumption and follow-up creative production of Coriolanus-related cultural products but also the very mechanism of the live broadcast itself. Active reading of a transmedia narrative “sustains a depth of experience that motivates more consumption” REF \_Ref404071939 \r \h [22] (p.98).

The core narrative of Coriolanus is fractured and complicated by its mediatisation and delivery as a live broadcast. Its existence in this form both enables and drives demand for fan consumption and production in a variety of modes, often at odds with NT Live’s focus on the live, ephemeral, and communal cultural experience. Fans demonstrate activate engagement with the text, and assert characteristics of ownership in spreading and remaking aspects of the narrative, often deliberately defying official modes of distribution and official interpretations. However, despite the tensions between the official and non-official narratives, in producing new content, extending interactivity and access, and encouraging particular interpretations, fan activity is not dissimilar to that of the official producers. NT Live’s Coriolanus is, at its core, a fractured, transmedia narrative.

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# Special-Organised Virtual Narratives of Contested Urban Space: Methods of mapping the Spatial Experience of Shared Heritage

## Dr Georgios Artopoulos

The Cyprus Institute  
20 Konstantinou Kavafi Str. Aglantzia  
Nicosia, 2121 Cyprus  
g.artopoulos@cyi.ac.cy

## Dr Nikolas Bakirtzis

The Cyprus Institute  
20 Konstantinou Kavafi Str. Aglantzia  
Nicosia, 2121 Cyprus  
n.bakirtzis@cyi.ac.cy

## Dr Sorin Hermon

The Cyprus Institute  
20 Konstantinou Kavafi Str. Aglantzia  
Nicosia, 2121 Cyprus  
s.hermon@cyi.ac.cy

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### Introduction

The daily experience of historic urban environments remains an ideal context to probe questions of urban identity. The broader Eastern Mediterranean basin preserves significant examples of cities whose continuous history and inhabitation can be traced all the way back to Antiquity. Specifically, the capital city of Cyprus Nicosia is considered amongst the most contested urban environments in the globe featuring a rich stratigraphy of past historical layers and perplexing present-day realities [1]. This paper offers a methodology for the cross-disciplinary study of complex urban realities with the use of advanced technologies that can support the formulation of real-time virtual environments that spatially document user behaviour in and around monuments of cultural heritage.

The presented methodology focuses on knowledge sharing and communicating experience. They are based on interdisciplinary collaborations between heritage, archaeology, architecture, urban studies and simulated environments. The paper suggests a new experience-centred method of site-explorations that facilitates data collection of mis-appropriated territories and challenged historical sites.

### Real and Virtual Narratives of Contested Urban Space

The past decades have witnessed a continuously increasing trans-regional movement from the countryside to urban centers. This development is expected to further fragment large metropolitan areas with contemporary or historic territorial, social and cultural divisions, thus resulting to further gentrification and decomposition of their territorial cohesion [2]. In this context, historic cities at the crossroads of cultural activity or at national borders, like Jerusalem, Mostar, Berlin, Belfast and Nicosia, which operate as interface areas, demonstrate important transformations of public space [3]. This dynamic character of these territories offers a particularly intriguing framework to analyze and map the relation between identity, collective memory and spatial experience. Although this relation has been addressed extensively in scholarship in the past, advanced technologies can offer vast new possibilities for interdisciplinary research. Monuments of cultural heritage can be a catalyst in redefining the spatial experience of historic cities for citizens and outsiders alike, cf. [4].

The case of historic Nicosia [5], which is the primary example for this research, provides an urban reality that is not only physically divided between Greek and Turkish Cypriots (Fig. 1), but also fragmented in its preservation and development [6]. Different from studies that focus on the politics of division, this research starts with the impact this enforced separation of the urban terrain has had on the experience and understanding of the city. Shared space and resources in multicultural environments are considered as some of the most dynamic constituting elements of the spatial experience of the contemporary city. In these complex urban realities monuments can play the role of 'cultural lighthouses' that is condensers that

punctuate flows of movement and trigger social interaction and engagement with history. Chapters in the long, layered history of these monuments can be used as stages of the ever-transforming urban terrain that unhide critical moments in the palimpsest of the city's history, cf. [7].

The presented research focuses not on the contested borderline separating the city but on the relationship that citizens and visitors establish with it. The city's division can also be invisible, expressed in the way different communities occupy the public space, incorporeal language barriers, political or religious identities, etc. It is thus clear that although the topography of a borderline (i.e., its physical presence) can be ephemeral, the topology of separation (i.e., spatial configuration and the apparent relations between distributed enclaves of occupation) can last longer and may be permanent. The theoretical aspirations of the presented research focus on how users understand their physical body location in relation to the border and what does the border mean to them in terms of their everyday use of public space.

Historical actions like accumulative building of auxiliary structures, change of use, transformation enforced by cultural, political or religious reasons, rehabilitation, or partial demolition of cultural monuments and parts of a historic city, produce a different, unplanned image of space. These transformations of the built environment provoke changes in the perception of social and cultural identity. Distinct from the socio-political discussion of the destruction of landmarks and monuments for retaliation and erasure of the other's presence from a place, this research focuses on the everyday use and spatial recognition of heritage by citizens and visitors alike. In this context, choosing, or learning to ignore, particular sites, is a political act that forms a selective understanding of shared histories.

The case of Nicosia, whose historic core remains enclosed behind the iconic 16th century Venetian fortifications, offers an instructive example of this selective process. Following the 1960s hostilities between Greek and Turkish Cypriots and the consolidation of the physical division of the city after 1974, heritage sites like churches, monasteries, mosques, public fountains, Medieval and Ottoman houses and mansions were respectively abandoned and forgotten along the two sides of the division line [8]; [9]. The historic city's center became a contested borderline and as a result its topography and organization reflected the polarized experience of the two separated communities. Responding to this problem, bi-communal initiatives like the Nicosia Master Plan and trust-building efforts sponsored by the international community, invested in the restoration and preservation of shared heritage [10]; [11]; [12]. However, most restored buildings remain in an awkward historical limbo. Although being sporadically used for cultural events they have in effect lost their role and position in Nicosia's

traumatized civic identity [13]. Studying how and what users of Nicosia choose to neglect will enable our research methodology to develop and test spatial strategies that can contribute to the re-association of these historic sites with the city's everyday experience.

An intriguing context to probe these questions is offered by the historical transformations of the structure of the Paphos gate [14]; [15]. As part of the city's medieval fortifications, which for centuries defined the experience of Nicosia's urban space, the Paphos gate was one of the city's thresholds, separating urban from rural, outside from inside, safe from hostile, known from unknown and so on [16]. Since 1974 and the physical separation of Nicosia, the Paphos gate has become an iconic symbol of division, as it is virtually located in the infamous 'Green Line' that divides the city (Fig. 2). The virtual re-staging of the spatial experience of the different historical phases of selected parts of Nicosia's public spaces, due to their association with important monuments, can help to unlock their condensed meaning in collective memory and thus utilize this knowledge to mend Nicosia's threatened cultural cohesion.

Challenges comparable to the condition of the Cypriot capital are presented in other cities of the island where rapid touristic growth has literally swallowed the cultural landscape of the ancient settlements and towns of the island. Their physical absence is in stark contrast to their cultural importance and their presence in communal and civic memory.

## Methodology and Tools

Contemporary methods of 3D documentation of heritage assets have demonstrated their potential as an ideal method for accurately capturing the details of shape and colours of cultural monuments and sites. Such data can be used in a variety of modes, among them, simulation of phases of past built environments and their related social activities. These are virtual environments where hypotheses regarding past human behaviour can be tested and scientifically analyzed through various methods (crowd behaviour, agent based modelling, etc. [17]), in diachronic and chronologic frameworks. This part of the paper discusses the methodology and related applicative pipeline for a comprehensive 3D workflow for the interdisciplinary study of heritage assets.

In the Nicosia case study, the reconstruction of the various historic phases of the Paphos gate will be spatially contextualized with the digitization of the moat and the Venetian fortifications of the city and this constitutes the first stage of the presented research (Fig. 4); (Fig. 6). This contextualization demonstrates how the presented research can contribute to the analysis of the physical space of the

city via the use of a simulated interactive environment - as the moat is currently an empty, open-air zone around both parts of the divided capital and thus could be used creatively for the development of the city's contemporary identity (Fig. 1); (Fig. 3). This research framework, implemented in the on-going study of the infamous Green Line that still divides the city, contributes to the development of innovative methods of capturing, analyzing, archiving and visualizing information about the use of spaces such as:

Cultural heritage sites, e.g., pilgrimage sites and sacred spaces;

Architectural monuments and sites of cultural heritage that have vanished or, were never completed due to historical events such as war, natural disasters, political interests and economic difficulties; and,

### ***Future spatial interventions on the urban fabric.***

This methodology enables researchers to form detailed research inquiries about the symbiotic, and complementary, participation of old and new interventions in the development of a city.

Wandering through a city a spatial text is written which, if read, emanates with chance and memory [18].

The concept behind the data acquisition tools that complement this new methodology relies on the association of bodily movement with spatially distributed presentation of historical and future narratives. The real-time exploration of a projected space extends the participant's experience of street walking into a journey of exploration, discovery and understanding spatial relations. Through exploration, the users engage with a narrative, and with this strategy the presented research aims to place them inside digital and physical spaces. Digital methods of urban analysis have been criticized for not integrating notions of bodily movement into space, since computational environments are often considered to be scale-less and body-less [19].

Introducing exploration incentives and narrative inquiries in virtual spaces adds a new level of engagement with the tools of spatial analysis and will hopefully contribute to the long standing discussion about new technologies of representation and their role in understanding and constructing built environments [20]. The digital techniques used to stage these simulated environments enable us to understand how the position, scale, organization, form, proportions of openings and other experiential aspects of the simulated space, impact the bodily movement of users with regards to their walking pace, direction, points of stasis, points of interest, gaze, etc.

In the second step of the first stage of this research, the user-base of the simulated

environment will be extended to include also non-expert users (e.g., citizens, tourists). This interactive environment will not only host reconstructions of historic buildings, but, in its second stage, will also present future interventions that are at the phase of procurement, or under public discussion (like Nicosia SOPAZ Educational Campus Strategy, Cyprus 2013, cf. [21]). It is expected that this stage of the research will provide insights for the degree of integration that the planned works may have with the rest of the existing urban space as well as information regarding their acceptance by the locals.

The presented methodology facilitates the emergence of a new narrative flow between the new (that is, future interventions in the urban-scape), the old and the absent (that is, unbuilt, demolished or transformed buildings and monuments). This co-existence of parallel dimensions of alternative realities (for example, a construction complete as it used to be, or as it is planned to become) allows professionals to experiment, test and explore hidden conditions of the built environment and also invites visitors (inhabitants and tourists) to learn from past stories, imagine their place in the new conditions presented for the city and immerse themselves in staged places. The purpose of this journey is two-fold: while users educate themselves about the history of a monument, operators of the simulated environment are able to collect data of the visitor's spatial behaviour. Through the analysis of these data, the proposed platform will enable researchers and scholars involved to further understand the capacity of the simulated common ground in staging the public life of different communities, but also to value the role of the monument studied in the lived experience of the particular area of the Nicosia.

Previous experience of digital, and hybrid, environments underlined the importance of embedding in the virtual space practical activities that will motivate individuals and communities to share the spatially-organized resources of the simulated space [22]; [23]. The combination of dedicated interaction hardware and advanced computer simulations brings particular interest to the field of digital cultural heritage, especially when this system of hardware and software enables the expressive potential of bodily movement. Relying on the stereoscopic vision of the Oculus Rift™ goggles and the Virtuix Omni walking device for interaction in the real-time virtual environment of the Paphos gate (Fig. 5), allows the collection of metadata of bodily movement in the simulated terrain of Nicosia that are more descriptive of the user's spatial behaviour than data collected through typical input devices in digital worlds (like keyboard, mouse, joystick, SpacePilot™, hand-gestures).

Producing metadata of virtual visits by users of different age, education, cultural background and ethnic origin, can offer a broader spectrum of responses which can further the understanding of the qualitative variances

of their city-walking experience. This interaction method aims at helping users to understand the remaining traces of the Paphos gate's building phases in their urban context, a process of unfolding the palimpsest of Nicosia's history (Fig. 7); (Fig. 8). This prototypical interface enables the staging of a responsive narrative experience and, in doing so, provides a method of investigating human actions in knowledge-based environments [24].

### ***Mapping the spatial experience of shared heritage***

Presence in the world is such that we find ourselves in an inside, whose threshold we have never crossed, an inside that has no outside. This is why inside is defined by continuity, by the impossibility of reaching, starting from within, any sort of limit at all [25].

The synergy of virtual environments techniques with urban studies and architectural history can contribute to the development of cross-disciplinary projects that will enable holistic studies of contested urban space. Distinct from practices that work at a 'bird's eye view' of urban dynamics [26], the methodology presented focuses on the micro-scale of the moving body on the performative stage of the public realm. The real-time exploration of this staged space extends the participants' experience of street walking into a journey of exploration, discovery and understanding spatial relations. Through exploration the users engage with a narrative, and with this strategy the methodology presented aims to place them inside projected spaces.

In the physical space of a city, when its users walk around, mental maps and places anchored to the built environment are produced like knots - connection points - in a distributed network, cf. M. Foucault's concept of heterotopias and their formation [27]. Consequently, a real-time 3D virtual environment will never compete, or surpass, the stimuli, complexity and richness of experiencing the physical space of a historic city. Therefore a question arises: what can interactive digital environments do different (or better) than the physical space?

This simulated space can offer a neutral virtual canvas upon which researchers can engage urban planners and policy-makers for experimentation and remote collaboration;

Typical methods of research often lack the kinaesthetic and situated identity that characterize the historical performance of the studied artefacts, and therefore omit the embodied knowledge that could lead to new, informed understanding of the cultural context of found objects;

This simulated environment would enable the exploration of archaeological hypotheses; of unrealized conditions (e.g., planned but never materialized transformations of the urban environment or a building) and

unresolved situations - for re-visiting historical narratives; Also, it can offer in depth exploration of important characteristics and parameters of the studied site, or artefact, that would otherwise remain hidden. Some examples of techniques and media taxonomies employed by the research presented to support this exploration include: digital simulations, Reflectance Transformation imaging, hi-fidelity animations of construction details, of construction process, and the history of materials used, the evolution of the monument's design, etc.; and lastly,

It could function as a didactic platform addressed to the public that would make complex, otherwise unattainable, knowledge accessible by opening up the educational process to communities of the city that may be excluded.

### **Acknowledgment**

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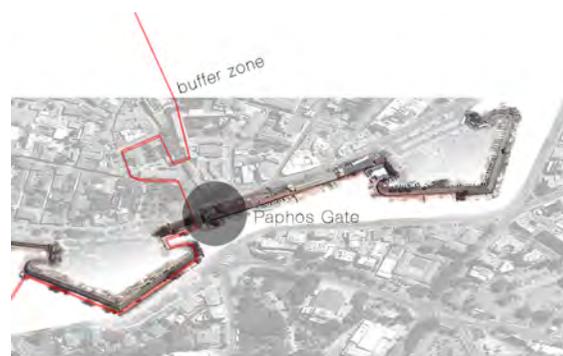
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*Aerial view of the historic centre of Nicosia and its medieval fortifications (the location of the Paphos gate is highlighted in red).*



*In the beginning of the 20th century part of the walls adjacent to the gate was demolished to effectively free the city and allow its development beyond its fortified limits. Since 1974 and the physical separation of the Nicosia, the Paphos gate has become an iconic symbol of division as it is virtually located on the infamous 'Green Line' that divides the city.*



The excavation site of the moat outside the Paphos gate. Archaeological research unearthed multiple structures and finds related to the long utilitarian history of the gate, all of which have been documented and reconstructed in 3D.



Photographs of the four indicative historical phases of the Paphos gate with diagrams of the respective circulation in and around modelled in the presented 3D interactive environment. This co-existence of parallel dimensions of alternative realities (e.g., a construction complete as it used to be, or as it is planned to become) allows professionals to experiment, test and explore hidden conditions of the built environment and also invite visitors (inhabitants and tourists) to learn from past stories, imagine their place in the new conditions presented for the city and immerse themselves in staged places.



Fig. 5 Setting up and testing the 1st generation of interaction hardware at the Visualization Lab (Cyprus Institute).

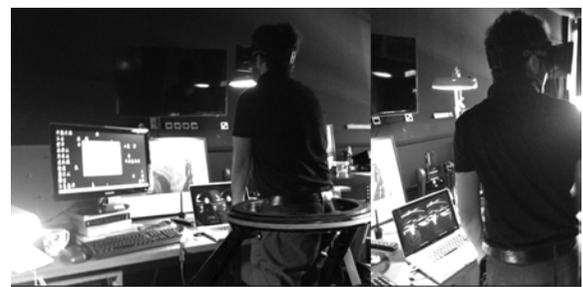


Fig. 6 Plan view of the Paphos gate area (screengrab of the raw pointcloud 3D model produced by the laser scanning of the monument).



Fig. 7 The facade (top) of the Paphos gate area and plan view (bottom) of the excavation area of the moat by the gate (screengrab of the raw pointcloud 3D model produced by the laser scanning of the monument).



*Fig. 8 Applying textures on the tessellated model (which was generated by the raw 3D pointcloud) of the Paphos gate. The textures were applied by means of photogrammetric techniques.*



# Com-Note: Designing a composer's notebook for collaborative music composition

**David M. Frohlich, Tom Armstrong, Janko Calic, Haiyue Yuan, Tara Knights**

Digital World Research Centre, School of Arts University of Surrey,  
Guildford GU2 7XH, UK

**Simon Desbruslais**

Jesus College Turl Street Oxford OX1 3DW

## Abstract

Although numerous digital tools exist to support the capture and editing of music, less attention has been paid to supporting the creative process of music composition. In this paper we report the design of a new tool in this area, targeted specifically at collaborative composition between a composer and one or more performers. The tool is an open source 'composer's notebook' app called Com-Note, which supports the creation and exchange of multimedia narratives on an Android smart phone. Requirements for the design of Com-Note were derived in a case study of the collaborative composition process, as assisted by a digital storytelling app called Com-Phone developed on another project. This involved the creation and performance of a new work for trumpet and string quartet entitled Albumleaves.

## Keywords

**Collaboration, music, composition, composer, performer, digital storytelling, multimedia, narrative**

## Introduction

The composition of music is a complex, creative and collaborative act (Burnard 2012). This is currently done with a range of tools including the editing of musical notation, the playing, recording and playback of musical phrases, and their verbal discussion. Different styles of music are associated with different approaches to organizing these compositional activities. For example, contemporary

classical music composition is still done mainly by a single composer working under a commission, and moderated by a musical score that the composer generates and refines through orchestral or ensemble performance (e.g. Hayden & Windsor 2007). Popular music may be more collaborative in its origins, with a lead composer/songwriter sharing more of the early musical ideas for a piece within a band. This may be done in group sessions through performance demonstrations and without rigorous musical notation. Jazz music is even more extreme in encouraging live collaborative composition through improvisation around a theme. In all these cases, there is a changing relationship between the original musical intention or idea, its notation in a musical score, performance of the music and its recording (c.f. Frisk & Osterjö 2006).

Existing tools for music composition, like GarageBand, Sebelius and Symphony Pro, focus mainly on the latter parts of the process by supporting the generation of Simon Desbruslais Jesus College Turl Street Oxford OX1 3DW synthesised performances from musical notation, or the automatic transcription of performed music into notation (via MIDI interfaces). Music editing software also allows multitrack recordings to be laid down and mixed into different arrangements. Many of these facilities are presented through a personal computer, and amplify the abilities of individual composer/musicians who are able to realise musical intentions without extensive collaboration with other performers. Modern software packages also support cloud-based archiving and sharing of music files, but editing is still done through a single-user workstation. Research into composer/performer collaboration shows a whole host of collaborative practices that take place through

rehearsals and remote interaction between musicians, but few of these are supported by existing technology (e.g. Clark et al 2013, Collins 2012, Davidson 2004).

In this paper, we explore an alternative approach to the support of music composition which addresses earlier parts of the process and encourages greater collaboration with performers. This approach is based on the simple use of mobile phone technology to capture and share musical intentions and ideas, as and when they occur. The core notion is that of a ready-to-hand composers' notebook into which he or she can quickly enter 'sketches' of compositions for personal reflection and feedback by performers. Although these sketches might include musical recordings, they are intended to be a vehicle for discussion and comment rather than for mobile music editing. Half diary and half messaging system, the notebook can be used by performers as well as composers, and is designed to facilitate communication between them.

A similar motivation lies behind recent work by Bainbridge and colleagues, but they focus on support for a centralized library of musical ideas called Apollo, accessed from a workstation interface (Bainbridge et al 2012). Our approach is simpler and based around a portable multimedia notebook suggested by our own previous work in a different domain. We had developed a community media toolkit called Com-Me for mobile digital storytelling in rural India and South Africa: <http://digitaleconomytoolkit.org/> This allowed local news stories to be shared primarily through audiophoto narratives on mobile phones, rather than through text-based communication (Frohlich & Jones 2008). Because the toolkit is open source, it can be easily adapted for other uses. One of these might be the sharing of musical fragments, notations and verbal comments in music composition. This suggests a kind of digital storytelling for musicians wishing to circulate musical ideas within a small group.

In the rest of this paper we explore this idea during the creation of a new work called Albumleaves for trumpet and string quartet, using the Com-Phone Android app from our toolkit (Frohlich et al 2012). This involved close collaboration between two of the authors of this paper: Tom Armstrong as composer and Simon Desbruslais as trumpet player. The findings of this Com-Phone trial were then used to create a new version of the app called Com-Note specifically for the music context. In this way, Com-Phone was used as a 'technology probe' for uncovering requirements for Com-Note (Hutchinson et al 2003), which we subsequently implemented as described below. The study was designed to address the following research questions about the music composition process:

1. What is the value of recording and sharing multimedia narratives in collaborative music composition?

2. How can this behaviour be better supported by mobile technology?

## Methods

A naturalistic opportunity to trial the Com-Phone app arose during the composition of a contemporary classical piece of music for trumpet and string quartet. The piece, called Albumleaves, was commissioned from Tom Armstrong by trumpet player Simon Desbruslais as part of a new album of trumpet music by Signum Classics, and was also intended for live performance. The Ligeti quartet were hired to provide the string parts and also included in the composition process which was collaborative from the outset (<http://ligeti quartet.com>). As an evolution of his own practice, Armstrong had already experimented with the development of more open scores and compositional ideas that were refined through interaction with performers. The intention with this piece was to develop this practice, with Com-Phone providing additional opportunities to document and share musical ideas more easily across the distributed composer-performer group of six. The resulting piece was created over about 6 months from April 2013 and performed at Kings College Chapel in London in November 2013.

At the beginning of the composition process, three Galaxy Note smart phones were given out to the composer (Armstrong), trumpet player (Desbruslais) and string quartet (the Ligeti Quartet). Each phone supported the creation and sharing of short digital 'stories' in a series of multimedia frames combining image, sound and text, through the Android Com-Phone app. See the online user manual for full details: <http://www.digitaleconomytoolkit.org/manuals/com-phone.pdf>

Essentially, narratives can be made in the form of a storyboard of frames, as shown in Figure 1. Each frame is composed of any combination of image, sound or text items, with up to three layers of sound opening up as clips are added. Images and sounds can be imported from the phone's memory, or recorded live through camera or dictaphone functions. Narratives are represented as 'smil' files and play full-screen as audioslideshows. They can also be converted to other file types, such as webpages (html) or video clips (mov), and exported off the phone to another device, emailed or posted to a YouTube account. In the context of this study, Com-Phone therefore allowed the composer and performers to individually dictate ideas or comments, insert existing music comparisons, make new music recordings, take pictures of musical scores or other sources of inspiration, and share them with each other for feedback.



Figure 1. *The Com-Phone interface*

Members of the musical group were encouraged to try out the app during the composition process and to exchange the resulting narratives with each other for this ‘trial’ period. Both pre and post-trial interviews were held with the group, and all resulting narratives were collected for analysis. The interviews explored current practices of collaborative composition and how these were affected by use of the Com-Phone tool, as well as providing an opportunity to describe use of the app and the recorded narratives, and any difficulties encountered. All interviews were transcribed for thematic analysis. Multimedia transcripts were also created for each narrative showing the sequences of images and text, references to recorded music and a transcription of any recorded speech. The resulting findings are based primarily on repeated viewing of narratives themselves, and analysis of interview and narrative transcripts. Some inspection was also made of YouTube channels used by Armstrong & Desbruslais for narrative exchange, as these contained a log of when narratives had been uploaded and some associated textual comments. Analysis was focused on answering the two main research questions, and designing a new Com-Note app which would be more useful than Com-Phone for this context.

### **Collaborative composition of albumleaves**

Participants reported different existing practices of collaboration in the pre-trial interviews which form a baseline for assessing the impact of Com-Phone. For example, the composer (Armstrong) had a habit of keeping a logbook of handwritten notes on each of his compositions, as a reflective diary on the process. These were useful for future academic collaboration and talks on the composition process, as well as resolving problems with the composition as he went along. He also reported use of a digital Dictaphone for recording long periods of rehearsal with performers, which he could listen back to later. Finally, he was in the habit of emailing pictures of musical score to performers for comment during the process of composition.

In contrast, the trumpet player (Desbruslais)

reported responding to fragments of score received by email and recording himself performing such fragments for self review. Recording applies a kind of live performance pressure which is useful for improving practice. This was said to go along with other tricks such as lining up ten matchsticks and knocking down each matchstick in turn following a perfect rendition of a piece, but starting the series again after one mistake.

Members of the quartet described recording live rehearsals in video form and archiving these in a shared Google Drive account for later review. Any difficulties with an emerging composition would be worked out face to face in rehearsals or through follow up contact with the composer. Whereas Armstrong and Desbruslais were actively seeking new methods of greater collaboration, the quartet expressed some skepticism about needing to influence the composition itself. They felt that was the composer’s job, whereas their role was to interpret and perform the composer’s intentions as represented on the score: “We are not huge believers in the idea of back and forth operation.. Once the score is complete then that’s the end of the composer’s role”.

Throughout the composition process a total of 18 narratives were created and shared on Com-Phone. An additional x narratives were recorded by Armstrong for personal use and not shared with the others. The average duration of each shared narrative was 8 minutes, comprising 4 frames which typically contained a photograph with text label and some combination of voiceover and/or musical recording. Most frames contained only a single channel of sound, but this could include serial presentation of voiceover and music recorded and performed in the same recording session. However, narratives varied between 8 and 1223 seconds in length, and between 1 and 19 frames, reflecting considerable diversity of form. While most photographs were of handwritten scores, others included pictures of people, instruments, computer screens or rehearsal contexts. Of the 18 narratives, 3 were made by Armstrong, 9 by Desbruslais and 7 by the quartet, although Armstrong’s were long multi-frame narratives at the beginning middle and end of the composition process, while the quartet’s were short sections from a single early rehearsal.

By analysing the participants’ narrative constructions and post trial interview data, we found that participants used their devices very differently, either as a journal of the creative process, as a mechanism for commenting on the technical and aesthetic properties of the composition, or as a focus for creating the finished sound. We will illustrate these three uses by summarizing the narrative and post-interview analysis together for Armstrong, Desbruslais and the quartet respectively.

### ***-Com-Phone values to Armstrong-***

Figure 2 shows a typical narrative from the composer (Armstrong) early on in the creative process. This particular narrative was 20 minutes long and comprised 13 frames assembled over multiple days. The first three frames are shown in the figure and show some handwritten notes and two annotated pages of a musical score in the making. They are accompanied by voiceover narration about a technical problem Armstrong faced at the outset, resulting from a decision to allow performers to play self-contained pages of the score in any order and to distribute parts of the page in varying permutations between instruments. The third page labeled ‘Perm success!’ describes the solution to this problem derived from the use of four-by-four tables for allocating the four string parts. Later frames of the narrative address the trumpet player Desbruslais directly to explain the solution to pass onto the string players in rehearsal. Armstrong’s subsequent narratives are similar, but start to include responses to Desbruslais’ narratives containing short discussions and performances of the score. The overall form of communication is a cross between a spoken diary and a multipart voicemail, illustrated mainly with pictures of handwritten musical notation of various kinds.

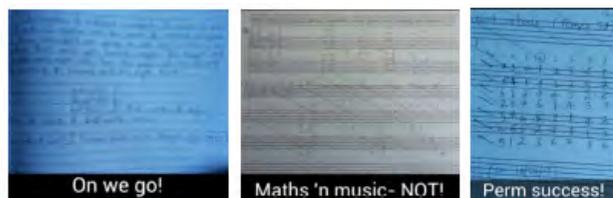


Figure 2. Narrative 2 – ‘Quadrants’

When interviewed about his use of Com-Phone, Armstrong described three main values of the resulting narratives. First, he felt they replaced his written logbook as a method of documenting his creative practice. In this respect the content was authored for his own reference and also for a more general audience of the future who might want to examine his work: I think I was thinking, what if someone, when I’m dead, comes across this [laughter]. Second, the narratives were felt to be useful for discussing the emerging sound of the piece with Desbruslais, who was not only one of the performers but also the commissioner of the music. The fact that both parties could include musical demonstrations within the narratives made it possible for the composer to demonstrate certain musical intentions, for the performer to play early fragments of the score and for the composer to hear what they sounded like: To have a system like Com-Phone as Simon says, very clearly recording and documenting the different versions, is really helpful because there were instances where I had written things that were essentially unplayable... So taking the ideas I had and changing them until they sounded like they would work, that was interesting. A third value of the narratives

derived from those made in rehearsal, allowing Armstrong to eavesdrop in a way that was not possible before: It’s a window, and the important thing is, I’m not there...I can listen to it at my leisure and tactfully respond.

**-Com-Phone values to Desbruslais-**

Figure 3 shows a typical narrative from the trumpet player Desbruslais half way through the composition process. It is seven minutes 45 seconds long and comprises three frames accompanied by voiceover and music narration. In fact all narratives by Desbruslais include recorded performances of the music, explained by surrounding voiceover. Unlike Armstrong’s narratives which are ambivalent with regard to the audience, Desbruslais narratives were exclusively for Armstrong and usually start with the greeting ‘Hi Tom’ on the first frame. They therefore sound like multimedia voicemail messages and often discuss the playability and sonic effects of the emerging score. For example, in the three frames shown in Figure 3, Desbruslais introduces the issue of pedal notes for trumpets which are an extended lower range of notes achieved with a special blowing technique, and demonstrates their sound on a C trumpet, flugel horn and piccolo trumpet for Armstrong to hear.

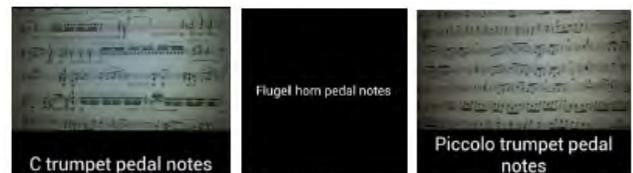


Figure 3 Narrative 12 – ‘Trumpet pedal notes’

Like Armstrong, Desbruslais reported three main values of these narratives in the post-trial interview. One of these was similar to Armstrong’s value of hearing what the score sounds like, which in Desbruslais case involved performing the sound. This value was somewhat different in the performers’ case, as Desbruslais was trying to communicate an insight not only into the technical playability of the score but also his playing technique and interpretive style: It’s not just technical things I’ve been able to offer, but it’s almost like Tom has had a greater insight into the way my mind works, the way I look at a score and then try and realise it. In some cases this resulted in suggested changes to the score and arrangement. Desbruslais also valued the Com-Phone narratives as a practice aid for himself. This replaced his own previous use of a Dictaphone: I would record myself on a regular basis anyway and listen back to it. Finally, he valued the exchange of narratives with Armstrong as a way of keeping track of the progress of the composition. This supported his role as commissioner of

the music and kept him more involved in its evolution: I guess I have quite a hands-on approach with my composers because this commissioning model we have been talking about can sometimes remove the personal interaction.. with the composer

### ***-Com-Phone values to the quartet-***

Figure 4 shows a typical narrative recorded by the string quartet early in the process. It was recorded in their first rehearsal session and is seven minutes nine seconds long. It is made up of five frames of music and voiceover, indexed mainly with individual pages of the score they are playing. The first frame is somewhat different, comprising a sound check to a picture of the rehearsal room. All frames have a textual title, which is something all participants did for every narrative. Each rehearsal frame begins with a verbal explanation of what is being attempted, followed by the performance itself. Many frames include a subsequent discussion between the performers, but this is often inaudible and not really designed for an intended audience.

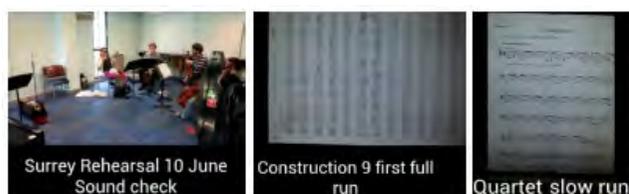


Figure 4. Narrative 3 – ‘First run’

In fact the nature of the intended audience for Com-Phone narratives was unclear to the quartet who did not fully buy into the aim of collaborative composition as shared by Armstrong and Desbrulais (see above). For them, the use of Com-Phone to record rehearsal performances stood in for their existing practice of video recording rehearsals. Although it had the effect of chunking up the rehearsal recording into more manageable parts, there was an overhead of interrupting the rehearsal that the quartet didn't like. Essentially, it slowed them down: So going through this process really extends the time that we would normally spend on doing something. However, they did recognise the value of sharing narratives asynchronously between face-to-face rehearsals, or even skype rehearsals, which were often difficult to arrange: It's hard to get four of you together at the same time, and then five of us and then six of us when the composer is involved... I can personally imagine using this to send something over to a composer in America and say 'did you really mean this?' or 'did you get the cleft wrong in the viola part?'

### ***-Problems with Com-Phone-***

All participants found the Com-Phone app

itself easy to use to create narratives. The main reported problem lay in how to share and review the narratives more effectively in the collaborative music context. Armstrong and Desbrulais wanted to exchange narratives directly with each other, to play fragments of photographed score, and to comment on individual frames. None of these activities were easy to perform with the current version. Instead, the original multimedia files (.smil format) were saved as video clips (.mov format) and uploaded to a YouTube channel for sharing. This allowed participants to review the narratives as films, but not to edit them, or zoom in/print out the visual scores for playing. Consequently, Armstrong and Desbrulais resorted to saving fragments of the photographed score as pdf documents and emailing them to each other in parallel to the narratives. These were then printed out to play. Some discussion of the narratives then moved to email or YouTube comments, rather than taking place within narrative responses as desired. This was frustrating since the .smil format of the original narratives remained highly editable, and lent itself to extension with new frames or audio layers. With a little revision, frames could technically support spoken commentary on recorded music as it played back: something that was thought to be highly attractive when suggested to participants.

### **Com-note design**

To optimize some the values of multimedia narratives discovered in the trial and address reported problems with Com-Phone, we held a design workshop to consider new functionalities for a composer's notebook app. This resulted in the following modifications to the open source code, and release of a new app called <http://digitaleconomytoolkit.org/extending-com-me/Com-Note>:

### ***-Synchronized sharing and annotation of the narratives***

The sharing mechanism of the Com-Note app needed to facilitate effective and effortless collaboration between the composer and the performer. The original sharing methodology for Com-Phone supported three main ways of sharing: video upload to a social media sharing platform, creating a webpage with shared video, or direct sharing over Bluetooth connectivity. Based on the elicited requirements, a sharing mechanism using the cloud storage platform Dropbox was introduced. The user has the option to link Com-Note to an existing Dropbox account, thus enabling instant upload and download of the narratives, as depicted in Figure 5. More than two users can join a shared Dropbox folder to annotate and share the narratives seamlessly with automatic synchronisation.

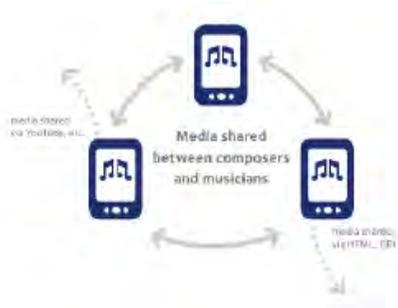


Figure 5. Com-Note sharing mechanism

### ***Narrating over music recordings & selective channel playback***

Laying additional audio tracks over the existing audio in the narrative emerged as an important feature for both composers and performers in order to efficiently express immediate feedback on the shared narrative. A way of recording over a playing track was supported, as long as users listened to that track with headphones to avoid feedback. Additional support was also provided for muting or balancing the volume level of each audio layer, with three volume controls as shown in Figure 6. This enabled selective channel playback, and as well as optimising the user’s sonic experience when mixing different kinds of sound.

### ***Zoom in/out on images of musical score***

Com-Note’s screen real estate is very limited on a smart phone or tablet. This makes it difficult to read the details of musical scores on any frame. An image zoom in/out functionality was therefore developed using hand gestures to address this problem.

### ***Printing of musical scores***

An additional feature of wirelessly printing the image from any frame of the narrative was added, provided a compatible printer is available nearby.



Figure 6. New audio recording and mixing interface

## **Discussion**

In this study we have tested out the value of multimedia narratives in collaborative music composition (research question 1). This was done by trialing the use of the Com-Phone app on a smartphone with a composer and five performers during a composition process. The main discovery was that the value of this process differs between participants, and the extent they ‘buy into’ collaborative composition as a goal. The four members of the string quartet involved in the study were busy professional musicians who did not particularly want to extend their role into co-writing or refining the score, whereas the trumpet player commissioned the music and was keen to track its evolution and input to its development. The composer was particularly interested in this as an extension of his own previous collaborative practice.

The extent to which these values were supported by the Com-Phone app was also tested in the study (research question 2). Com-Phone supported greater transparency and communication between the composer and trumpet player than was usual through their previous habits of emailing fragments of score to each other and discussing the music face-to-face. They each used the app to document their ongoing progress with composing and performing the emerging music, and to comment on each other’s reflections. Commentary was less direct than they wanted it to be, and mediated by a YouTube channel where narratives could be reviewed but not edited selectively. Hence Com-Note was created to support automatic synchronization of narratives across two or more phones via a shared dropbox folder. Better support was also provided for ‘director’s cut’ commentary during recorded music playback, and the viewing or printing out of photographed scores.

The ability to create editable multimedia narratives that can be passed back and forth between partners is reminiscent of a multimodal messaging system called Voicemail that we were involved in developing many years ago (Daly-Jones et al 1997). Users could annotate electronic documents with speech and writing on a tablet computer and pass the documents back and forth with additional annotations. This halved the number of messages required to do the same task in fax or voicemail alone. Some of the same dynamics seem to have been at play here in allowing musicians to record comments more spontaneously and with greater feeling in spoken rather than written language, but also to share music notation and performances as a basis for such comments within the same system.

Further work is now needed to evaluate the Com-Note app with a broader range of musicians from different musical traditions. It might also be tested by ethnomusicologists as a research tool for ‘listening in’ on the creative process, and communicating opportunistically with composers and musicians during composition. A final use of Com-Note might be to exploit the new collaborative features aesthetically. Frame-based segments of music might be invited from different musicians who might build up a

full piece through a single collaborative narrative itself. This would bring the tool full circle back to a more conventional music editing approach, but across a mobile and distributed socio-technical platform.

## Acknowledgements

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# Lighting the Lit

## luminosity as protagonist in mediated performance

**Natalie Rowland**

Dance Department  
University of Chichester  
Chichester, England

### Abstract

The explosion of light emitting diode (LED) and liquid crystal display (LCD) screens into our lives has had a significant impact not only on the availability and portability of media and information, but also on our relationship with light.

This article considers an exploration of the relationship between dancer, designer and light and the question is asked; how is digital light a new voice in performance? From this discussion the paper proposes an approach to lighting design that acknowledges the voice of digital lighting and its ability to communicate both through luminance and mediatized content.

Digital light has the potential to significantly affect spatial and communication experiences for both the viewer and the performer. In its ability to both illuminate other spaces as well as define its own through content, digital lighting speaks to us not only of the spaces it inhabits, but also of spaces it can create.

In exploring this duality, the work of Massumi is brought into the discussion. Massumi proposes that tracing the pathway of movement opens up opportunities to re-trace, to take a retrospective journey along the trajectory and that this can create, by feedback, new notions of movement. Through an exploration and retracing of the pathways of digital light, ideas about the nature of its movement and notions of affect on performance are presented.

### Keywords

**digital light; lighting; virtual; LED; reversibility; retroduction; feedback**

### Introduction

The liquid-crystal-display (LCD) has become a part of everyday life for most of us and over the past decade developments in mobile technologies, the internet and wifi have meant that we spend more time looking into screens. Through these developments our relationship to light has fundamentally changed. A far greater proportion of the light our eyes receive is now directly from a light source. We look into light rather than use indirect light to allow us to see.

Elizabeth Grosz posits that; “Perhaps the most striking transformation effected by these technologies {the chip and screen} is the change in our perceptions of materiality, space and, information...” [1]. Grosz focuses mainly on the prevalence, availability and range of information and communication options now presented to us, and the way that these have impacted on our relationships and perceptions. This article aims to approach the changes in our relationship to light effected by the chip and screen, and the way that these have impacted on our perceptions of space and information.

The focus is on digital light, an emerging term, but one which is being investigated by researchers including Professor Sean Cubitt of Melbourne University, whose book ‘The Practice of Light’ highlights the implications of technological developments in visual practices. The symposium ‘Digital Light: Technique, Technology, Creation’ held in Melbourne, Australia in 2011 drew together artists and researchers seeking to investigate the “capacities and limitations of contemporary digital light based technologies and techniques”[2] however a resulting article in the ‘Moving Image Review and Art Journal’ [3]

suggests that the definition of digital and its relationship to the analogue is still very much under discussion. For the purposes of this paper, digital light is considered to be light that is either generated by the use of semi-conductors rather than traditional light-bulbs (such as light emitting diode or LED), or light that hosts or projects content (as seen in mobile phone displays and data-projectors).

Lighting designer Richard Cadena acknowledges in his book 'Automated Lighting' that digital lighting is different to other lighting tools available to the designer. However, he finds it hard to articulate exactly where the difference lies; "Is it the content, the light engine, the control mechanism?" [4]. To an extent, it is all of the above. There are several factors that have led my research to single out digital lighting as a new 'voice' in lighting and performance practice.

Key aspects of the physical behavior of digital light have presented new opportunities for artists and technologists in the application of these fixtures. LED fixtures, for example, are cool to the touch offering potential for closer proximity and integration to scenic and costume design. For lighting designers, limitation in the luminous efficacy (sometimes referred to as 'throw') of LED directly impacts positioning and purpose. The complexities of the control mechanisms for digital lighting mean that new language is applied in their use. Concepts and terminology from graphic design and computer sciences such as pixels, refresh rates and content are now in the lighting designer's domain. Yet despite these fundamental differences that working with digital light brings, lighting designers, directors and artists continue to approach digital light and apply it in familiar paradigms of twentieth century scenography. This might be considered an example of what Cubitt et al describe as "the normative tendencies inherent in technical innovation processes" where the prevailing workspaces provide a "normalization of visual digital culture" [3].

### **The duality of digital light**

A very common issue when working with projection in performance involves the ambient light required for the live work negatively impacting the rendering of the projected image. When using a live camera feed to projector, this is made further complex since the live action must be well lit in order to be captured by the camera and projected. This led me consider the concept: lighting-lit. The lighting-lit echoes Susan Kozel's discussion of Merleau-Ponty's relation of reversibility. The "seeing seen" and "dancing danced" existing in the dichotomy of an action which also becomes a new object in its execution [5].

Throughout my research to date, this notion recurs with respect to digital light. In the example of the live camera feed to projector, the lighting (projection)

cannot exist without the lit (visible performers) and the lighting must surrender to the lit. In examining digital light through this lens, the difference between 'generic' lighting and digital light becomes clearer. Projection is lighting, it illuminates, it has beams, it has texture, it travels. It is also the 2D lit surface or object of content. An LED lighting fixture is lighting, again it exhibits properties of the action of illuminating. It is also a lit object, often positioned to be viewed in its own right. A common practice of lighting with LED fixtures is to use them as what is termed 'eye candy' in the industry. Lighting that is to be viewed, to be attractive to the eye, to distract and perform as an object in itself. Digital lighting frequently exhibits itself as an object through the process of its action.

The duality of digital light is what sets it apart from generic theatre lighting. As Kozel states; "this dynamic [the seeing-seen] helps rework the relation between bodies and media technologies by overturning the suggestion that the digital image is merely a visual representation of the world" [5]. I am interested in the ways that digital lighting can affect movement, the body and instigate change in the performance space. While many mediatized productions play heavily on visual media as representation and suggestion, my research seeks to explore not only the visual and pictorial aspects of these technologies, but also the spatial and sensory implications.

Through an understanding of the behavior elicited by this duality, the digital light can tell us more about materiality, space and information. Could the experience of digital light and a methodology for working with it potentially expand scenography and provide theatre makers with a new medium with which to access the window of the virtual? The virtually lived areas of our lives are frequently inhabited in light – in phones, in tablets, in screens. In a related reversal, could we use this light as a window establishing a link between these spaces and the embodied reality of performance?

### **Emerging never arriving**

Emerging Never Arriving was a collaborative choreographic project. PhD researcher Alan Duffield from the theatre and drama department of Royal Holloway College worked with six dancers over a two month period, during which I was invited to workshop a technological element. Following the workshop a series of solos and duets were developed and a selection of phrases were then interrogated further with the addition of camera and portable lighting. I asked the dancers to highlight one part of their body or movement by presenting it close up to the live feed camera. The resulting images were projected behind the performer across the remaining group as illustrated in Fig. 1.

This first sequence produced an intense and

intricate visual discussion of notions of foreground and background, in frame and out-of-field. What occurred in the live performance space during this project was an unusual situation of having the frame projected in the background, while the out-of-field remained prevalent in the foreground. The digital light of projection, together with camera technologies, created a space within the performance space that relegated the camera frame and brought to the foreground the mechanisms of the live capture. In viewing the projected close-up image, awareness of the action creating this image was raised. The lighting producing a lit space, a window of virtual space making more clear to us the 'real' space in front of us. This caused me to consider relationships between notions of the digital, analogue and virtual.

While Massumi writes that, "the body, sensor of change, is a transducer of the virtual", he posits that, "Sensation, always on arrival a transformative feeling of the outside, a feeling of thought, is the being of the analog. It is matter in analog mode. This is the analog in a sense close to the technical meaning, as continuously variable impulse or momentum that can cross from one qualitatively different medium into another." [6]. The close relationship between the analog of transformed and transduced sensations and the virtual suggests strongly that there will also exist such procedural links between the digital and sensation. The virtuality of the content of digital lighting insists that there is the potential for change and transformation in the movement and empirical experience of such lighting.

Massumi challenges this discussion by stating that; "nothing is more destructive for the virtual than the digital..." [6]. He asserts the importance of the difference between the virtual and the digital, in order to address the common misconception that they are the same. While I can see Massumi's point, I would suggest that the digital does belong to the virtual in that it belongs to analogue, experience and the haptic.

Digital processes must be transduced through analog processes in order to be experienced and understood by the body and the mind. The virtual concerns the fleeting, the transitions and the sensations associated with the almost but not quite complete. You need only to consider the notion of refresh rates and the moving image to see that the digital realm relies on the virtual in order to exist. No sooner than an image is sent or created it is re-sent, re-rendered, looped back upon itself. In order to create movement, the digital partners with the virtual. As Massumi states, "the virtual is in the ins and outs, the only way an image can approach it alone is to twist and fold on itself, to multiply itself internally" [6].

The codification of content and light that defines digital light results in a relationship with the virtual. Both of these produce an analog experience of light. However, this

light differs from incandescent light in the relationships in its creation; relationships to frame, content, code, notions of technology.

But are there physical differences too? Why do some people say that LED light and projected light 'feels' different? There may be something to do with the 'haptic' here. In the sense of "a synesthesia proper to vision: a touch as only the eyes can touch" (ibid). These properties of digital light are to be explored further in future investigations.

## Retroduction

A further example of how changes in relationships alter the language and experience of digital light can be demonstrated through a second sequence from *Emerging Never Arriving*. In a second sequence, dancers were asked to reprise their solos from earlier in the piece, but this time to hold a battery-powered LED light and highlight parts of their movement or body (illustrated in Fig. 2.). The dancer was followed by another holding the live feed camera who was asked to focus on the LED lit movement. These instructions addressed two points: Firstly, the need to provide sufficient illumination for the movement to be read by the camera and secondly, to explore a non-traditional lighting technique.

While the first camera-focused sequence provided content for digital light as large-scale projection, the second sequence introduced a diode generated light source with no mediated content to the scene.

Sequence one demonstrated the way that digital light and the context of its content can create new spaces and visual relationships on the stage. Sequence two returns us to the notion that digital light can have a different voice to generic lighting.

In reworking the relationship between the body and technology, this sequence saw digital light take the role of protagonist in the visual dialogue. In illuminating a particular part of the body or movement, the LED fixture became a lens, directing and drawing focus both in the live space and for the camera and subsequent projection. The 'frame' created by the LED isolated and redefined the body, showing us the same movement but in a new way, touched by, altered by the digital light. The movement of the light, directed by the dancer, also created a new set of movement on the stage as the light shifted across the space, throwing dynamic shadows and altering those existing.

Massumi proposes that tracing the pathway of movement opens up opportunities to re-trace, to take a retrospective journey along the trajectory and that this can be a; "retroduction": a production, by feedback, of new movements" [6]. Using this notion as a methodology, could retracing the pathways of digital light reveal to us the nature of digital light's movement and notions of affect on performance?

The second technology sequence in *Emerging Never Arriving*, offers a practical exploration of a possible “retroduction” of lighting. A retrospective journey along movement traced by camera, LED lighting and projection creates a feedback loop presenting to the viewer a new set of movement and dynamics in a space and frame that communicate with a different vocabulary to the live performance.

The retrospective journey along the movement of the solo focused or framed by the LED light is reproduced through the camera presenting a microcosm or framed analysis of the dance. Fed back to the viewer (and to the other dancers) via projection, presenting the live movement but seen through the lens of the light. Presenting a new set of movement and dynamics in a space and frame that communicate with a different vocabulary to the live performance.

The camera allows us to view the frame created by the light as the camera does not compensate for the intense contrast of the LED like our eyes do. This feedback presents the new frame alongside the existing diffuse frame of the light in the live foreground.

But how does this retroduction allow us to examine movement? What does it offer us? Responses from the dancers provide some indications of the affect of the digital lighting vocabulary. The reframed movement shows us shape and shadow that would not ordinarily be seen. The retroduction shows us every fold, every shift, every glance and change in velocity. The detail is not only limited to the projection space, LED light also provides a highlighted or framed view in the live foreground. Much of the movement and dynamics is presented here in the contrast of moving light and shadow.

In LED lighting where the light is both lighting and a lit object the feedback loop is complex, as is its relationship with the movement, objects and the space. The retroduction of this movement involves the movement/shift of the gaze, as well as the source movement from the content. It separates and isolates the focused frame and highlights changes in speed and time.

### **What’s so special?**

The question has to be asked; couldn’t this have been achieved with incandescent light? In theory, yes the basic circumstances of a dancer moving with a light could have been created with incandescent light. While an ordinary light bulb would be too delicate to move around, a halogen torch could have been used. However, this returns the discussion to what it is that defines digital light and sets it apart. If a torch were used, the light emitted would have had different physical properties, both in the way that the light itself behaves and is seen, but also in the suggestive or semiotic language it portrays.

In theatre lighting, lights that are used on stage, within the ‘action’ are usually representative of a naturalistic or utilitarian use. Referred to as ‘practicals’ these lights appear as or suggest their real-world use. For example a table-lamp or street light. They imply context or purpose and often speak directly to the narrative or the atmosphere of the performance. Digital light, I would suggest, still retains its own ‘signature’. The means by which the light is generated – be it by diodes or manipulation of polarizing lenses and so forth – produces an ‘ethereal’ quality to the light. Screens bathe us in a blueish hue, tinting our skin and stimulating our eyes and brain. LED’s scatter light and create shadows in a very different way to an incandescent lamp. They are subtle in their movement, sometimes indistinguishable in their reach. The shadowing created by LED is frequently multiple, with lower contrast suggesting ghostly figures or abstract shapes and movement.

Ultimately the difference between digital light and that of traditional or incandescent sources is the way that we work with it. Our relationship to digital light differs in the ways that we use it. As a technician and designer I interface with digital light at a more complex level than I do with traditional lighting where I deal mainly with levels of intensity and angles. As performers and directors digital light presents you with content and information (both on a cognitive and experiential level). Digital light is frequently positioned where traditional lighting is not, and this forced new presence requires acknowledgement.

If the differences and challenges that digital lighting presents to us are so deeply rooted in our relationships and physical responses, surely it then follows that this lighting is a different voice on the stage? As such it is a language that needs to be explored and acknowledged rather than simply forced into the paradigm of traditional lighting. Even in ignoring the digital screens and worlds created on our stage, we surrender a level of power to this light. It has a presence that cannot be ignored since it affects our understanding of space, time and information. Digital light is a protagonist on the stage – it alters situations and creates new ones, it can lead the action and it can direct the audience to new understanding and experiences. Our challenge now becomes how to work with this developing force on the stage, how to understand and respond to our relationships with it.

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“The space became much bigger when using the projected images, especially the live camera feed, as it felt like we were surrounded by the dance we were creating. I felt that it especially impacted our group dynamic: the relationship and attention we held between us. I found it completely absorbing as a dance space because you were free to observe as well as be a part of it, free to see the patterns and relationships between different images across the space as a whole, and strengthen the performance of a solo by being witness to it not once but three times; through flesh, shadow and film. . . . . What was crucial here was the projection of the solo as it happened, as it gave us so many points to watch as we moved; we could shift between watching the dancer at work, watching the solo on screen and watching the play of light and shadow over the whole studio.”

Sarah Richter-Rose (dancer)



*Fig. 1. Image from projection sequence 1 in Emerging Never Arriving*



*Fig. 2. Image from projection sequence 2 in Emerging Never Arriving.*



# TuneGraph, an online visual tool for exploring melodic similarity

**Chris Walshaw**

Department of Computing & Information Systems University of Greenwich  
London SE10 9LS, UK c.walshaw@gre.ac.uk

## Abstract

This paper presents TuneGraph, an online visual tool for exploring melodic similarity. The underlying data comes from a large index of online music, all transcribed in abc notation, and TuneGraph uses a melodic similarity metric to derive a proximity graph representing similarities within the index. A rich but dense graph is built and then sparsified by removing weak, non-essential edges. From this a local graph is extracted for each vertex, aimed at indicating close variants of, and similar melodies to, the underlying tune represented by the vertex. Finally an interactive user interface displays each local graph on that tune's webpage, allowing the user to explore melodically similar tunes.

## Keywords

**cultural informatics; music similarity; force- directed placement; search visualisation**

## Introduction

### *-Background-*

Abc notation is a text-based music notation system popular for transcribing, publishing and sharing folk music, particularly online. Similar systems have been around for a long time but abc notation was formalised (and named) by the author in 1993 (Walshaw, 1993). Since its inception he has maintained a website, now at abcnotation.com, with links to resources such as tutorials, software and tune collections.

### 1) Tune search engine

In 2009 the functionality of the site was significantly enhanced with an online tune search engine, the basis of which is a robot which regularly crawls known sites for abc files. The downloaded abc code is cleaned and indexed and then stored in a database which backs the search engine front end. Users of the tune search are able to view, listen to and download the staff notation, MIDI representation and abc code for each tune, and the site currently attracts around half a million visitors a year.

### 2) Breadth

The aim of the tune search is to index all abc notated transcriptions from across the web. However there are a number of reasons why it is unable to do this completely:

- Unknown sources: the robot indexer is seeded from around 350 known URLs (some of which are no longer active), but it does not search the entire web.
- HTML based transcriptions: in the main, the indexer searches for downloadable abc file types (.abc, or sometimes .txt). However, there are a number of sites where the abc code is embedded directly into a webpage. Mostly these tend to be small collections (especially if the abc code has to be manually inserted into the HTML code) and are ignored by the robot (although there are 3 larger collections which are included by parsing the HTML and looking for identifiable start and end tags).
- JavaScript links: for a small number of sites the file download is enacted via JavaScript, making

the link to the .abc file difficult to harvest.

Starting with an initial database of 36,000 tunes in 2009 the search engine has expanded to cover around 450,000 abc transcriptions at the time of writing (November 2014). Most of these are folk tunes and songs from Western Europe and North America, although two massive multiplayer online role-playing games, Lord of the Rings Online and Starbound, have adopted abc for their in-game music system resulting in a number of dedicated websites with mixed collections of rock, pop, jazz and, sometimes, folk melodies which contribute ~37,000 transcriptions to the search engine.

### 3) Duplicates & variants

Although each tune comes from a distinct URL, there are many duplicates and closely related tune variants contained within the database.

From a search engine point of view, there is little point in presenting users with dozens of identical results and so an important part of the pre-indexing clean-up involves identifying and, where appropriate, merging exact duplicates (such as those copied from one website to another – see section II) within the index.

On the other hand tune variants are an important part of folk music's aural tradition which can occur for a number of reasons (see section III) and distinct, but closely related versions of the same tune can be of interest to researchers and musicians alike. However they are not always easy to identify by eye from a large number of search results.

### *-Aims-*

This paper discusses work which aims to address the question of how to present closely related search results to the users of a search engine. It is based on a graphical user interface developed as part of the abc notation tune search but the ideas are generic and should, in principle, be applicable to other datasets where the difference between any pair of items in the dataset can be expressed numerically (i.e. with a similarity measure).

The remainder of this paper is organised as follows:

- Section II discusses duplication and indicates how duplicates are identified and merged in the search results.
- The bulk of the work is presented in Section III which describes the development and implementation of TuneGraph, to facilitate the exploration of tune variants by users of the search engine.
- Finally Section IV presents some conclusions and future work.

## Eliminating duplication

Duplication occurs widely within the abc corpus for a number of observable reasons:

- Compilations: particularly in the past, certain enthusiasts have published compilations of all the abc tunes they could find, gathered from across the web.
- Selections: some sites, usually those containing repertoires (perhaps that of a band or an open session), publish a selection of tunes gathered from other sites.
- Ease-of-access: a number of sites publish collections both as one-tune-per-file together with a single file containing all of the tunes in the collection.

As indicated above there is little point in presenting users of the search engine with duplicate results and so the pre-indexing clean-up involves identifying and merging duplicates within the index. However, it is not necessarily clear which level of duplication to remove.

### *-Duplicate classification-*

To discuss this topic further it is helpful to consider the structure of an abc tune transcription (see 0).

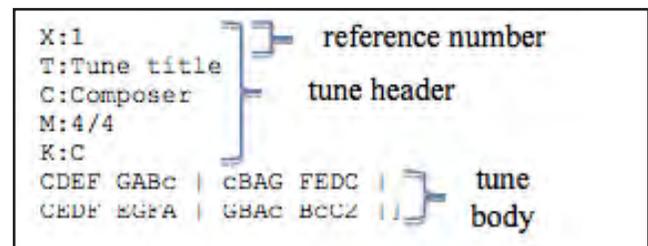


Fig. 1. An example abc transcription.

Each tune consists of a tune header (including a reference number) and the tune body.

The header contains descriptive meta-data mostly, though not exclusively, with no musical information. Typically this includes the title and composer (where known), and amongst other data may also include information about where the tune was sourced (book, recording, etc.), who transcribed it, historical notes and anecdotes and instrumentation details (particularly for multi-voice music).

The tune body contains the music, and may also contain song lyrics.

With this structure in mind, duplication can be classified into 4 increasingly broad categories:

- Electronic: the duplicates are electronically

identical (the exact same string of characters) – i.e. the tune headers and bodies are identical (although in practice this is relaxed somewhat by ignoring the reference number and any whitespace).

- Musical: the duplicates are musically identical (including song lyrics) although they may contain different meta-data in the tune header – i.e. the tune bodies are identical.
- Melodic: neglecting any song lyrics, grace notes, decorations and chord symbols, the first voice of each duplicate is identical – i.e. the primary melodies are identical.
- Incipit: when transposed to the same key, the duplicates are melodically identical over the first few bars of the tune.

In fact, and as might be expected, analysis reveals that there are no substantive differences between the musical and melodic duplicate categories and numerically there is only a 4% increase in duplication in the latter as compared with the former (Walshaw, 2014).

The other categories are substantially different, however, with 42.7% electronic duplication, 58.1% melodic duplication and 70.4% incipit duplication. (Here, the percentage duplication refers to the percentage of the corpus which can be excluded, leaving one representative example of a duplicated tune, without reducing its diversity.)

Whilst this indicates a very substantial amount of duplication within the corpus, when melodic duplicates were excluded (in a previous study, Walshaw, 2014) it gave a headline figure of 167,632 distinct melodies (out of the 400,160 under consideration), even when all of the meta-data, decorations and lyrics are stripped away.

The remainder of this paper considers only electronic duplicates and discusses ways to allow users to explore musical, melodic and incipit duplicates as tune variants.



**Black Joke, The TS.210**  
 Found in sands.abc from the Village Music Project abc collection  
[browse similar](#) - [search: file | collection](#)  
[download: abc | midi | png](#)  
[viewing problems](#) - [switch to png](#)

Black Joke, The TS.210 Lincolnshire

♩ = 120

www.abcnotation.com/tunes

```
X:210
T:Black Joke, The TS.210
M:6/8
L:1/8
Q:3/8=120
S:Thomas Sangs' MS, 1810, Lincolnshire
R:jig
N:As above
O:Lincolnshire
Z:vmp.Ruairidh Greig, 2011
K:G
D2DG2G|ABA AGA|BcB BAG|ABA AGF|G2GE2E|DEFG2:|!
|:c|Bcdd3|efgd2c|Bcdd3|efgd2c|B2gB2g|!
ABA AGA|BcB BAG|ABA AGF|G2GE2E|DEFG2:|]
```

**Similar tunes**

104. La Bodine

Fig 2. An example of a tune page, showing the tune in standard notation (top left), the MIDI player (top centre), the abc notation (bottom left) and the TuneGraph of close variants (top right). One of the close variants has been selected by the user (the vertex is enlarged) and is displayed below the TuneGraph viewer (bottom right).

At the time of writing of the 449,845 transcriptions in the database, 240,902 are electronic duplicates. Of the remaining 208,943 tunes, 40,179 are identified as potentially copyright. Since the abcnotation website does not display copyright tunes (unless the copyright holder has given their explicit permission) these are also excluded from the TuneGraph results, leaving a total of 168,764 under consideration.

## B. Informationarchitecture

This section discusses how the data is organized and, in particular, how the search engine distinguishes between duplicates, which are not presented in standard search results, and tune variants, which are. information architecture is as follows.

### 1) Duplicates

One possibility would be to completely remove duplicates from the database. However, this would mean that if, for example, users filter their search to look at a particular source website they will miss all the duplicates offered by that site. It also gives a misleading impression of the contribution from each site.

Instead tunes are categorised into primary and secondary sources. Thus a cluster of  $n$  duplicates would contain 1 primary representative and  $n - 1$  secondary.

Using this categorisation, standard search results only include primary tunes, but when a user clicks through from the search results to a tune page (each tune in the database has its own page), a list of secondary sources for that tune is also included (since some tunes can have many secondary sources this list is restricted to a maximum of 10 randomised entries).

If, however, the user filters their results to a

particular source website (for example, the search query term “site:www.example.com/folder” would restrict the search results to tunes from http://www.example.com/folder/ and any subfolders) then both primary and secondary tunes are listed in the search results.

The scheme (not discussed here) for categorising sources into primary and secondary is based on their originating URL and the author’s somewhat subjective view of where a tune was first published on the web.

## 2) Tune variants

Tune variants are an important part of folk music’s aural tradition which can occur for a number of reasons, including:

- Transmission: folk music is an aural tradition – a tune may be misheard or misremembered when it is passed on
- Improvisation: many traditions have an improvisatory aspect
- Innovation: musicians may devise their own versions of a tune

As a result of these and other reasons the same tune may have developed differently in different geographical locations over a period of time.

These may be of interest to researchers and musicians alike. However they are not always easy to identify by eye from a large number of search results.

It is not obvious how close variants should be presented and one possibility might be to show, somehow, a representation of variants on search results pages.

However, it was felt that this would clutter the results too much and so instead each tune page shows a representative group of variants in a small(ish) interactive graphic, the TuneGraph viewer (see section III.B) on the right hand side of the page (see Fig. 2).

The following section discusses how the variants are derived and the user interface for the graphic.

## **Tunegraph – exploring variants**

The aim of TuneGraph is to facilitate user exploration of tunes variants.

Given a corpus of melodies, the idea behind it is to calculate the difference between each pair of melodies numerically with a difference metric or similarity measure (e.g. Kelly, 2012; Stober, 2011; Typke, Wiering, & Veltkamp, 2005).

Next a proximity graph is formed by representing every tune with a vertex and including (weighted) edges for every pair of vertices which are “similar”. Finally, the resulting graph can be visualised using standard graph layout techniques such as force-directed placement, (e.g. Walshaw, 2003), either applied

to the entire graph or just, as here, to a vertex and its neighbours (i.e. a tune and similar melodies).

The concept is not dissimilar to a number of other software systems which give a visual display of relationships between tunes, often based on a graph (e.g. Langer, 2010; Orio & Roda, 2009; Stober, 2011).

The TuneGraph software consists of two parts – TuneGraph Builder (Section III.A), which analyses the corpus and constructs the required graphs, and TuneGraph Viewer (Section III.B), which provides the online and interactive visualisation.

### **A. TuneGraphBuilder**

#### 1) The similarity measure

In the current implementation, each melody is represented by quantising the first 3 bars (the incipit) into 1/64th notes and then constructing a pitch vector (or pitch contour) where each vector element stores the interval, in semitones, between the corresponding note and the first note of the melody (neglecting any anacrusis). Since everything is calculated as an interval it is invariant under transposition.

The similarity measure or difference metric then calculates the difference between two pitch vectors either using the 1-norm (i.e. the sum of the absolute values of the differences between each pair of vector elements) or the 2-norm (i.e. the square root of the sum of squared differences between each pair of vector elements). The 1-norm difference metric has long been available as part of the abc2mtex indexing facilities (Walshaw, 1994), but experimentation suggests that the 2-norm gives marginally better results (see below, section (7)). If the pitch vectors have different lengths then the sum can be calculated over the length of the shorter vector (although see below – section (3)).

Similarity measures of this kind are well explored in the field of music information retrieval, (e.g. Kelly, 2012; Typke et al., 2005), and there may be other, more advanced similarity measures that would work even better. However, in principle any suitable metric can be used to build the proximity graph, provided that it expresses the difference between pairs of melodies with a single numerical value. Indeed, even combinations of similarity measures could be used by forming a weighted linear combination of their values.

#### 2) Building the proximity graph

The proximity graph is formed by representing every tune with a vertex and including (weighted) edges for every pair of vertices which are “similar” (i.e. every pair where the numerical difference is below some threshold value). However the question arises: what is a suitable threshold and how should it be chosen?

Perhaps the simplest choice, and one which is well-known for geometric proximity graphs, is to find the smallest threshold value which results in connected graph, i.e. a graph in which a path exists between every pair of vertices. Although computationally expensive, this can be done relatively straightforwardly starting with an initial guess at

a suitable threshold and then either doubling or halving it until a pair of bounding values are found, one of which is too small (and does not result in a connected graph) and one of which is large enough (and does give a connected graph). Finally the minimal connecting threshold (minimal so as to exclude unnecessary edges) can be found with a bisection algorithm, bisecting the interval between upper and lower bounds each iteration.

This was the first approach tried but it resulted in graphs with an enormous number of edges: the test code ran out of memory as the number of edges approached 200,000,000 and the threshold under test had not, at that point, yielded a connected graph.

Further investigation revealed the basic problem: the graph is potentially very dense in some regions, with many similar melodies clustered together, whereas elsewhere there are outlying melodies which are not similar to any others. This means that in order to connect the outliers, and hence the entire graph, the threshold has to be so large that in the denser regions huge cliques are generated.

### 3) Segmentation by meter

In order to reduce the density of the graph, one successful approach tested was to segment the graph by meter – i.e. so that tunes with different meters are never connected. In fact a simple way to implement this is to avoid connecting pitch vectors with different lengths. This has the added benefit that some meters can be connected (i.e. those with the same bar length such as 2/2 and 4/4) meaning that the strategy is blind to certain variations in transcription preferences (although not universally as it will fail to connect related melodies, such as Irish single jigs, which are variously transcribed in 6/8 and 12/8, and French 3-time bourrées, which can be either 3/4 or 3/8).

Each pitch vector length results in a subset of graph vertices: in all, for the 168,764 tunes under consideration, there were 137 subsets, ranging in size from 65,568 vertices (for 2/2 and 4/4 tunes), down to 60 subsets containing just one vertex. However, 99.46% of vertices are in a subset of size 100 or more and 99.85% are in a subset of size 10 or more.

The small subsets generally result from unusual vector lengths, usually because of errors in the transcriptions (i.e. extra notes or incorrect note lengths) and there was often no close relation between the melodies, meaning that a very high threshold would have to be used to connect that subset. To avoid connecting very different transcriptions, for each segment the edge threshold was, somewhat arbitrarily, limited to the length of the pitch vector for that segment. In most cases, this upper limit was never needed, but for very small subsets it sometimes meant that no edges were generated at all.

### 4) Target median degree

Even with segmentation by meter in place the method can still generate graphs with huge numbers of

edges. However, there is no particular reason that the graph needs to be connected so the idea of trying to build a connected graph (or connected sub-graphs, one for each pitch vector length) was abandoned as impractical. Nevertheless, it is attractive as essentially parameter-free and it does work for small collections of relatively closely related tunes (for example, English morris tunes, where there are many similar variants of the same melody).

For the purposes of representing the entire corpus as a (disconnected) proximity graph, this still leaves the choice of a suitable edge threshold open. Rather than picking a value out of the air, instead a target average degree for the resulting graph is determined by experimentation. With this average degree as a parameter the same bounding and bisection method as above (section (2)) can be used to find the smallest threshold that yields this average degree.

An important observation is that the small number of vertices which have very many similar neighbours generate a relatively large number of edges in the graph. For example a cluster of, say, 100 very similar melodies will form a (near) clique with up to 4,950 edges. This significantly skews the average if it is expressed as the mean degree. However, the median degree ignores these outlying values and gave much more useful results empirically and so the TuneGraph Builder uses the target median degree,  $D$ .

Considerable experimentation has been carried out with a number of target median degree values with the aim of finding one which yields a large number of local graphs that are small enough to be useful in search but which are sufficiently rich enough to express similarities visually (see below, section (7)).

### 5) Sparsification

Experimentation also revealed that, on its own, the use of the target median degree to decide which edges to include is far too crude.

An alternative approach which proved much more successful is to build a rich, and hence very dense graph initially and then sparsify it by removing the weakest “non-essential” edges. The advantage of this approach is that in effect it provides a variable threshold for including edges: in regions where the graph is dense, many edges are removed. However, in areas where the graph is already sparse, edges are retained even if they are weak, if they are deemed to be essential.

The algorithm designed to achieve this sparsification turned out to be very simple but also extremely effective. All the edges are added to a list and sorted primarily by combined degree (if edge  $e$  is incident on vertices  $u$  and  $v$  then the combined degree of  $e$  is the degree of  $u$  plus the degree of  $v$ ), largest to smallest, and then by weight, smallest to largest. This roughly prioritises the densest regions and within them, the weakest edges.

To sparsify the graph the list is traversed and each edge encountered is removed from the graph if both of its incident vertices have degree greater than a pre-specified

minimum sparsification degree parameter,  $S$ .

For example, if  $S = 3$  then an edge is removed if both of its incident vertices have degree of 4 or more. Since the degrees of vertices are updated during the sparsification process this means that once a vertex is reduced to a degree of  $S$  then no more of its edges can be removed.

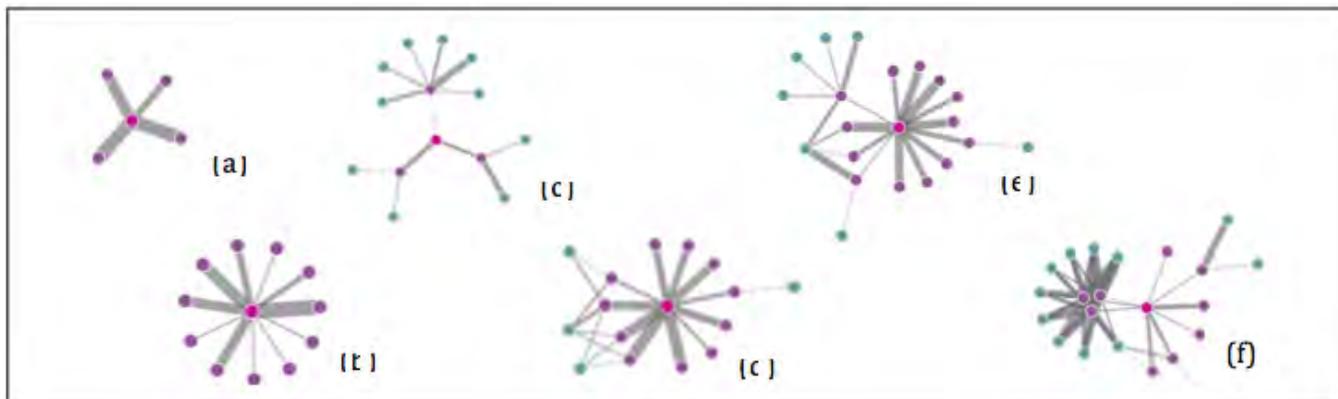


Fig. 3. Some sample local graphs.

#### 6) Extracting local graphs

Having built and subsequently sparsified the graph the TuneGraph Builder code extracts a local graph for each non- isolated vertex (the local graph is what will ultimately be displayed alongside the tune represented by that vertex). One way to do this is simply to extract the vertex, plus all its neighbours plus any edges between them. However, this can lead to clique-like local graphs where edges are hard to discern.

Instead, the local graph is built in layers: the seed (layer 0) is the original vertex for which the local graph is being built, layer 1 is any vertices neighbouring layer 0 and layer 2 is any vertices (not already included) neighbouring layer 1, etc. In order to maximise the clarity of the local graph, it only includes edges between layers and excludes edges between vertices in the same layer.

Fig. 3 shows some examples: Here (a) and (b) come from local clique-like graphs with no immediate neighbours (recall that edges between vertices in the same layer are not included in the local graph so not all edges of the clique are shown). The tree shown in (c) indicates a number of tunes which are related but probably not immediate relations of each other. The graphs in (d) and (e) are similar to (b) only with some outlying tunes related to those in the clique. Finally the graph in (f) shows a tune, with many variants, on the edge of a tightly coupled clique.

If the local graphs are just built from layers 0 and 1, each will be star-like, as in Fig. 3(a) and Fig. 3(b), yielding limited immediate visual information to the user (other than the number of neighbours and the strength of the relationships). Instead the builder code uses layers 0, 1 and 2, e.g. Fig. 3(c) to Fig. 3(f), to show some of the richness

of certain neighbourhoods. Here colours indicate the layers, with layer 0 shown in crimson, layer 2 in light blue, and layer 1 interpolated between the two of them.

Finally, the graph edges are all weighted in inverse proportion to the difference between the two tunes that they connect. Since graph edge weights are indicated in the online tool by their thickness this conveys helpful information to the user by showing the more closely related tunes with thicker lines between them (and also affects how the graph is laid out by force directed placement).

#### 7) Experimentation and parameter selection

It is difficult to say exactly what features are desirable in the visualisations provided for users, but experience with suggests that the local graphs should be small enough not to overwhelm the user, but rich enough to convey some useful information. In particular the aim was to limit the maximum local graph size but maximise the average size.

Experimentation was carried out with a number of different parameter settings but it is not at all easy to decide which are the best parameter settings to use and therefore a simple scoring system was employed.

Based on (subjective) analysis of many example graphs, the following principles were established:

- graphs with 20 or fewer vertices are the most easy to assimilate and use; above 40 or so vertices they start to become over-crowded and as they approach 100 vertices they are virtually unusable (at least in the space allowed for them on the web page);
- star graphs, e.g. Fig. 3(a) and Fig. 3(b), are less interesting than layered graphs, e.g. Fig. 3(c) to Fig. 3(f).

With these in mind the following scoring system was implemented:

- 1 point for each star graph with up to 40 vertices
- 0 points for each star graph with 41-60 vertices -1 point for each star graph with 61+ vertices
- 2 points for each layered graph with up to 20 vertices 1 point for each layered graph with 21-40 vertices
- 0 points for each layered graph with 41-60 vertices -1 point for each layered graph with 61-80 vertices -2 points for each layered graph with 81+ vertices

The two most crucial parameters were found to be D, the target median degree (section (4), used to find a suitable proximity threshold for adding edges) and S, the sparsification minimum degree (section (5), used as a lower limit when removing edges). These are interdependent: D determines the richness of the overall graph whilst S determines how many of the weaker edges are removed.

Of the two S is the cruder control. If S = 1 then all of the local graphs end up as star graphs (and so the overall score is considerably reduced). However, as S is increased (and hence sparsification decreased), the average size of the local graphs increases accordingly and the overall score is negatively impacted by increasing numbers of large local graphs regardless of which value for D is chosen.

Thus, and perhaps surprisingly, the best value for S is 2. 0shows some example results giving the overall score for selected values of S and D. For S = 2, where the best scores were obtained, the very best choice of D was 28, but in fact there are several scores close by and all values of D between 24 and 32 (not all shown in the table) yield scores over 229,000. Even when D = 45, the score is still over 227,000.

	S = 1	S = 2	S = 3	S = 4
D = 10	133,432	210,430	207,573	198,140
D = 15	138,906	221,248	216,589	<b>200,535</b>
D = 20	141,915	227,229	<b>218,551</b>	196,382
D = 25	143,590	229,177	217,148	191,005
D = 26	143,594	229,194	217,133	190,964
D = 27	143,629	229,260	216,919	190,692
D = 28	144,310	<b>229,903</b>	215,939	187,701
D = 29	144,618	229,843	215,203	185,915
D = 30	145,039	229,197	213,270	181,658
D = 35	145,342	228,363	210,222	176,267
D = 40	145,955	228,290	207,152	170,785
D = 45	<b>146,636</b>	227,531	201,983	162,379

As S increases the scores drop off rapidly, particularly as D increases. 0illustrates the reasons why by taking a closer look at the graphs produced for D = 28 and

different values of S. In each case, 145,594 local graphs are produced and the table then breaks them down into categories by size and by type, star and layered.

Perhaps the best way to view this is by looking at S = 4 (right hand column) first of all. The majority of graphs here are layered but nearly 15,000 of them are above 40 in size, contributing nothing or even negative points to the score. When S is decreased to 3 around 9,000 of these are reduced in size and end up either as smaller star graphs (~5,000) or smaller layered graphs (~4,000).

When S is reduced to 2 a further 6,000 large layered graphs are removed, probably becoming smaller star graphs.

Even more importantly the decrease of S transfers a large number of layered graphs from the 21 – 40 category into the 1 – 20 category, doubling the score for them.

	sizes	S = 1	S = 2	S = 3	S = 4
star	1 – 20	137,038	<b>37,215</b>	24,936	21,142
	21 – 40	7,408	<b>2,453</b>	2,930	1,842
	41 – 60	1,012	<b>66</b>	357	400
	61 – 80	136	<b>2</b>	18	55
	81+	0	<b>0</b>	2	3
layered	1 – 20	0	<b>86,660</b>	77,526	60,622
	21 – 40	0	<b>17,063</b>	33,825	46,396
	41 – 60	0	<b>1,989</b>	5,323	12,559
	61 – 80	0	<b>146</b>	570	2,285
	81+	0	<b>0</b>	107	290
score		144,310	<b>229,903</b>	215,939	187,701

Finally, as mentioned above, there are no layered graphs produced when S = 1 so that even though the number of graphs in the 1 – 20 category is the highest of all 4 S values, the total is lower as the scoring system favours layered graphs. A large number of other tests were carried out, not presented here. However from these the following final parameter settings were chosen:

- Difference norm:  $\| \cdot \|_2$  – see section (1)
- Segmentation by meter: true – see section (3)
- Edge threshold limit: pitch vector length – see section (3)
- Target median degree: 28 – see section (4)
- Minimum sparsification degree: 2 – see section (5)

In all experiments, regardless of parameter settings, there were a residue of isolated vertices, usually because there are no closely related melodies in the corpus or, less commonly, because there are no other transcriptions with the same pitch length. Eliminating these isolated vertices gives a final graph (for the chosen parameter settings) of

145,594 vertices.

Prior to sparsification the graph had 7,139,396 edges, maximum vertex degree of 2,060 and an average degree of 98.07; afterwards these figures were reduced to 204,639 edges, with a maximum degree of 77 and an average of 2.81, indicating the success of the sparsification algorithm.

The sparsified graph is less connected than the pre-sparsified one and the former contains 10,536 connected subsets (many with as few as 2 vertices) as compared with 5,616 connected subsets in the latter. However, a connected graph was not an aim of the process (particularly since the graph is already segmented by meter).

From this global graph 145,594 local graphs were produced with an average size of 12.3 vertices. The maximum size was 80 vertices and 154 edges.

Finally it should be emphasized that these figures are just a snapshot taken at the time of writing (November 2014) and indeed differ significantly from the prototype version layered star presented previously (Walshaw, 2014) which did not use sparsification. Furthermore, the robot which gathers data for the tune search is run every month and each time the abc files available change, meaning that so too will the underlying graph and the number of local graphs produced. The choice of parameters is chosen with the current data in mind but it is likely that the highest scoring choice of target median degree,  $D$ , may change over time according to the underlying data.

It is also likely that the scoring system will be modified as users' impressions of the local graphs are assessed.

## B. TuneGraphViewer

The TuneGraph Viewer has been deployed on the abcnotation.com website since 1st September 2014 and provides the an interactive user interface for viewing each local tune graph (on a webpage alongside the tune it corresponds to).

The local graph is visualised as a dynamic layout using D3.js (Bostock, 2012), a JavaScript library for manipulating documents based on data, and employing the inbuilt force- directed placement features.

It provides the following user interface:

- The graph vertices find their own natural position dynamically via force directed placement and vertices can be dragged to rearrange the layout (other vertices then relocate accordingly).
- Vertex colour indicates the relationship to the root vertex (with layer 0 shown in crimson, layer 2 in light blue, and layer 1 interpolated between the two of them).
- Edge thickness indicates visually how closely related two vertices are (i.e. how similar their corresponding tunes are).

- Moving the mouse over a vertex reveals its name and displays the associated melody.
- Double clicking on a vertex (other than the root vertex) takes the user to the corresponding page (with its own tune graph).

Fig. 2 shows an example webpage corresponding to the tune Black Jack (a well-known English tune). The tune is displayed on the left with the abc notation underneath and the local tune graph is shown on the right. When the user moves their mouse over one of the graph vertices, the interface enlarges the vertex and notation for the tune associated with that vertex appears below.

## Conclusion

This paper has presented TuneGraph, an online visual tool for exploring melodic similarity.

It is based upon a large index of online music and uses a melodic similarity measure to derive a proximity graph representing similarities within the index.

A rich but dense graph is built and then sparsified by removing weak non-essential edges. From this a local graph is extracted for each vertex, indicating close variants and similar melodies of the underlying tune represented by the vertex. Finally an interactive user interface display each local graph is on that tune's webpage, allowing the user to explore melodically similar tunes.

### A. Futurework

The main focus for future work is to enhance the capabilities of TuneGraph. In particular it is intended to explore some of the wide range of similarity measures that are available as a means to build the proximity graph. As was indicated in section III.A there may be other, more advanced similarity measures, or combinations of similarity measures, that would work better than the 2-norm of the difference between pitch vectors.

Furthermore, at this point the similarity measure used to assess the proximity of variants is based on the incipit only (first 3 bars, neglecting any anacrusis) and at some point in the future it is intended to use a more discerning metric based on much larger portions of the tune (as not all closely related incipits are as a result of closely related tunes).

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# Locast as a Tool in Education: Mapping Moby-Dick in a Literature Class

**Pelin Arslan, Federico Casalegno, Wyn Kelley, Amar Boghani**

Massachusetts Institute of Technology  
Cambridge, USA  
{parslan, casalegno, wkelley, amarkb}@mit.edu

## Abstract

This paper describes generally the use of Locast, a digital mapping platform built by MIT's Mobile Experience Lab, as an innovative tool for education, and presents a specific study of its use in literary pedagogy and research through a university course on Herman Melville's *Moby-Dick*. We explain how the Locast platform provides an interactive space in which students can contribute to knowledge of the world of the book, work with multimedia content, and relate information to a geographical location. Locast was deployed as part of a class assignment, as well as to investigate the potential for developing a Map Room in the Melville Electronic Library, a critical archive of Melville's works. The paper explains the experiment, both its plan and rationale, and shows its results

## Keywords

**digital mapping; Moby-Dick; digital humanities; collaborative learning; pedagogy; Locast; location-based platform**

## Introduction

### *-Locast and Digital Mapping in Pedagogy-*

Increasingly, teachers and scholars are finding value in using digital tools for teaching and conducting research in the fields of digital humanities, civic media, and mobile learning. Modern digital mobile devices are location-aware, Internet-connected, and can produce high-quality media. Such devices led the MIT Mobile Experience Laboratory

(MEL) to rethink the relationship between digital media and physical space and to seek a better understanding of how evolving media technologies might be used to improve connections between people and their social, cultural, and physical spaces. From this rethinking, Locast was born.

Locast is designed to enable the rapid prototyping and quick deployment of location-based media platforms. It is an open-source project composed of two primary components – a Web application and an Android application that act in unison to provide a platform that can be tailored to fit various user experiences. It was designed to allow users to upload pictures and video from a range of digital devices to a central map, with sites, or “casts,” selected to receive, store, display, and share this uploaded material. It enables, for example, the creation of interactive narratives that are crafted by linking together videos and photos thematically, geographically, and chronologically. Viewers can then explore these stories in a non-linear fashion. In addition, Locast provides location-aware mobile guides that allow people to discover new information about places through layers of curated and user-generated media.

As students become more comfortable with online platforms, we increasingly see potential in using digital tools to expand critical reading and thinking in a literature class. Locast's mapping function provided the means with which to conduct an experiment. At MIT, an instructor of literature specializing in Herman Melville experimented with Locast's mapping function. Locast incorporated into her class in Spring 2013. Using this tool coincided with the instructor's work to develop ideas for interactive tools that could be used for the Melville Electronic Library ([locast.mit.edu/melville](http://locast.mit.edu/melville)), an online resource comprising a variety

of materials and services to help with Melville-related research. In particular, the instructor was looking for ways to represent Melville's geospatial imagination in his most global text, *Moby-Dick* [1] – widely considered one of the greatest of American novels.

Locast's digital mapping platform allowed students to annotate the literary text, tag annotations for use in writing and oral presentations, and share comments with members of the class or group. Using that tool suggested further uses for digital tools that could enhance and expand the reading process. Tagging and archiving their annotations, students made their reading process visible to the instructor for the first time in classroom experience, showed a heightened awareness of their own reading habits and predilections, and provided a rich database of student responses to a literary text, responses they could later mine for ideas and information and could use to inform good writing.

Although some literary scholars feature map visualizations in their critical work, this use of interactive maps for teaching is still relatively new in a literature classroom.

### ***Diverse Uses of Locast***

Locast has been used in diverse educational situations. In a neighborhood of Rio de Janeiro, Brazil, Locast Civic Media was the centerpiece of a project to build civic engagement among youth, empowering community self-organization to learn more about and address many of the problems faced by residents. It provided an integrated platform of mobile and web tools to help users create individual and collective narratives, share content, and build local conversations. Young residents were able to map their neighborhood, identify where governmental and non-governmental services exist or may be missing, address issues of accessibility for young people, point specifically to places where they might face particular risks or hazards (and thus point to actionable items related to infrastructure and the environment, and locate public social spaces where the community was coming together [2]).

For an educational workshop involving a class of high school students in Northern Italy, Locast (Locast H2Flow) was used to teach about global and local issues related to sustainable water use such as the environmental impact of bottled water consumption and the predicted future of glaciers and other natural water resources. Cooperating in small groups, the students conducted interviews, surveyed the public, and participated in role-playing scenarios as reporters, environmental activists, and owners of private water companies. The Locast tool promoted an explorative and contextualized learning approach by providing the means for completing assignments, sharing student work,

and creating templates for the video recording [3,4].

The "Memory Traces" project in Boston employed Locast to explore the potential of digital storytelling using mobile devices among multiple generations of Italian-Americans in the city. Interviews produced some 150 "episodes," or stories, that could then be accessed by time, place, person, period, or theme. A mobile application then allowed users to follow the episodes as they traveled through the city. This feature linked the stories to the physical urban environment, the users to the stories and the environment, and all the content to all the other content, including across generations. The educational benefits are considerable.

## **Structure and aim of the study**

### ***-Mapping a Literary Text-***

The specific aim of the study was to understand Locast's utility as a pedagogical tool to help students engage with literature, using Melville's *Moby-Dick* as the subject of inquiry for the use of interactive mapping tools in teaching literature.

### ***The American Novel Class***

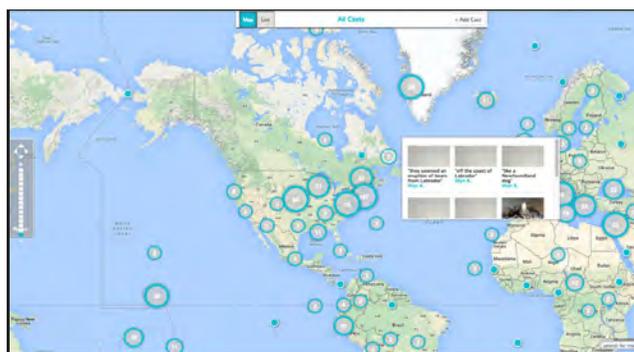
In the 2013 spring semester, Locast was used in MIT's course 21L501, "The American Novel: Stranger and Stranger" – an undergraduate, mid-level class in which students read a range of novels from the nineteenth- to the twenty-first centuries with a particular focus on standard literary practices (theme, uses of language, structure and plotting, character development), historical and cultural contexts, and the ways authors address a diverse body of readers in a changing world. The class subtitle, "Stranger and Stranger," draws attention to the fact that as with humans communicating in an online universe, characters in fiction present themselves as strangers with whom readers can achieve a remarkable and often unsettling intimacy.

### ***Skills and Expectations***

Students in the class are expected to practice a range of communications skills, from close reading, engaged discussion, and responsible research methods to effective oral presentations and thoughtfully written essays. *Moby-Dick* provides an opportunity to practice all of these skills and also presents many challenges for first-time readers, who can find its heady brew of poetic language, philosophical enquiry, scientific discourse, and whaling adventure somewhat intimidating. The instructor saw mapping *Moby-Dick* as a way to address issues of structure and language, history and nautical adventure, through a flexible lens.

Given the class's limited time for the class, mapping the book also seemed to provide a convenient way to represent a wealth of visual and spatial data. Locast

was seen as a potentially ideal tool for helping address the particular questions raised by Melville's constant and far-reaching references to geographical locations and itineraries.



*Location-based content mapped in Melville web platform by students*

The instructor populated the Locast map (Figure 1) with quoted text from *Moby-Dick* mapped to the locations referenced in the quotations. Students were assigned to pick locations featured prominently in the novel based on the quotations already mapped. They then used Locast to annotate the world map with additional media they found to be relevant. This media could come from any number of online sources, or from the student's personal experience with a location. Media could relate to the novel's content or to Melville's life. The students then wrote essays based on their exploration of their chosen locations.

## Methodology

To assess the value of Locast in the experiment, the content uploaded to Locast by students in the class was analyzed using two qualitative methods of inquiry: a questionnaire and a focus group.

The questionnaire asked about content uploaded, the user experience, and – from the user's perspective – the usability of the Locast platform in literature education.

The focus group questions combined a pre-determined set of open questions with the opportunity for the interviewer to explore particular themes or responses further in three main areas. The first area was activities, and specifically focused on what students did differently in the class, that is, how was their approach to learning different from their traditional methods and experiences? Second, students were asked about what they learned. Finally, students were asked for suggestions they might have for Locast as a tool to develop literary imagination and help support active learning.

## Results

The tool was shown to be simple to understand and use. Students created a cast or selected an existing one, opened a media box, and were able to upload images, videos, or links to online videos. In a "Description" box, they could create written statements on the relevance of the materials for understanding the presence of that geographical site in the text. In a "Comment" box they had space to add further reflections.

After using the Locast application for one semester, students participating in the study all agreed that they had learned more about Melville, *Moby-Dick*, and related topics. Some students also indicated that their perception of learning literature had changed. Specifically, the assignment and using Locast helped them gain a greater understanding of references in the novel than they believe they would otherwise have achieved, and overall the tool contributed to a different perspective on the work and gave them more insight into the book.

Students also stated that they had come to see how location-based media could play an important role in active learning when geography in general is so central to the particular work of literature being considered. As one student explained, "The locations encourage us to look at the book through a different perspective ... You can say 'think of how geography plays a role in a book,' but [using Locast] is a lot more tangible ... You are tagging locations, finding in the text where that location has been mentioned, and going around online to find things."

Students agreed that the enhanced focus on location afforded by using Locast serves the learning particularly well when very specific locations are part of the work of literature and play a large role in the narrative. "The 'Isle of Man' was mentioned three times in the book," said one student, noting unfamiliarity with that particular geographic location. "A lot Melville's readers would have known this is famous for shipping and boating ..." Having access to further information about it through Locast created "a greater cultural awareness, or context" of and for the book.

Student participants in the study also stated an interest in having content visualized chronologically as well as spatially. Using Locast mapping to provide some understanding of the period of mapped content, too, was seen as potentially useful. They suggested this could be achieved by including some sort of time-slider or color-coding map markers based on the time to which content corresponds. One student expressed an interest "in the physical space and the time space" when a novel has "a lot of incidents or events" in a given geographic area, and "seeing the development of events ... across time ..." Another suggested "potential functionalities for different books, where you are adding an annotation, and then tag it to a window of time [such as] 10

years ... and the user could slide along a time-bar and the annotations [for that time period] would appear.”

What participants liked most about using Locast was that it allowed them to interact with multimedia content, relate information to a physical location, and see what their classmates were doing. Although students did not collaborate on individual locations, they were aware of what classmates were doing because all students uploaded material to the same digital map. Some students mentioned that while it was useful to see what others were doing and thinking, they required more motivation in order to collaborate with other students.

Locast also fostered class discussion, and helped students understand references in *Moby-Dick* they might not have otherwise grasped. For instance, as one student said, “I was glad I could see what other people were doing. It gave me an ‘expectation level’, as well as new ideas ... I did Cape of Good Hope and some one else did Cape Horn, so we could compare and contrast the resources and references [for each]. By having it on the map and having all links to, it made it a lot easier to do than flipping through the book to [compare references to those locations].”

One student made particular mention of how Locast helped in constructing a narrative. For some participants, finding and uploading relevant multimedia was an important part of engaging with the novel. “I chose the Pacific Ocean,” one student explained, “I found videos of whale patterns throughout the Pacific Ocean, such as where they would be, and related it to the actual map [of the route] in *Moby-Dick*.”

Another student spoke more generally of what the experience provided. “Something we as a class got from the *Moby-Dick* [digital mapping] experience was context. A lot of the links we had were outside of the text – [for instance] YouTube videos of paintings, and chanteys, and things about where the author lived.”

Participants had several suggestions for improving Locast as a tool for learning about literature. One comment concerned usability, and a desire to see several issues with Locast addressed and resolved. These included: the lack of basic text formatting capabilities and inability to enter page numbers; making it possible to link a part of a video; and problems with zooming the map. All the students agreed that whereas viewing content on the website was easy, creating content on the website could be difficult at times.

Finally, one student mentioned that because he has an established way of reading a book, the classroom instructor must provide more guidance and encouragement if he is to use an interactive technology while learning about a work of literature. In other words, the technology needs to be integrated more seamlessly into the reading experience.

## Discussion

Results showed that after using Locast for one semester, students agreed they learned more than they expected about Melville and *Moby-Dick*. Some students mentioned that their perception of learning literature had changed. For future steps, students recommended dedicating more time to learning the digital mapping tools of Locast.

Although it is too soon to judge the effectiveness of this approach to teaching a complex novel, we did learn that a map provides a powerful tool for visualizing an author’s work spatially. Locast also makes students’ learning visible to an instructor, to the student themselves, and to each other, and provides a rich database of student responses that can be used to inform future coursework. Students find this an engaging tool for navigating the text, for their research and presentations, for enhancing their writing skills, and for encountering the book in a pleasurable way.

While we would not expect Locast to make it possible for a student encountering *Moby-Dick* for the first time to “get” the novel completely, or even to do so in a few weeks, mapping the text does offer an appealing way to “get into” the novel and find one’s way.

Locast is a promising tool not only because it opens up a “difficult” novel for student readers, but also because working with Locast in classrooms allows educators to think critically about using mapping tools in a digital archive. The Melville Electronic Library plans to include a Map Room in its digital building, a place where readers can see and learn about the global reach of Melville’s geographical imagination. Starting with *Moby-Dick* and moving on to other novels and to Melville’s short stories and poetry, the research team at the MIT Mobile Experience Lab hopes to provide resources for readers at every level of curiosity about and expertise in Melville’s works. The ultimate goal is a variously interactive space in which one can contribute to knowledge about Melville’s world.

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# Explicit and Implicit Narratives in the Co-Design of Videogames Mapping Moby-Dick in a Literature Class

**Rosamund Davies, Ryan Flynn**

Department of Creative Professions and Digital Arts  
Faculty of Architecture, Computing and Humanities  
University of Greenwich  
London, UK

## Abstract

This paper discusses key narrative design challenges posed by an on-going multi-disciplinary research project, Maritime City. The paper focuses on how narrative has, in different ways, been at the centre of the design process and on how principles of co-design might be used and adapted to address the challenges posed by the project.

## Keywords

**narrative; game design; educational games; serious games; co-design; participatory design; interdisciplinary research**

## Introduction

This paper discusses key narrative design challenges posed by an on-going multi-disciplinary research project, Maritime City. The project involves researchers and students (across the disciplines of narrative and games design and health and social care) as well as healthcare professionals, in the development of a video simulation game, which is aimed at training health and social workers. To date two different scenarios have been developed within the project – one relating to child protection and the other to healthcare for dementia sufferers. The paper focuses on how narrative has, in different ways, been at the centre of the design process and on how principles of co-design might be used and adapted to address the challenges posed by the project. It also suggests that such co-design methods might

be relevant to a range of collaborative research projects, which often face similar challenges of communication and understanding [3]

### *-Designing games for education-*

We begin by stating some general principles relating to the design of games for education and also by establishing the rationale for learning through gameplay. Modern theories of effective learning ally closely with certain features of gameplay [2] [4]. Connolly et al state, for example, that both effective learning and game activities can be described as ‘active, experiential, situated, problem-based’ [2]. Beyond this general fit, lies the more specific need to design for precise learning objectives. It is important to ‘know the semiotics and context for the entertainment the game is to provide and the semiotics and context for the education the game is to provide’ [5] and to make sure they don’t pull in different directions. In other words, in order to design the game effectively, the designers need to understand the educational objectives, values and frames of reference and to tailor the game accordingly.

### **Case study – maritime city**

#### *-Genre and Style of Game-*

The serious content of the subject matter, particularly the child protection scenario, to some extent resisted gamification, in that this might seem to trivialise it. Moreover, the health educators involved in the project made clear that it was not generally their approach to teach clear right or wrong answers to most situations, but rather to role play and discuss alternatives. The designers therefore decided not to employ a traditional gamification

model: for instance awarding points or stars for completing the scenario in the “right” way, keeping scores, facilitating players to win or lose. The decision was made to produce a simulation type game, in which the player would take the role of a social worker. The simulation would take the form of a world that the player could explore (in a fairly limited way, by being able to look around him/her and focus on different things in the environment) and a branching narrative structure, through which players might take different routes, depending on their choices. Although a simulation may not facilitate a player to win or lose in a cut and dried way, it can encourage a player to reflect upon their choices and reconsider or reformulate them and offers many of the features attributed to both games and active learning: including agency, problem solving, effective skills practice and learning through concrete experience, rather than through general principles [4].

### ***-Narrative Structure-***

The simulation genre relies, more heavily than do some videogames, on narrative elements such as story and character, in order to engage and motivate players. The key narrative challenge was to adapt the case studies and roleplay scenarios, which were employed in health and social care training, to a branching narrative structure suitable for a videogame simulation. A series of planning documents were used to do this. The health educators supplied final year undergraduate screenwriters with case studies and roleplay scenarios that were used in health care education. The case studies provided brief character profiles and back histories of key characters, while the role play scenarios outlined the key events to take place in the simulation. These documents included questions for health care students to address in assessing the case studies and participating in the roleplay.

The writers adapted these documents to produce first episode outlines and then scripts. Their key tasks in doing this were to:

- develop the characters according to the notes given
- outline a basic plot progression based on the events listed
- reformulate the key questions and issues raised for health care students into choices for players to make as they progress through a branching narrative

Key issues to address in this adaptation were:

- 1) The scenarios tended largely to take the form of reported speech. These reported events needed to be turned into action that the player experienced in the game
- 2) The writers needed to consider the difference between a) the relationship between participant and role

in live action educational roleplay and b) the relationship between player and player character in a videogame. In the former case, the participant has to stick to a set scenario, but can decide what to say to the other characters and how to say it. In the case of the video simulation game, the player plays a pre-defined character and chooses action and dialogue for her character from a narrow set of choices. Compared to live action roleplay, in the video simulation there is therefore more distance between participant and role and less freedom in how the participant interprets the role. These features can be seen as both advantages and disadvantages from an educational and motivational point of view. For example, if a participant is confident and gifted at roleplay and well informed of the professional context, they might find the live action context more rich and engaging than the video simulation. However, a participant who is under confident in roleplay and ill informed as to the professional context, might find the structure of the video simulation a more supportive environment for learning. The aim must be therefore to maximise the obvious advantages and to try to turn any potential disadvantages into further advantages.

The screenwriters therefore considered how to develop the player characters and their interaction with non-player characters (NPCs), so as to exploit the dramatic potential of the complex relationship between the participant’s sense of self and that of the character role he/she plays during the simulation. The intersubjectivity that results from this relationship can create a dynamic third space of dialogue and reflection [13], which maintains richness of experience for all players. Another potential advantage was the fact that in a videogame the player relates to the player character (in this case a social worker) in a game not only as a ‘fictional being with an inner life’ [13], but also as a ‘game piece’ or tool, which he or she uses to progress through the game. This can be leveraged to focus the player on the particular skills they are employing and so increase the potential for learning and self actualisation.

3) The screenwriters could not fully grasp the educational objectives and values from the documents alone. They sought additional clarification from the health educators, who provided written answers via email to specific questions. However, as detailed below, this did not entirely solve the problem.

### ***Initial Problems***

On reading the first script draft, the health researchers working on the Child Protection scenario wanted to take out most of the choices, which had been incorporated into the gameplay of the script. This was a problem for the writers as the game relied on these choices to create the branching narrative, which is a common way of handling storytelling in videogames. Meadows’ definition [10] (via

Lindley [9]), succinctly describes the main concept: “a time-based representation of character and action in which a reader can affect, choose, or change the plot”. Games are usually structured in this way in order to facilitate replayability. In scenario based serious games such as Maritime City this enables different areas of teaching and learning to be presented to the player. The writers therefore felt that a purely linear storyline would mean that the educational use of the game, especially with the same cohort of students over a period of time, would be problematic.

Through further discussion the reasons behind the health researchers’ reaction became clear:

1) The health educators’ intention was to amplify the game with written materials and class discussion. They wanted some of the consequences of choices to be left ambiguous to facilitate wider discussion. Therefore, a much closer integration of the design of the game and the design of the wider pedagogical context was necessary. The writers and game designers had to get involved in the design of classroom discussion and additional written materials, which had originally been considered the sole preserve of the health educators.

2) In several cases, the choices had been rejected because they didn’t relate to the key learning areas and outcomes. The writers therefore needed to better understand the educational objectives and values.

3) Because they were unused to reading the script format, the health educators found it hard to separate form and content and initially rejected the choice mechanic itself, when it was ultimately the content and context, rather than the form itself, which posed the problems. The health educators therefore needed to develop their understanding of dramatic and screenwriting conventions and game aesthetics and technology.

The concept of the boundary object is a useful one to employ at this stage. The term was coined by Leigh Star, in an analysis of cooperative working practices. Her research suggested that cooperation was often achieved through the use of boundary objects, which meant different things to different communities of practice, but allowed them to work together by creating a ‘shared space’ [7]. A boundary object might be many things, including a map, a document, a form, a set of rules, or even a concept. Boundary objects tend to have a vague identity that is shared across different groups, allowing them to work together, while at the same time different groups will also use the same object in a more tailored, specific way within a more local context.

With regard to the Maritime City project, the concept of the serious game, the scenario, the story outline, the script, the learning objectives and many other elements might all be considered boundary objects. Although they facilitated collaboration and discussion between writers,

designers and health educators, each focussed on different priorities in their use and understanding of these objects. They therefore also became sites of communication breakdown and conflict, when these differences in interpretation were fully revealed. One of the reasons for this breakdown was the fact that we were employing boundary objects from two different work structures: script development and health education. This meant that there was in fact very little shared identity of the boundary objects across the groups, much less than the local groups initially assumed.

### *Co-Design*

At this point it became clear, in a way that had not fully been articulated before, that the project necessitated a process of participatory design, or co-design [11]. The reason that we did not initially follow co-design principles lies in the cultural practices and conventions of media production, to which game design belongs. Co-design is rarely applied within media production either as a theory or a methodology. It is clear however, that it is an important consideration for the design of educational videogames and that it would have been a good idea, in the Maritime City project, to have acknowledged the context of co-design and taken steps to achieve a shared understanding of the design space at the start of the project. These steps are named differently by different theorists and practitioners (e.g [11], [12], [15]). However, broadly speaking, they aim at a) establishing a design team that includes non-designers, e.g end-users or other stakeholders b) facilitating knowledge transfer between designers and end users/domain specialists. c) shared problem definition d) shared generation of design concepts. Within the Maritime City project, the problems discussed above could be attributed largely to the fact that we had not explicitly addressed stage b) and not given sufficient attention to stage c).

### *Implicit Narratives*

In the Maritime City project, we found that there were narratives in play within the professional worlds of the stakeholders, of which they were not consciously aware, but which impacted on the game. We will illustrate this with examples from both the child protection and the healthcare for dementia sufferers scenarios. In the case of the former, the key learning objectives of the simulation were established as being to develop players’ skills in communication and empathy, as well as decision making and prioritising. The writers incorporated these into the narrative and gameplay from story outline onwards. However, quite late on in the process, as part of the face to face discussion of the first draft of the script mentioned above, the health educators stated that these learning objectives related to particular priorities in child protection. These priorities were to a)

combat a perceived lack of robust risk assessment and b) improve information sharing between professionals. It further emerged that these priorities related to the serious case review of the baby Peter Connelly child abuse case, which contained a number of recommendations about how to handle the situation of a manipulative stranger in the family as well as the difficulties of communicating between different parts of the system (e.g. police, healthcare professionals, social workers) [8].

This context could not be understood from the case studies and scenarios from which the writers were working, yet it was ultimately crucial to the narrative. For example, it clarified for the writers why the health educators assumed that the parents ('Ellie' and 'Luke' see figures 3-6 below) in the child protection scenario should be 'guilty', whereas the writers wanted to build in more dramatic complexity through ambiguity. It also made clear to the writers that they needed to include conversations between professionals as part of the action and part of the decision-making engaged in by players.

The issue here is that, although there were many discussions about learning objectives, the wider context for these objectives was so foundational to the understanding of the health educators that they took it for granted and weren't conscious of the need to communicate it to the writers.

As recounted above, the design team did not properly implement all the recommended stages of co-design for this first scenario. However, we posit that, even if they had, it is unlikely that these implicit narratives would have emerged immediately through such an approach. This is evident from the fact that explicit efforts were made, when developing the second scenario, relating to healthcare for dementia sufferers, to include stages b) and c) of the co-design process. However, as the project developed, it became apparent with the second scenario that there were once again still tacit imperatives that had not initially been voiced by the health educators and professionals. These included the facts that early diagnosis of dementia was a current health care priority [6] and that David Cameron had made a substantial increase in early diagnosis a specific government target [1]. Again these narratives were crucial to aims and objectives of the project, but were so embedded in the domain experts' understanding that they remained implicit till some time into the project, despite efforts to elicit them early on.

While it may be a good idea to try to get the tacit and implicit voiced and explicit at the start, therefore, this just may not be possible. We would propose that the creation of a shared understanding of the design space must be understood as an on-going activity, rather than something to be resolved at the start and then be done with. It must be an iterative process at all stages [11].

A crucial element in this process would appear

to be face to face dialogue. When working on the second scenario, the boundary objects of aims and objectives, case studies, treatment and script were used as starting points for extensive face to face discussion between game designers, health educators and professionals. Through these face to face discussions, implicit narratives and tacit knowledge emerged more quickly and a shared understanding of the design space was firmly established. There appears to be no easy substitute for this social interaction in developing 'a shared framework for interpretation' [14]. Just like the unique interaction that takes place between player and player character in playing a videogame, face to face dialogue between co-designers creates an intersubjective space of understanding and reflection, which it is hard to achieve through other methods.

## Conclusions

The narrative design of Maritime City as a serious/ educational game involved a co-design process, through which case history narratives and role play, used within a health education context, were adapted into a video simulation, using a branching narrative structure. Our experience of this process leads us to recommend, first, that the design of educational videogames (including but not exclusively the narrative design, which is the particular focus of this paper) is best considered as a project of co-design; second, that the following principles and practices are crucial to the co-design of educational videogames:

1) It is useful to begin the project by explicitly sharing expertise and values relating to the domains to which the co-designers belong. For example, in a project like Maritime City, it might be useful for the health educators to give a sample lecture/seminar, health professionals to give a presentation on key issues in their field, game and narrative designers to present on principles of game design, drama and narrative etc.

2) It is also vital to understand the importance and unique potential of on-going face to face dialogue and social interaction, through which to create an intersubjective space of creation and understanding.

3) It is necessary to adopt an iterative approach through all stages of the process and to expect that tacit knowledge will emerge as part of the process and cannot all be voiced at the start.

4) An informed understanding of the role of boundary objects is also useful, when designing for a particular institutional or cultural context. Within an iterative work model, they can provide catalysts to elicit tacit knowledge and implicit narratives. They can be used strategically to deliberately (rather than accidentally) foreground differences in interpretation and understanding and so gain new insights into institutional values and

cultural practices that have not yet been explicitly voiced.

It is our hope that, beyond the field of educational game design, these conclusions may also provide a useful contribution to the wider discussion of participatory design or co-design and may also be relevant to a wider range of collaborative projects, which involve cross-domain knowledge and values, such as interdisciplinary research and knowledge transfer between HEI and industry.



*Figure 4 - Ellie and Luke*



*Figure 1- The house and street*



*Figure 5 - Liam in his cot*



*Figure 2 - The view as the player nears the house*



*Figure 6 - Inspecting the baby bottle with glass in the top*



*Figure 3 - Meeting Ellie for the first time*



*Figure 7 - The final scene of Scenario 1*

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# Networks of care, or how in the future museums will no longer be the sole caretakers of art

**Annet Dekker**

PhD, Centre for Cultural Studies  
Goldsmiths University of London  
London, UK  
annet@aaaan.net

## Abstract

To depart from a museum's perspective when talking about caretaking is significant because museums are where art conservation began and where its practices have developed. However, this position may change as specialised organisations, artists and the public begin documenting or conserving artworks. As I will show, at times a network of different people gather around an initiative and start working together. It is not uncommon for such networks to form around artworks that are not collected by museums, large institutes or private collectors: either to protect the work from censorship, or to safeguard and protect it, often after an artist dies. I argue that such a network could evolve into a 'network of care' that maintains or conserves parts of an artwork. In what follows I will describe the value of these networks and demonstrate that a community-driven conservation strategy is not unlikely to happen.

## Keywords

conservation; museums; networks; net art

## Mouchette.Org

To describe how a 'network of care' could take effect I will focus on the artwork *mouchette.org*. Created in 1996, *mouchette.org* is an interactive website by a pseudonymous character who calls herself 'Mouchette'. Over the years the project developed and evolved – additional pages were added and other physical offline projects and events were

organised. After many years of well-kept secrecy in 2010 Martine Neddham decided to reveal herself as the author behind the work. Today as in 1997, on the home page the visitor is welcomed by a large bright flower and a small stamp-sized photo in the upper left-hand corner showing a young girl looking down – presumably a picture of Mouchette. Mouchette claims to be almost 13 years old, an artist, and living in Amsterdam.

The name Mouchette derives from the novel *Nouvelle histoire de Mouchette* (1937) by French author Georges Bernanos, and the movie *Mouchette* (1967) by Robert Bresson, a free adaptation of the novel. In both accounts, Mouchette is a girl between childhood and adolescence. She leads a harsh life – rejected by society (family, school and friends). She is raped by a trusted older man, and also experiences the death of her mother. These events leave her disheartened, and although never made explicit, the story ends with her suicide. *Mouchette.org* takes many of the themes that play out in the book and film and re-performs them in a contemporary setting, namely as an online diary with several project pages. And what initially appears to be the personal website of a female teenager evolves into darker themes on subsequent pages. Neddham uses some web characteristics in intricate ways to emphasise the drama and enigma of the story. For example, hyperlinks create confusing circulation; interactive possibilities produce several layers of information; and, identity play is performed in various ways.

The artwork poses several challenges for conservation. For instance, it consists of some old-fashioned technical aesthetics; some of the outdated code and software can be difficult to read; maintenance can be

very time consuming; participating users might change the work; and the website also evolves into other projects. Finally, it allowed visitors to use the website for their own projects, to build on or re-use in their own space. The latter testifies to the project's success, as several Mouchettes have been created over the years. It could be argued that these problems are not unique to mouchette.org, or net art for that matter, however the combination is rarely found in other artforms. Moreover, the speed of developments, and consequently the depth and breadth of different knowledge fields, are major concerns. For now I will concentrate on the potential and value of a knowledge field that is often neglected when discussing conservation strategies: the caretakers of mouchette.org

### **A communication tool**

For Neddham, mouchette.org is foremost a tool for communication: a social platform that branches into several directions. First of all, mouchette.org is a playful interface as Neddham explains, to express herself about issues that she as a non-native English-speaking person would find difficult to articulate [2]. Her online (anonymous) character also enables her to abandon intellectual authority while maintaining contact with visitors [2]. Similarly, in an attempt to provoke art discourses, Neddham uses 'pink aesthetics' to criticise institutional art worlds, which are enhanced by cheeky comments from an apparently well-educated thirteen-year old. Secondly, mouchette.org as a social platform is a space where people can communicate with or help each other. And thirdly, it allows visitors to use the website for their own projects, or to build on or re-use in their own spaces. At a certain place in the website visitors are invited to enter Mouchette's network. They can obtain a password that enables them to act like Mouchette. With this password, texts and photographs can be uploaded to mouchette.org. E-mails sent to Mouchette may also be answered by the new inlogee. This community investment testifies to the project's success, as several Mouchettes have been created over the years. Moreover, the work was promoted by a close but dispersed community of followers (a fan club and simultaneously a hate club formed around the website). This could be one of the solutions for its future conservation.

### **Networks of care**

The term 'network' is used in different ways to characterise current social formations (especially within technological cultures). It is not my intention to focus on a theory of networks, but to indicate the potential of networks as collaborative practices that work towards the realisation of projects. As such, the networks I am referring to are

closest to what media researchers Geert Lovink and Ned Rossiter have termed 'orgnets' [10; 9, pp. 239-55]. Orgnets are organised networks that should be seen in opposition to commercial social networking websites. These network formations are based on people who come together for a common purpose by building strong ties among dispersed individuals, thereby bringing goal-driven organisation to the Internet. The emphasis is placed on collective intelligence [8], or the idea of a knowledge community [5], in which everyone knows something, but no one knows everything. However, I do not want to confine my use of the term networks to technology. And following researchers Yuk Hui and Harry Halpin [4], who lean on philosopher Gilbert Simondon's collective individuation [14], I want to stress collectivity in networks. Such a point of departure helps to analyse the underlying structures of networks, by seeing the individual and the group not as opposing but as entities that influence each other and together constitute a constant process of individuation. As stressed by Hui and Halpin Psychic individuation to Simondon is more a simple individualization, which is also the condition of individuation, while collective individualisation is the process that brings the individual into a state of constant transformation (...), each individual is at the same time both an agent and a milieu [4, p.111].

It goes beyond the aims of this paper to elaborate on Simondon's theories and their potential use to conservation. It is simply worth explicating the value of these networks and worth demonstrating that a community-driven conservation strategy is not unlikely. For instance, a situation presented itself on 23 July 2002. A few months after Neddham launched a quiz comparing characters from the film Mouchette with the website, Neddham received a summons from Bresson's widow to take down any reference to the film. Shortly afterwards, Neddham posted the letter on her website and through her e-mail lists. In response, several independent organisations took it upon themselves to mirror the project on other websites.

Similar initiatives are becoming more common. Instead of traditional institutions, a collection of individuals and small organisations gather to form foundations that look after an artist's legacy. In such examples, a network of different people gather around an initiative and start working together. It is not uncommon for such networks to form around artworks that are not collected by museums, large institutes or private collectors: either to protect the work from censorship (as was the case with mouchette.org), or to safeguard and protect it, often after an artist dies. With different stakeholders and caretakers who do not have a centralised system or organisation to manage archival information, the relationship between conservation or documentation practices and knowledge transfer becomes inherently political. In her article, 'The Ethics and Politics

of Documentation' [15], Vivian van Saaze examines how collaborative knowledge production takes shape in discussions about the continued existence of an artwork, and what role documentation plays in such a process. Analysing the documentation of Robert Smithson's land art project Spiral Hill/Broken Circle (1971–present) shows that several stakeholders became involved in the discussions around the project's preservation, but that reaching a solution was difficult 'partly due to the fact that the relevant information was distributed over a wide range of archives' [15, p. 81], complicating the decision-making process. Nevertheless, the most recent restoration (in 2012) was completed as a result of individual and collective efforts by a network of caretakers. Van Saaze concludes that in the absence of a common heritage framework, the decision to keep this work for the future cannot be traced to one single moment in time; the history of the work shows that its prolongation had to be negotiated again and again [15, p. 82].

The distributed network of caretakers functioned through a combination of experts and non-specialists who brought in knowledge from different fields and backgrounds. As acknowledged by Van Saaze, a thorough investigation of the different roles of the stakeholders, or more precisely caretakers, might provide a lot of insight into the political dimensions around the artwork, as well as in the art world at the time; moreover, I would add that analysing the underlying structures could show how sustainable such a network can be over time.

Similarly, with regard to mouchette.org users not only influence and assume ownership of the work, but they also take care of it – at least to a certain extent. The extent to which this happens will most likely shift in time and through different networks, because the process is ever evolving, like the work itself. Nevertheless, the formation of what I call 'networks of care' also adds to the importance of mouchette.org. Besides reflecting on its own artificial conditions, it uses these conditions to set unintended, emergent and distributed events in motion. These conditions add to the work's original ambition.

Although important questions remain – for example, how shifting constellations and power relations will affect future prolongation efforts of the artwork, or who will be leading or even responsible for safekeeping and tracking the documentation that is distributed across several caretakers – it is clear that these networks can operate without the structures of centralised archives and authorised custodians, which are present in most museums. For a 'network of care' to succeed outside of an institutional framework, or to become effective as a tool for transformation, it ideally has to consist of several characteristics. These can be traced by looking at how a network gives agency to individuals, instead of answering the question of how individuals create networks. A 'network of care' is based on a transdisciplinary

attitude and a combination of professionals and non-experts who manage or work on a shared project. To enable the creation and administration of a project, the transmission of information is helped by a common mode of sharing where everyone in the group has access to all the documents or archives. Ideally, it would be an open system, or a dynamic set of tools that is used and cared for, where people could add, edit and manage information and track changes that are made. Such a system indicates and can also be monitored by the network. An added bonus is that if someone leaves, the project can continue because the content and information is always accessible and part of a larger network. Such a structure allows people to take control of a shared project, thus obtaining meaning from their 'investments'. To be able to share information and benefit from experience and insight gained elsewhere, for example, in other networks dealing with similar issues, a network should be dynamic such that individuals can easily move between networks and projects can be merged or split into separate smaller or more specialised groups. Similarly, next to user contributions Neddham has also created several objects, performances and presentations that she considers part of mouchette.org [2]. When I asked her about the 'collection' of mouchette.org, she replied

It's hard to say what constitutes mouchette.org. Over the years I have lost track of all the performances, projects and objects that I made. But for sure, mouchette.org is more than just a website.

Although Neddham's lapse of memory could be questioned, it highlights that, for her, the concept of the work is the most important aspect of mouchette.org. Knowledge about Neddham's project is distributed across different (groups of) people, where each person knows something, but not everything. In other words, no single element contains the 'whole' story. Neddham uses relationships and situations as means to produce and distribute mouchette.org, as well as to illustrate her message.

This 'social life' of the project is important for conservators. It is something that they will have to take into account and can benefit from. As Kathleen Fitzpatrick argues, a future preservation of digital objects may be less about

new tools than new socially-organized systems, systems that take advantage of the number of individuals and institutions facing the same challenges and seeking the same goals (...) Context is equally important, and equally volatile, in shaping our understanding of the production, circulation, and preservation of digital texts [3, p. 126].

A dispersed network of knowledge with a non-hierarchical structure places importance on localised knowledge, avoiding standardisation and ensuring variability rather than creating a freeze state. Whereas several networks

around artworks or between organisations and museums already exist, and some of them such as Inside Installations, Matters in Media Art, Variable Media Network and INCCA are, or have been, very successful, none of them have explicitly recognised or framed their work as ‘using’ the potential of ‘collective individuation’. To briefly return to Simondon [14], in collective individuation, relations to others, to self, and to technical ensembles, are knotted together through processes of individuation. In other words, something becomes in relation; it ‘emerges’ from processes of becoming that are instantiated by differences. This also means that something, a technology for example, is never final or complete – it is contingent, depending on variables such as personal backgrounds, intentions, competencies, or other contextual restrictions

## Conclusion

As for mouchette.org, I have not been able to trace all the different elements that are part of it, nor will a future conservator, but as the above shows this might not be necessary. Some parts can be physically archived or digitally stored in archives and museums, others will linger and evolve between various networks, and some of it will be automatically cached through crawlers. Another scenario could be that a community takes control of mouchette.org and ensures its continuation in different versions. Stories will continue to be told through multiple authors and caretakers and because Neddham does not want to control its growth mouchette.org keeps generating more objects, events, and comments. Together with evolving communities that are growing around the website mouchette.org is a circulation of traces, experiences, and sharing that started at some point and progresses without a definite plan.

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To see how it works, instructions are found at:  
<http://www.edit.mouchette.org>.

Bresson's wife did not see the work as an adaptation, but as a contradiction to the film's narrative. More surprising, the letter was addressed directly to Mouchette, believing

she was a real person. By replacing the quiz (in its French version) with the letter, Bresson's wife became part of the experience and the narrative of Mouchette, bringing it to life. For more information see Paule Mackrous [11] and <http://www.mouchette.org/film/>.

See, for example, the Nan Hoover Foundation, which was set up a few months after her death and is now dedicated to preserving her work as well as making it accessible to the public. See:

<http://www.nanhooverfoundation.com>.

By using the term 'care', or 'caretakers', I am referring to care as described by Annemarie Mol [12] in her ethnography of health care. In this sense care as a practice involves political, economic and institutional power relations, but more importantly care is not a matter of making well-argued individual choices, it is something that grows out of collaborative and continuing attempts to attune knowledge and technologies to diseased bodies and complex lives. Mol makes explicit what it is that motivates care: an intriguing combination of adaptability and perseverance.

Such distribution and dispersion of events is not uncommon in net art and is often what it thrives on. Similar examples are Olia Lialina's *My Boyfriend Came Back From the War* (1996) and *Mission Eternity* by Etoy (thoroughly analysed by Josephine Bosma [1, pp. 173-83]). They demonstrate a more recent way of dealing with memes and virals, in which the distributive effects are intentional if not foreseeable.

I am following the method proposed by Hui and Halpin [4] who analysed online collective social networks like Facebook and made suggestions for alternatives that would allow people to work together towards common goals.

Personal conversation with Martine Neddham, August 2011 Amsterdam.

I borrow the term 'social lLife' from John Seely Brown and Paul Duguid. In *The Social Life of Information* [13], they argue for a stronger emphasis on the context of social networks around information. Information, they argue, only acquires meaning through social context. Similarly, Matthew Kirschenbaum advocates the importance of social dimensions in preservation of digital media, which is 'at least as important as purely technical considerations' [6, pp. 240-1]. Conservator Glen Wharton [16] examines professional authority and community involvement with a civic monument, which shows the benefits of involving public participation in conservation. Similarly, Pip Laurenson and Vivian van Saaze [7] conclude with reference to the collection and conservation of performance art that the liveness or non-materiality of performance art is not the main challenge, rather what these works demand to maintain their memory; i.e. the maintenance of the networks which support the work [5, p. 39].



# Visualizing Texts

## A design practice approach to humanities data

**Jacqueline Lorber Kasunic and Kate Sweetapple**

School of Design, Faculty of Design Architecture and Building  
University of Technology, Sydney  
Australia

### Abstract

The availability of archival data coupled with the use of digital tools, alongside a growing awareness of the scholarly potential of visualization (Jessop 2008) has seen an increase in the use of visualization in the humanities. However, these forms of visual representation borrow heavily from the conceptual and visual language of scientific positivism, and subsequently do not reflect many of the core concerns and conditions inherent in humanities research. In this paper we look towards the field of visual communication design as a source of practices that use metaphorical and analogical approaches to text visualization, approaches that may better serve the interpretive nature of humanities research.

### Keywords

text visualization, design practice, visual communication design

### Introduction

Within contemporary debates in the digital humanities, design and design research should play a central role in the emphasis on visual methods of knowledge production and organisation. As Caviglia (2013) explains, “the nature of humanities inquiry... [into] data and representations provide[s] an almost-perfect context for design and design thinking” [1]. However, despite these opportunities there is very little analysis of the way design and design practitioners have visualized large textual data

sets (specifically qualitative data such as manuscripts and corpus literature) [2].

Instead the focus has been on the treatment of quantitative data through the use of visual communication strategies such as colour, scale, and hierarchy etc (e.g. See Nicolas Felton and his annual Feltron reports). The recent interest in information visualization as a field of study as well as the growth of design literature and blogs favouring models of aggregation, quantification, efficiency and impartiality are testament to this focus.

In this paper we look at how visualization can be turned towards qualitative textual sources that contain uncertainty, ambiguity, impartiality and contingency. This focus stems from visual communication designs historical association, lineage with word and image. Unlike other design disciplines, visual communications has always been engaged with questions of representation and knowledge. Historically, graphic design can be traced back to the nineteenth century, but the discourse of diagrams for example, are a mainstay of visual communication and can be traced back to antiquity. [3] To examine the possibility inherent in this association we specifically look at the work of designers whose practices move beyond the representation of aggregation to richer and more complex forms of visualization that are grounded in rhetorical argument and poetic display, and that acknowledge the subjective and situated context of the work. To do this we identify a range of rhetorical approaches to the visualization of qualitative textual data sets. We describe how these approaches generate, structure and create knowledge by using analogical and metaphorical frameworks to shape and interpret the data.

Drawing on the work of historian David Staley (2014), we suggest that visualization can generate new ideas for conveying meaningful information in the same way as prose. He writes, “visualization allows the information designer to represent simultaneity, multidimensionality, pattern and non-linearity with a speed and an efficiency that prose cannot capture.” That said, he “does not mean that visualization is a superior form of communication, only that it is an alternative, that it offers different constraints on our thinking.” [4]

Before turning to the work of these contemporary designers it is worth looking briefly at how visualization has been used in the humanities in the past, and how it is currently being used and the problems associated with these visual languages borrowed largely from the empirical sciences.

### **Visualization and the humanities**

The use of maps, diagrams, charts, and timelines, reveals a long history of visualization within humanities scholarship, but one that places the visual very much in the service of ‘the word’. These visuals are often a collation of evidence, a summative visual form supporting what exists in the text. And although these visualizations represent knowledge in a more appropriate and effective way – a map of trade routes is best articulated visually – they are largely, making known, in a visual form what is already known in writing.

There is however, another way in which visualization is being used in the humanities: as an analytical and interpretative tool. An increase in the availability of digitized archival data coupled with the development of digital tools has enabled scholars to explore sources in ways that were previously difficult, if not impossible. This has resulted in practices such as ‘distant reading’, established by literary theorist Franco Moretti, which refers to the slicing through of large corpora in order to reveal patterns that would otherwise remain hidden. This is in contrast to the well-established practice of ‘close reading’ where single texts, even single words and phrases are slavishly pored over for intended meaning and interpretative possibility [5]. Visualization is therefore changing the way texts are being read, offering new interpretational approaches, and potentially, new lines of inquiry. In this instance, visualization has not been used to answer questions or provide evidence for an argument, but rather it has been used within the interpretative process. Johanna Drucker refers to this shift as “a methodological reversal which makes visualization a procedure rather than a product.” [6] Alongside a growing understanding of the contribution visualization can make to Humanities scholarship (Staley, Jessop) there is a growing concern about the language of

empiricism embedded within these visuals [7]. Many of the visualization methods applied to textual data are derived from quantitative methods that favour aggregation at the expense of more expansive, contingent, and ambiguous values, all of which are central to humanist scholarship. As Stephen Ramsey argues:

Most of the visualizations one sees in text analysis are there to demonstrate the facts of the case – to prove to the reader that things cluster this way or that, that there are indeed more instances of this feature than of that feature. Relatively few of them are there to offer the open possibilities of interpretative insight. And this is odd, when we consider the kinds of texts that interest humanists are solidly of the later variety – less concerned with proving a point, and far more concerned with allowing the reader the intellectual latitude to see something new. [8]

In this paper we want to extend the possibilities of visualization as a tool for critical and interpretative insight by focusing on experimental practices in visual communication design. We are particularly interested in the way designers working in this field have combined formal graphical structures with the use of analogy and metaphor to better account for the subjective and situated context of the work as well as the material and embodied nature of textual data which is so critical to humanistic inquiry. [9]

To do this we will examine the way formal as well as rhetorical visual structures in design can order information and help us perceive patterns and relationships differently. More specifically, we will show how two contemporary visual communication designers working with textual data have organised information through graphical means. These examples not only demonstrate the increased potential of visualization as an interpretative interface (see Kirschenbaum and Whitley) but they also hint at the way visualization could allow scholars to read and interpret texts differently, thereby provoking and/or inspiring inquiry [10] [11].

This analysis of visual communication design can also be seen as a response to a larger (possibly more ambitious) agenda set by Johanna Drucker’s seminal paper *Graphesis* [12]. In it, she calls for a deeper and more considered study of the visual production of knowledge. She urges scholars to develop a “domain of expertise focused on visual epistemology”, that is “ways of knowing that are presented and processed visually.” [13]

Drucker’s insistence is significant in the context of the emerging intersection between design and humanities because it recognises (amongst other things) the inherent epistemological value of the visual in the evolving space of knowledge production. Which is why a study of visual

communication design and its capacity for understanding the visual as a form of graphical argumentation is timely.

To understand how visualization operates we have selected two contemporary examples by Stephanie Posevac and Greg McNerny, and Owen Heterich. Each example draws on a specific text or set of texts. In each case, we will show formal structures combined with the use of analogy, comparison, metaphor and narrative have made new insights possible – and have given qualitative, contextual perspective to these representations.

### Visual communication practice

(En)Tangled Word Bank is a collaborative project between Stephanie Posevac and Greg McNerny to visualize the insertions and deletions of text through the six editions of *On The Origin of Species*, by Charles Darwin. Using the ‘literary organism’ structure developed by Posevac during earlier projects, each diagram represents one of Darwin’s six editions.



Figure 6 - Inspecting the baby bottle with glass in the top

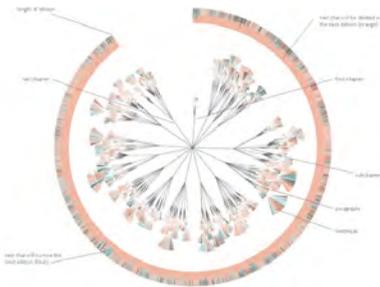


Figure 7 - The final scene of Scenario 1

Posevac explains:

Within the diagram, chapters are divided into subchapters as in Darwin’s original text, and these subchapters are divided into paragraph ‘leaves’. The small wedge-shaped ‘leaflets’ represent sentences. Each sentence is coloured according to whether the sentence will survive to the next edition (blue) or whether it will be deleted and not

be within the next edition (orange).

There are two key metaphorical visual systems at play – first is the individual ‘circle’, a branching ‘literary organism’ that reflect the text as containing living, breathing ideas which remain in flux until, as far as we know, the final edition. Evident in these diagrams are references to microscopic images of biological structures. These diagrams represent growth: in quantifiable terms, each edition is growing in length, each edition is longer than the last (outside circle). Equally, we can see the growth of Darwin’s thinking, possibly a more qualitative change. We can see how his ideas, from one edition to the other persist, (in blue) and how they disappear (in orange).

Posevac has created diagrams that embody the core Darwinian principle of evolution, of the well-known but wrongly attributed concept of ‘survival of the fittest’. (Herbert Spencer first used the phrase after reading Darwin’s *On The Origin of Species*, Darwin then used it in the fifth edition). Only the strongest, most robust ideas survive each edition, the weaker concepts are written out. Posevac has developed a narrative that shows the iterative and dynamic composition of the text, one that reflects Darwin’s theoretical development. And in doing so she has arguably created a visual analogy between biological and theoretical evolutionary processes.

In assembling these diagrams, Posevac refers to a second metaphoric visual system – that of a specimen plate taken from a book of botanical illustrations. Fig. 3 Through the placement and hierarchy of the circles (large primary specimen, smaller subsections of same specimen), the choice of typeface (classic serif), and the identification of the whole - complete organism –and its parts–chapters, subchapters, paragraphs and sentences

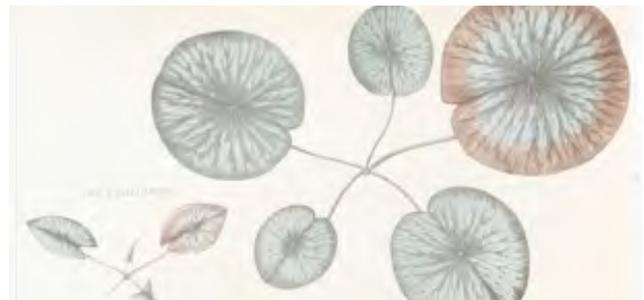


Fig 3 Young Plants, frontispiece from *Victoria Regia*, 1854 William Sharp (American, 1803-1875). Amon Carter Museum of American Art, Texas

Posovec mimics the visual conventions of scientific identification and documentation. By likening the text to a scientific diagram two critical things happen. First, the viewer readily understands that the context work of the work

is scientific not because of the information contained within the form but because of the form. Second, by playfully framing her work as an empirical study she lends rigour to her rather unorthodox depiction of Darwin’s writing process.



Fig 4 ‘Plate 3’ *The Origin of Species* Posevac and McInerney

### B. To See and Hear

In the second example, *To See and Hear* (2013) Owen Herterich visualizes the entire dialogue of a novel. For him, dialogue is a ‘way of seeing the overarching hierarchy and plot of a novel.’ The collection of novels, he has carefully chosen, spans a ‘wide range of time, genre and intended audience’. And while his selection process is not made explicit to the reader there is a sense of diversity visible in the designed outcomes.

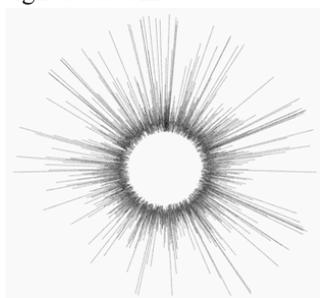


Fig 5 Visualization of dialogue from one novel. ‘*To See & Hear*’ 2013 Owen Hetrich. See: <http://owenherterich.com/projects/dialogue/index.php>

Heterich’s visualizations are drawn directly from the novel’s text. Each line represents one line of a dialogue in the book. The dialogue is then wrapped around an imaginary ‘inner circle’, ‘the diameter of which is determined by the length of the book’. Fig 6

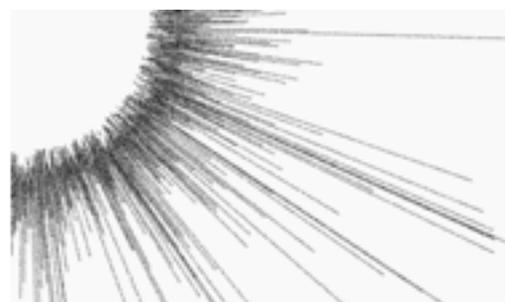


Fig 6 ‘*To See & Hear*’ [detail] 2013 Owen Hetrich

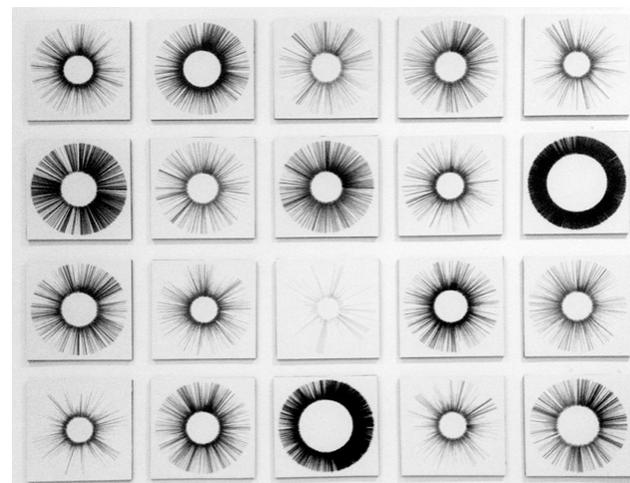


Fig 7 ‘*To See & Hear*’ 20 Novels, 2013 Owen Hetrich

The denser the visualization presented, ‘the higher the proportion of the dialogue that exists in the specific work of literature.’ Apart from the overall sense of a novel being more or less dialogue driven, you can also see how the dialogue is dispersed over the course of the novel. While the dialogue in some novels is quite consistent, others have obvious moments of intensity. Fig 7.

A basic distinction between visualization as a ‘representations of information’ and visualization as a ‘knowledge generators’ can be cast here. ‘Knowledge generators’ says Drucker [14] are capable of creating ‘new information’. Rather than been static in relation to what they show, they are ‘open’ and ‘dynamic’ about what they incite and provoke. The conception of visualization as performative or sentient is crucial in so far as it recognizes the capacity of graphical structures such as composition, placement and sequence to generate semantic value.

In *To See and Hear*, Herterich enables us to read the frequency of the dialogue through the number of lines around the circle, creating an opportunity to generate new insights from the text. Similarly he enables us to get a sense of the intensity of the dialogue by reading the sentence length sequentially around the circle. These graphical structures – not only represent the level of noise (the more dense the

diagram the more intense the dialogue and the less dense the diagram, the more sparse the dialogue) but they provide the reader with a context – a visible map that graphically codes the situatedness of the text within the novel.

Another point worth noting here is that rather than transforming the data into a numerical value, Herterich has decided to represent the dialogue with the text itself. This faithfulness to the text creates a measure that is unlike a measure created by a node or vector. It suggests a materiality that a node or a vector cannot replicate. It alludes to the relationship to graphical structures and the intensity, the frequency, the loudness or softness of a novel.

Herterich himself describes how the ‘visualizations’ can be viewed as ‘fingerprints’ where ‘no two’ fingerprints ‘are alike’. This anatomical metaphor is a powerful reference. It suggests a forensic accountability of the text, a faithfulness to the data that is both quantitative and qualitative in so far as it demonstrates how the text the physical properties of the text can reveal an emotional tenor.

The comparative potential of To See and Hear is also worth noting. Combining close reading (number of words per sentence in a dialogue and number of sentences in a dialogue over the course of an entire novel) means it also enables us to read the dialogue comparatively across a number of novels. This type of reading is synonymous with Franco Moretti’s ‘distant reading,’ mentioned earlier.

## Conclusion

In this paper we have begun to look at how a visual communication practice might expand contemporary approaches to text visualization in the humanities. We have done this by analysing the work of two designers Stephanie Posevac and Owen Herterich, whose work specifically draws on recently digitized texts. Both designers have sought to reveal something new about the texts they have selected by employing a series of formal and rhetorical strategies. These strategies rely heavily on analogical, metaphorical and graphic elements to produce effects that both interpret and shape the reception of the data.

While the use of formal and rhetorical conventions are well understood in the field of design (as strategies for meaning making and production), there is little evidence to suggest that these are being translated in the context of the humanities where the visual has recently gained acceptance.

This paper questions the ease with which visual strategies have been borrowed from the empirical sciences, and offers instead possible alternatives from visual communication design. This shift towards a ‘graphical expression of interpretation’ would realign the practice of visualization as Armonk, NY principles [15].

Developing a critical appreciation of visual forms of

knowledge production, however, requires an understanding of the structuring and rhetorical principles of design and its implications. As Drucker, so often reminds us – we should be aspiring to a visual language where “interpretation, ambiguity, inference and qualitative judgment take priority over quantitative statements and presentation of ‘facts’” [16]. This aspiration depends on collaboration between humanists and designers to better understand the role of visual knowledge production and its place in humanities research.

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This is a complex and emergent field of study that requires a significant degree of discussion not possible here given the length of the paper.

This has been an overarching theme in Drucker's work for the past two decades.

<http://www.stefanieposavec.co.uk/-everything-in-between/#/writing-without-words/>





# Communication Design in the Information Age

## An Algorithmic Approach

**Ana Filomena Curralo**

Escola Superior de Tecnologia e Gestão

IPVC – Polytechnic Institute of Viana do Castelo Viana do Castelo, Portugal [anacurralo@estg.ipvc.pt](mailto:anacurralo@estg.ipvc.pt)

### Abstract

This paper explores an algorithmic approach to communication design. A multidisciplinary perspective enhances innovation and off-the-shelf solutions in the field of creative/artistic strategies. Targeting logotype design, an open source programming language allowed generative interactive logotype creation, adding to the diversity of experimental, original final solutions. In a traditional approach, conventional tools also include programming to generate digital representation. However, it is inaccessible to the designer/program user. The paradigm shift changes the role of the program user into ‘producer’, in a knowledge-based society surrounded by a high-tech global economy reaching for competitiveness, efficiency and convenience. Downstream, instead of presenting static logos, designers and clients interact and preview logotype changes. The generated compositions, in a wide range of colors and different combinations, have common morphological properties. Algorithmic thinking requires a step-by-step project, explicit relationships between elements, prioritized requirements, and enhanced control mechanisms. Generative methods allow assessing the dynamics of composition, adjusting data representation, self-expression and inspiration. Thus, incorporating dynamics from the artefact’s production, this system constitutes Design Experience.

### Keywords

**Communication Design; Algorithmic Approach; Generative Design; Design Experience**

### Introduction

Associated with the Digital Revolution, the Information Age is characterized by an economy based on information computerization. The information industry is able to allow individuals to explore their personalized needs, therefore simplifying the procedure of making decisions and significantly lowering costs for producers and buyers. In this scope, generative design may be considered an aesthetic strategy applied to the inner structure of the creative work: the code. Targeting fast, efficient, and convenient solutions, the code provides form, surface, beauty, and a strong design experience.

According to Buchanan, design experience is “a dynamic, complex and subjective phenomenon” [1] depending on the perception of multiple sensory variables, which are interpreted through filters that are formatted by contexts. Moreover, the quality of the experience changes over time, since it is influenced by different contexts through life.

Within the theoretical framework of generative design, we explored mathematical programming. Designers have left the front seat of a passive assembly line of program users, becoming active ‘producers’ in a knowledge-based society surrounded by a high-tech global economy.

In fact, generative design as aesthetic strategy does not merely concern surface or beauty, but rather constitutes a networked, cross-disciplinary approach, with clearly defined paths to follow. There are multiple agents participating in the production process. These include human agents, namely determining the rules. Algorithms produce interactive, generative logotypes, allowing multiple

versions of solutions, keeping the intended visual identity.

However, through a well-defined, finite sequence of unambiguous instructions (algorithms), the results develop randomly, with a certain degree of autonomy, bringing unpredictability to the system. The unpredictable results of the process can be described as situational. They are subsequent to an electronic device, not a univocal consequence of the designer's intents. Through mathematical codes, dots and lines create visual forms, enhance imagination and boost bolder graphic solutions, through unexplored and unsuspected territories of visualization.

Additionally, to experience an artefact is not something the designer performs in a vacuum. It happens in a dynamic relationship with other experienced objects, places and people. Also, the quality of the experience changes over time, affected by different contexts [2]. Hence, the design experience depends on perceptions of multiple sensory variables, interpreted through filters shaped by contexts.

### **The early days of generative design**

Computing, programming and algorithms were soon identified as key elements in visual production. Programmers and artists soon engaged in countless experiments, discovering unexpected and fantastic visual results as 'producers' [3]. In the 1960s, computers had already become everyday tools in the artistic creative process. Computer-assisted creations constituted a historical rupture. Henceforth, computers would participate in acts of generation, no longer restricted to men.

The researcher Philip Galanter [4] defines the Generative Art artistic movement as any artistic practice in which the artist creates a process, a set of language rules for a computer program, a machine, or any invented procedure that generates some degree of autonomy. For Geoff Cox [5], Generative Art applies to all automated art works, through instructions or rules of execution, but rather than a direct consequence of the artists' intentions, the product of the process is unpredictable, becoming art through the device.

Unlike Generative Art, Software Art applies to the software's generative performance, the ability to (pro) create and generate [6]. The object of Software Art is the code's performance, its effectiveness in a closed technical system, and also its impact on aesthetics, politics and society [7]. The concepts of Generative Art and Software Art differ in the importance of the software and encoding, more relevant for software artists, whereas autonomously generated products are more relevant for generative artists.

According to Susanne Jaschko, in *Contemporary Art and Design*, the first obvious aesthetic and conceptual quality of Generative Art is Generativity, Nature's essential model. And fundamentally, aesthetic ideals and concepts

have always been most heavily influenced by Nature [8]. Generativity involves emergence, appearance, the act of revealing, showing or making visible an event, object, or the result of a process.

Etymologically, the term 'generative' derives from the Latin *generare*, meaning to beget, to produce, originally in reference to natural forces, conditions or substances [9]. In reference to Art, such emergence involves novelty, surprise, spontaneity, activity, and creativity [10]. Generativity is a creative problem solving method for Architecture, Industrial Design or Communication Design. Generative Design is the application of this method to solve problems. Generative creators also seek self-expression and fascination from the resulting autonomous compositions. Information is processed and new networked information is generated and made visible, through dots and lines.

Through this design method, image, sound, 3D object, architectural model or animations are generated by a computer program under a set of rules or algorithm. Different kinds of algorithms may be applied: self-organizing systems, genetic algorithms, generative grammar systems, etc. For each one, different parameters may be adjusted in order to control the end result. Generative Design puts computational aptitudes at the service of design, allowing multiple and quick iterations of the algorithm.

Ultimately, it allows choosing the best version. By adjusting the parameters of the algorithm or the designer's needs or desires, this method allows generating multiple and uniquely customized variations of a baseline design. The interactive skills of computers allow the designer/ 'producer' to be part of the design process, controlling specific parameters selected by the designer.

Different kinds of algorithms may be applied: self-organizing systems, genetic algorithms, generative grammar systems, etc. For each one, different parameters may be adjusted in order to control the end result. Generative Design uses computational progress for the benefit of design, allowing multiple and quick iterations of the algorithm. By adjusting the parameters of the algorithm and the designer/producer's needs and wishes, the method allows generating multiple and uniquely customized variations of a baseline design. [11].

### **Algorithmic approach to communication design**

Communication Design is traditionally connected to visual arts and its formal and technical research methods. And although designers tend to develop more conservative approaches than visual artists, there are many graphic designers at the forefront of contemporary procedural creation, usually combining commercial design and art production.

Since the popularization of electronic editing in the early 1980's, there were successive waves of styles and trends in communication design. They explored the possibilities unveiled by digital typography, graphic composition, photography and every computerized or computer generated tool. In fact, during the end of 20th century, communication design was analogic rather than digital. Scanning had an outstanding impact in communication as it became widespread, and the opportunities to develop design works as systems also became more common.

Modern communication designers used commercial software packs through a graphical user interface (GUI). Similarly to a human hand drawing, they now create new design pieces by clicking, selecting and dragging. However, as main interaction tool, GUI can limit creativity and visual results. In addition, graphic software packs are quickly evolving and may even disappear in the near future.

The traditional software for communication design consist of vector image editors with Illustrator, Corel Draw and bitmap images such as Photoshop, paging programs (layout), and InDesign for editorial work. Animation programs such as After Effects, Motion Design, and Flash are also quite popular. These programs have been very useful tools for designers. However, there are limitations concerning what each software is programmed to do, unlike an Open Source software, allowing the designer to choose his individual choice of inputs, thus customizing the software outputs.

Systems and variation and derivation rules in design projects are keystones in any design work. Another cornerstone is the need to develop artefacts that will become independent from their creator and original context of creation, as logos, brands and corporate identities, letter types, or layouts for periodicals. New computational media and an algorithmic approach allow producing works that are not static.

They are systems, as complex and diverse as their target audiences with whom they will communicate. Identity projects are no longer established sets of visual-technical rules for designers to apply, but systems that allow designers to interpret the rules dynamically in order to generate variable solutions, according to each particular context. Nowadays, digital environments are open to the outside world and interact with it, as a touchscreen palmtop tablet.

In the new paradigm, information computerization does not merely provide a multimedia presentation of data inputs fed into a given device. The outputs are part of the raw materials to produce new design landscapes, namely inverse manufacturing or the re-design of systems to address public needs and problems. Disrupting Galileo's mechanical universe, designers from the new liquid modernity increasingly face feelings of uncertainty, ambivalence and

ambiguity [12].

Nothing is set in stone, least of all hard science. In astronomy as in cell science, Heisenberg's uncertainty principle now allows scientists to assume limitations and probabilities. Designers no longer strive for certainties through the restricted span of possibilities prescribed by the traditional approach. The merger of digital objects originated an outbreak of conceptual models, symbolic logic, algorithms, electrons and matter. According to Dunne [13], they are a means of bridging the gap between electronics and objects scales, through direct manipulation of materials such as electrons volumes. Intelligent materials are an area where this gap is being bridged, mainly for technical reasons. Designers have not yet explored the aesthetic dimension of these new materials with the same commitment of the engineers who made them functional possibilities.

Therefore, with the merger and the physical materials that are simultaneously computing devices, Dunne concludes that most of these works have not explored the poetic and cultural prospects that converge with the technical practical choices. Designing algorithmic processes, the designer creates complex virtually unlimited and universes as a legislator a notion supported by Lessig [14], who highlights that although able to create spaces of freedom, computer programs can also create oppressive controlling spaces, heavily regulated, since both freedom and control restriction are embedded in the architecture of the code.

Being the legislator doesn't necessarily mean the designer is an almighty puppeteer controlling each and every detail in his creations. The role of the designer can be demiurgic but can also be as elegant as gardening, according to Mitchell Whitelaw [15], planting seeds of systems that will evolve and grow somewhat independent and autonomous; Systems that are more nutritive than meticulous.

Hiroshi Kawano [16] chooses a metaphor of education to describe that process, comparing the relationship programmer/computer to a relationship father and son. When teaching a child to draw, for instance, indicating the very concrete and absolute steps to achieve the result, a father prefers to lead the child to achieve the result on her own. Kawano compares this "drawing" process to the algorithmic process of images-drawing, concluding that in order to pass it on to the child, the father must know in advance and explain what he knows about the algorithm, for the child to understand. This means that the quality of the children's drawings will depend upon the quality of the father's algorithm and teaching.

## **Design@ipvc - generative logo design**

Engineers, designers or artists who perform programming

do not create objects or products as was done before and through the ages, in a traditional approach. They now create artifacts that are systems, processes, “more comparable to a continuous stream of an object that is divisible in units.” [17]. Although programming also concerns form, its target is something that traditional design didn’t often explore: interaction design.

Design’s goal, considering the traditional visual communication strategies, would be to create a visual expression/message, to be interpreted by the perceptive mechanism of the human visual system. Shapes express contents by combining basic visual elements: dots, lines, forms (basic shapes: square, circle, equilateral triangle), direction (motion impulse), tone, colour, texture, scale, dimension (implied by perspective and depth) and movement. The organization of these elements and their correlations always fulfils a role: “the results of composing decisions determine the purpose and meaning of visual expression and have strong implications in relation to what is received by the spectator” [18]. Algorithmic language allows manipulating a much wider data set than it was possible just a few decades ago; it allows generating animated visualization, and most of all, allows interactive visualization.

In the computing context, to program is to determine a set of written instructions that describe in detail the tasks the computer is expected to perform, the sequence of execution and the execution conditions. This set of instructions, formalized in an algorithm, determines the operations cycles the computer must accomplish, which in turn define its behaviour. These instructions are written in programming language, composed according to predetermined rules, with a specific syntax characterized by objectivity and clarity.

Dealing with discrete units such as numbers, alphabets or geometric elements, algorithms are fundamental to the way computers process information, since essentially they communicate what specific steps the computer is to perform [19]. This emerging design field uses computer software and algorithms to generate visually exciting forms based on wildly complex concepts. The examples range from a series that visualizes the air quality in various cities through virtual plant growth to a company logo that evolves through a kind of genetic recombination [20].

Open source Processing [21] was the program used in this project. For experienced programmers, it allows writing complex code using all Java language best practices. For beginners, it allows exploring and self-learning, through tutorials and shortcuts, allowing the user to produce code in a user-friendly transparent manner, minimizing the occurrence of errors.

When addressing the table of behaviors that carefully and precisely describe every detail of an artifact,

including actions, narratives, images, sounds of every possible and necessary message, the programmed processes may be considered descriptive. On the other hand, if the processes are less contained and hold some control intentionally left by the designer, the processes that are being programmed may be considered generative.

Actually, most of the programmed design processes are simultaneously descriptive and generative. In order to communicate with contemporary media, descriptive processes convey non-algorithmic content, and should not be disregarded, since they account for much of what is produced in digital environments and for cultural preservation. Generative programming renders digital technologies more dynamic, useful and surprising vis-a-vis the analog media technologies. Descriptive systems are ‘vertical’, selective and analytical, while generative systems are ‘lateral’, thought-provoking and nonlinear [22].

In an algorithmic approach, the code presents the designer new identities, messages and interaction with new visual forms. This was the motto for the project Design @ IPVC, an annual event held by Design Major senior students at the IPVC - Instituto Politécnico de Viana do Castelo, in Portugal, where their works are exhibited to the academic and local community. This annual event has great prominence and therefore in the year 2013-2014 we decided to change the image of that event.

Instead of a traditional approach to image creation and development, we followed an algorithmic interdisciplinary approach in order to develop a bold interactive logo and explore different paths through unexplored territories. The code was implemented through ‘Processing’, open source software for electronic art and visual design, designed to facilitate learning the code through frequent visual feedbacks [23]. The rather simple programming language is in fact quite powerful, since it allows generating surprising visual effects through the application of basic mathematical concepts. Visual expressions that take days to create manually can be generated in seconds using rule-based systems and random processes.

Following the book Type + Code: Processing for Designers [24], we used the Code referred to as foundation for the program. It was possible to add some features to that code, allowing interaction between user and interface. We accessed libraries and imported sliders and keys for the interface, to allow interactivity between program and user. Color definitions (blue, red, green) and alpha definitions (transparency) were changeable, and it is possible to monitor the user’s actions in the interface (Fig. 1). Color contrast and intensity may be changed, as well as transparency, which allows changing the formal intensity of the generated logotype.

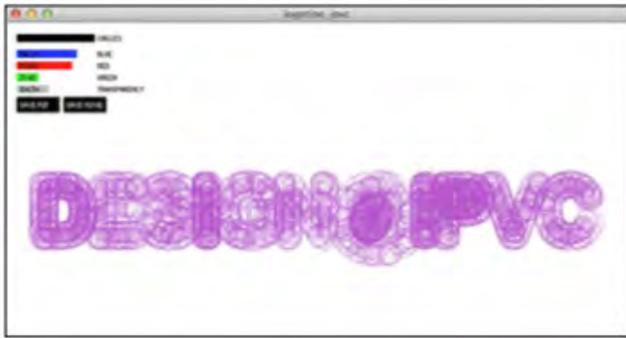


Fig. 1. User/interace interaction and DESIGN @ IPVC logotype.

The end result of the logotype DESIGN @ IPVC (Fig.1) is not static. The user may change it, and the program interface allows saving high resolution images in different formats, namely PDF and Movie.

## Conclusion

Autonomous generation is a research path in the Design process and a significant challenge for designers. The effort to find outstanding and innovative solutions is easily and rapidly assisted by generative methods, particularly concerning the artistic strategy, allowing follow up of the dynamics of change in compositions and tailoring them to the end user's needs.

Generative designers investigate innovative compositions. Generative representations hold no consideration of value, they are not based on data and don't demonstrate a semantic organization. The results are unpredictable and can be described as part of the apparatus or situation, instead of a direct consequence of the artist's intentions. More importantly, the description acknowledges other agencies as part of the production process, including human agency in predetermining the rules. Hence it may be considered an aesthetic strategy applied to the internal structure of creative work: the code.

To develop works as systems is not new in communication design. In different ways, this concept is present in corporate identity projects, books or design magazines, for example. Systems and rules of variation and derivation in design projects are an integral part of the design work, as is the need to develop artifacts that will become independent from their creators or contexts of creation, such as for instance logos, brands, corporate identities, fonts or layouts for periodicals.

Nevertheless, before the computational era, these systems had to be developed and were used by other artists or designers but could not generate autonomously, or semi-autonomously. Code experimentation is now vital for a new

generation of artists and designers who wish to go beyond the expected and ordinary visual thresholds, in search for solutions through which the user is exposed, between compromise and points of contact with the interface, generating moments of emotion and recall.

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# Structuring online learning collectivities

**Olga Ioannou**

PhD(c) National Technical University of Athens  
Adjunct Lecturer Dept of Architecture University of Thessaly  
ioannouolga@gmail.com

## Abstract

What appeared to be a technological breakthrough in education is now irrevocably changing the subject itself. The initial goal of equality in education as introduced by Massive Open Online Courses (MOOCs) has been extended beyond the rise in the number of learners to the actual consideration of them as individuals of equal intelligence who are aware of this fact and therefore, emancipated from the traditional forms of education by instruction. The new subject these courses refer to is not simply accumulating knowledge; it is creating it. And by doing so, it is creating the intellectual tools it will be using in the future not just in the educational context but in the real world problem posing and solving.

## Keywords

Learning, classroom, online resources, share knowledge

## Introduction

As natural a development as it may seem to those already acquainted with the use of online networking, it was nevertheless a quite radical act to introduce MOOCs to students and Internet users. Never has elite education been intended to be so open and democratic to such a wide public nor have the economic barriers ever been lifted so generously to offer unrequited service for knowledge.

The current evolutionary means disseminate the fruit of elite education by gradually dismantling the dependency on a specific place. University is handling matters

again as cooperation as it had in its original formation and can now overcome the limits of spatial anchoring providing system efficiency through the digitization of knowledge in specific teaching/learning formats. Along with the spatial, the temporal presuppositions are also renounced. Suddenly physical co-presence is abolished and registrants can now coexist as learners even though they are geographically apart.

## Changing lectures

By abolishing the mandatory physical presence in a classroom the student is also released from one's duty to attend to classes of 'face-to-face' lectures. Editing the content of lectures in the form of a video or an audio document has been one of the most welcomed consequences of MOOC's. When Prof. Gregory Nagy of Harvard University launched his course 'CB22x: The Ancient Greek Hero' the team that assisted him in the production of his video lectures had to go through all teaching material from the beginning and redesign the ways the professor addressed his learners by adding animated bits, blinking references, dramatized narration techniques, subtitles and everything that can attribute variety to a class which is no longer live but it aspires to be as lively as possible.

In online learning the teachers address a presumed audience. In fact, they address a generic user with no particular characteristics other than those attributed by the hypotheses data with regard to the participation expected. Even those data often remain to be verified much later. That of course changes both content and manner and the educational process becomes extrinsic to the learner. The

online course setup addresses a possible learner but it doesn't include him/her specifically. In the virtual environment this course is being produced: the audience is either simulated or implied, but in no way is it real. The courses are indeed made for anyone with the slightest interest in the subject without preconditions or further restrictions opening up at a larger audience that their predecessors ever did.

Instead of trying to capture the learner's attention, online courses presuppose that each learner has a different attention span and that it would be more effective to leave it to each one of them to decide where and when they shall attend and how. The knowledge is there in the form of a complete course, like a textbook, a totality, as Jacques Ranciere would name it and the student/learner should find the way to accumulate it alone at his/her own pace.

So, what MOOCs did was preserve the users' liberty to personalize their own studying habits by attending each course at one's own pace following some of the principles that were shaped in distant learning courses' formats or the blended ones. Each user can join in, in live discussions or not. They can watch the videos and pause and stop at any time and recuperate later. They can watch the same lecture for as many times as they wish in the safety of their own living room. But most of all they, the students, are now subjects free to choose courses from any institution at the same time and thus personalize not just their learning habits but their whole study programs.

The students have been handed a right to learn in a non dictated environment that offers a 'potential for greater integration with the vast creative and educative possibilities of the web'. The teacher is by definition distanced from the learner and can only absorb users' reactions at a later time and in large numbers. Responsibility is shifted from the educator to the learners. It is they now who customize the conditions and the quality of attendance.

This could be a way to share knowledge equally with minimum intervention from the part of the educator. But has equality finally become for education the point of departure? Is the nature of MOOCs based on their potential to challenge traditional disciplinary construction of knowledge? In this case, are MOOCs forms of resistance to educational knowledge/power systems?

### **Monitoring process outcomes**

The unexpectedly high figures of participation noted by the first MOOCs did not correspond with high graduation rates. The people who eventually finished the courses offered add up to a mere percentage of the total number of registrants and MOOCs have thereby sustained a relentless critique on their motives and their means.

The monitoring techniques that have been applied

produced a rich data-gathering pool illustrating intentions and actions in diagrams where the behavior of the users is being examined, analyzed and compared. What these diagrams represent is an average of the users' interactions with the course through the computer; when they register; how often they enter the course and how long they usually stay connected; their habits of sneaking in to get previews on the lectures or homework that follow; their involvement in public discussions about the course and their common misconceptions. All of this data is gathered from the individual profiles of the registrants and is evaluated after the fact.

It is here that some of the users finally meet; in these numerous diagrams that are mapping the unknown, showing the crooked lines of the fragmented and bitty decision making of the user in the Deleuzian society of control where each learner is in continuous flux and no one is ever finished with anything. (Deleuze, 1991) As cleverly put by S.M. Morris: 'Mere freedom to roam the Internet can result in a drowning sensation, and this can be just as debilitating to agency as oppressive leadership'. The information retrieved by the diagrams reveals the users' difficulty to attach to what maybe precious and free but ends up unexploited by the many.

Despite the noble motives that produced the need for change it seems that this first attempt of reorganizing education has not yet found its proper audience. It was intended for the less privileged, yet even the minimum precondition of internet bandwidth has been a negative factor in reaching these masses. It has been more successful with people who already have an advanced education and come from the richest part of the population; yet personal improvement and professional advancement have not yet been directly connected to MOOCs. In fact the multiple types of MOOCs that have emerged express this awkwardness vividly; apart from the main two types the connectivist (cMOOC) and the exponential (xMOOC) there have been other types of MOOCs and MOOCs derivatives that are trying to address the people outside the rather well defined learning community of the Universities and expand on more levels of communication with less likely learners. (Hollands & Tirthali, 2014; Donald, 2014)

### **Reviews and Critiques**

What has been at the core of the relentless critique that MOOCs have sustained is the limited interaction that people share while frequenting them. The learning process became a lonely process. And the low rates of attendance indicate that this maybe one of the most important factors for dropping out.

The scarcity of possibilities in communication has influenced MOOCs performance. In fact, interaction in

MOOCs has been possible in mostly written formats. One is encouraged to communicate with the rest of the students and the tutors in written form where he/she can exchange his/her opinions and thoughts. In MOOCs all communication has become verbal and it takes a high degree of verbal skill to be able to keep up with the rest of the participants and express oneself in what is for many a foreign language. In the case when conversation does not occur live, writing can become more methodical but in most cases less spontaneous.

The overall process of written exchange, however, limits collaboration. In the long term this impedes the creation of a learning community that MOOCs aspire to create and maintain. Online learning needs constant interaction between the like-minded individuals who share purpose and commitment to the common goal of learning. (Locke, 2007) So far, this interaction has not yet been established in MOOCs in a sufficient manner, nor have the students entering MOOCs garnered the sense of belonging in an online learning community they can relate to.

### ***Could this awkwardness be solely attributed to students?***

Online learning communities' properties and virtues have been scrutinized in order to produce new models of education that would incorporate the use of technology in a massive and radical manner. This quest is common to most Higher Education Institutions all over the globe and has until now produced various models of Internet interaction in learning. Yet, the so needed collaboration as a means of cultivating interest and nurturing relations in online learning communities needs to be planned forward and induced to the candidate members of an online learning community prior to the launching of any course. That way, developers and designers will be required 'to create a shared experience rather than an experience that is shared' (Schrage, 1990: 185), meaning that it should be up to the participants to figure their online learning experience instead of consuming a ready-made one.

In this context, different MOOC setup approaches have already been used to experiment with turning technology into communication and making use of the Internet to engage students in learning. The 'connectivist' ones (cMOOCs) in particular focus upon enabling students on how to create their own spaces of communication instead of using ready-made ones, thereby reinforcing their sense of independence by abrogating most of the central control. But there have also been other more isolated initiatives that although abide to the general understanding of a MOOC setup, are immensely differentiated when it comes to engaging the participants by continuously encouraging all participants to take over and become active in the course.

### ***Leuphana's Digital School and FutureLearn paradigms***

A fine example of a practice of this kind was set by Leuphana's Digital University. In 2013 it launched its first MOOC entitled 'Think Tank – The Ideal City of the 21st Century' produced by the famous architect Daniel Liebeskind in collaboration with a series of other professors from various disciplines. The University has already implemented a second MOOC on the 'Psychology of Negotiations' based on the same organizational tactic that focuses on communication and interaction between all parties involved.

The course is organized to last twelve weeks and is structured around six assignments. The people who register are grouped in teams of five and maintain the right to change their partners in case they are not satisfied by their initial grouping or they can form smaller groups. The lectures are launched according to the exercises assigned to the students and are available in the form of video presentations, articles and book chapters. Throughout the course, students can forward their questions to their mentors and their peers in open discussions and are also encouraged to give feedback to their peers' submissions. Team members are asked to interact more thoroughly by meeting online through Skype and exchange private emails regarding the preparation of their own work.

The platform is set up to function through communication practices in various levels. Once the users surpass their initial hesitations and awkwardness it is made possible for them to interact with others and communicate publicly or privately, both in writing and orally.

The teachers' presence and contribution is planned to be discreet. Apart from the lecture material which is designed to be short and dense, the students are invited to sustain their thoughts and examine the thoughts of others by themselves and are encouraged to take on their new responsibilities:

Remember that there is a learning community who is willing to help you and who is counting on those interim submissions and anxiously waiting to give you feedback on your work. Consider that by browsing through other teams reports, you will gain new insights yourself, and other teams will profit from the different perspectives and ideas of their peers.

Learning in these platforms can be described as a process of reciprocity; the students no longer rely on a certain master to decide upon the falsity or the correctness of one's work, rather they alone evaluate their work. They are asked to think critically and they are asked to verify the quality of the knowledge produced by their teams and others by themselves. Knowledge is thus acquired by attention and comparison and is not instructed but produced from people in collectivities that share a common interest on a matter and

they exchange their opinions on that matter, freely.

Likewise, in the English platform 'FutureLearn', the people attending the course of 'Decision Making in a Complex and Uncertain World' brought about by the University of Groningen were repeatedly asked to check on the opinions of their peers to the various questions posed by the teachers at the end of each unit. With the simple advice to: 'not forget to like answers of your fellow students that you agree with' learners were encouraged to read through their fellow students' answers before responding to the questions posed by the tutors and also directly comment on their peers' opinions if they wish to. This way, they had the opportunity to verify where they stood and broaden and deepen their understanding on each issue by just checking in with the answers of hundreds of other individuals with whom they were free to communicate and even start a conversation. The method used by the course designers depended on the kind of interrelations that were formed between participants and their involvement in group discussions and only a few answers out of hundreds disregarded previous peer comments on the same matters.

### ***Remembering Joseph Jacotot***

When Ranciere wrote the book *The Ignorant Schoolmaster* as homage to Joseph Jacotot's educational experiments in the turning of the 19th century, he described the revolutionary activities of a master who decided to teach a course he ignored. But he also described the activities of this master's disciples, an emancipated class of individuals who took on the challenge to attend this course and try to learn without being instructed. Jacotot's Dutch students explored the unknown (in their case the French language) by themselves, using the only means available at their disposal: the book of *Telemachus* that bore the text in both languages (Dutch and French) that their teacher suggested they should retrieve; their intention to learn; their attention; and their ability to compare.

Ranciere used Jacotot's experiments to demonstrate his belief that everyone is of equal intelligence and that emancipation comes from the consciousness of that equality (Ranciere, 1991: 101). In the most recent and elaborated examples of MOOCs like the one of Leuphana Digital School and the FutureLearn platform courses mentioned above, the people involved in organizing them have done more than taking into account the initial MOOC setup for its technological importance. Nor have they just decoded the discipline involved in their course to facilitate understanding. Rather they took into consideration an alternate model student, the emancipated one who is willing to contribute, participate and thus actively engage in the learning process with others.

In this aspect, these all so old yet all so new strategies of learning that reemerged after the massive

impact of the newest technologies used in education have dramatically changed the way education is perceived and practiced in matters of human intelligence. In these examples the dynamics have shifted from the self – always inferior within an Institution, to the self always equal to others – within a learning environment that the learner alone helps shape with others.

It is this involvement that helps learners to gradually disengage from traditional forms of University governance towards a new educational topography that has not yet been completely mapped but equally addresses to all its participants the right to shape it and help sustain it. This has been eloquently expressed by Emily Schneider of Stanford University, when asked about the benefits of peer grading as: 'turning down the authority that lies in the hands of the instructor and the TAs, and turning up the authority that lies in the hands of the other students' (Hollands & Tirthali, 2014:108).

The emancipation as in the equality of intellect is not solely intended in the educational context; it is a goal in itself as it constitutes the actual 'matheme' with which the student learner is to face up to the world in the future. Emancipation is thus the prerequisite for both a creative problem-posing and a problem-solving mind, otherwise the learner will always depend on authorities and experts and be subject to external schemata of interpretation.

### **Conclusion**

What has started as a huge advancement in educational technology has been proven to attribute unprecedented equality between learners. People can now overcome the schemata of instruction as introduced in the 19th century and become involved in online learning communities where knowledge is produced and not transmitted.

Changes in the University come hand in hand with the debate on knowledge itself, especially after designating knowledge to be the core around which any further development is to be expected of societies. Universities along with other great institutions have naturally had to reconsider their role towards the production of knowledge and their ways of communicating it with others according to the new technologies of information.

It was not so long ago that Universities' attention was directed to interdisciplinary studies, as a result of acknowledging the students as different in their learning methods and their interests. The outcome of the Boyer Report in 1998 emphasized on removing barriers between disciplines insisting on the fact that: 'customizing interdisciplinary majors should be not only possible but readily achievable' (The Boyer Commission on Educating Undergraduates in the Research University, 1998). It was

then believed that research would flourish by allowing access of all disciplines to all disciplines.

But in a complex environment such as this, it was the gravitational shift in the consideration and the profiling of learners themselves that has set a new dynamic to the complex equation of today's educational realities. It is not anymore a matter of adjusting to the students' habits but rather renegotiating who the learners are in the contemporary world. 'Disciplines need to be more involved in the research on how people think and how students learn' whether it is the disciplines themselves that need to be reflected upon here or the classroom practices (Middendorf, 2004: 2). And by admitting to this the model of Jacoto's emancipated student reemerges as a more definite possibility.

Both the educational issue of learning in open communities and the possibility of access to a multiplicity of different disciplines before that are addressed to the very constitution of the subject. The learners are no longer asked to accumulate knowledge but are learning to structure their own intellectual mechanisms for understanding, using intrinsic or extrinsic intellectual tools – their own 'weaponry' – for the detection, the representation and the management of the real. This is just like in the two courses previously mentioned, where the participants had to draw examples from their own experience and relate the course material with their own understanding of how they can use these resources in the real world. Education in these cases is not therefore a predetermined entity to be absorbed by already formed individuals but the process of the individuals' evolution into distinct subjects.

But still, the maturing of the individual learner can only be implemented when the learning process becomes a collective one as everyone's performance relies on that of others. The learning community as a dynamic agent reenters the educational landscape and is equally considered responsible for the integrity of knowledge, making the whole process as democratic as it has ever been.

## Notes

A thorough look into the genesis of the University as an Institution can be found in Mark Wingley's: 'Prosthetic Theory: The Disciplining of Architecture', *Assemblage*, No 15, p.p. 6-29, The MIT Press, <http://www.jstor.org/stable/3171122> (last access: 23/07/2012)

Prof. G. Nagy's on line course 'CB22x: The Ancient Greek Hero' is described in the article of Nathan Heller published in 2013, entitled 'Laptop U: Has the future of college moved online?', *Annals of Higher Education*, The New Yorker [http://www.newyorker.com/reporting/2013/05/20/130520fa\\_fact\\_heller?currentPage=all](http://www.newyorker.com/reporting/2013/05/20/130520fa_fact_heller?currentPage=all) (last access: 23/07/2012)

The term totality is being used here as is in Jacques Ranciere's book: 'The Ignorant Schoolmaster' to illustrate how a book can serve as an entity of knowledge complete in itself.

This position supported by S. M. Morris differentiates MOOCs from the rest of the online courses that are just mimicking an 'off the internet classroom' as he claims in his article: *A Misapplication of MOOCs: Critical Pedagogy Writ Massive*, (2004)

<http://www.hybridpedagogy.com/journal/misapplication-moocs-critical-pedagogy-writ-massive/> (last access: 20/12/2014)

An interesting analysis from the examination of some of MIT and Stanford University MOOCs can be found in: De Boer, Jennifer and Ho, Andrew D. and Stump, Glenda S. and Breslow Lori, (2014), 'Changing "Course": Reconceptualizing Educational Variables for Massive Open Online', *Educational Researcher*.

[https://tll.mit.edu/sites/default/files/library/Changing\\_Course.pdf](https://tll.mit.edu/sites/default/files/library/Changing_Course.pdf) (last access: 26/04/2014)

Again, in Morris's article entitled 'A Misapplication of MOOCs: Critical Pedagogy Writ Massive' special mention is made to how multiplicity of choice ultimately prevents the user from choosing. <http://www.hybridpedagogy.com/journal/misapplication-moocs-critical-pedagogy-writ-massive/> (last access: 20/12/2014)

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Leuphana's Digital School official site: <https://negotiations.digital.leuphana.com/course/pages/info> (last access: 03/07/2014)

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The term 'matheme' is used here as in the Greek word that stands for lesson. The term was introduced in that

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Olga Ioannou was born in Thessaloniki and studied Architecture at the 'Sapienza' University of Rome. She received her diploma in Architecture in 2002 from the Aristotle University of Thessaloniki. As a freelancer, she has been involved in numerous design and construction projects. In 2012 she received her M.Sc. in Architectural Design from the National Technical University of Athens (NTUA) where she now is a teaching assistant and a Ph.D. candidate researching architectural education.





# Spatial Humanities Moving

## Beyond the Dot on a Map

**Nick Baron**

Department of History  
University of Nottingham Nottingham, UK

**Laura Carletti, Angeles Muñoz Civantos**

Horizon Institute University of Nottingham Nottingham, UK

**Tim Coughlan**

Institute of Educational Technology The Open University, UK

**Robert Allen**

Digital Innovation Lab University of North Carolina Chapel  
Hill, USA

**Pamella Lach**

Head, Center for Faculty Initiatives & Engagement University  
of Kansas Libraries, Lawrence, USA

**Catherine Davies**

Institute of Modern Languages Research University of London  
London, UK

**Richard Tyler-Jones**

Independent Technology Consultant Nottingham, UK

**Bronac Ferran**

Royal College of Art

### Abstract

The rapid development of digital technologies for representing space combined with an ongoing explosion in potentially relevant data sources to which these technologies might be applied have led to a growing number of digital humanities projects that work at the nexus of space and experience. These bring together in new, creative and productive ways a wide array of source materials that illuminate relationships among place, event, and people. In order to inform the design and development of a new digital humanities platform that aims to provide a low-cost, sustainable solution to implementing projects, the People-Event-Place (PEP) project (2013-2014) surveyed the most commonly deployed features and functionalities that such a platform would need to incorporate, and interrogated the intellectual and practical issues that such a platform would need to address. This paper describes the PEP project's core aims, activities and findings.

### Keywords

**Digital humanities; spatial humanities; platform; data; visualisation; maps**

### Introduction

One of the most influential recent “turns” in the humanities has entailed a theoretical and practical reengagement with space “as a product of interrelationships; as constituted through interactions, from the immensity of the global to the intimately tiny”. In human terms, space is “the sphere in which distinct trajectories coexist” [1]. As such, space is always eventful: it is produced through and made meaningful by material practices that are enacted in the moment [2].

Paralleling this interest in space as “always in the process of being made” is increased attention to the role of human agency and experience, variously expressed in cultural/social history, cultural studies, cinema and theatre studies, art, popular culture, and other fields – including social computing and human-computer interaction [3] - through work on performance, spectacle, reception, exhibition, everyday life, the aleatory and agency.

The rapid development of digital technologies for representing space combined with an ongoing explosion in potentially relevant digitised data sources to which these technologies might be applied have led to the emergence of spatial humanities as a new area of research [4] and to a growing number of digital humanities (DH) projects that examine the nexus of space and experience, bringing together a wide array of source materials illuminating

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relationships among place, event, and people, including digitized maps, GIS displays, photographs/paintings, public records, newspaper accounts, oral histories, and diaries and letters.<sup>1</sup>

These projects usually are marked by the use of geo-spatial representation (identification of relevant places and events via geo-location on a digital mapping platform), often with associated multimedia content (from historical photographs to oral histories). They might incorporate capabilities for user comment and user-generated content, links to social networking platforms, time-lines and other modes of data visualisation. They tend, or aspire, to be dynamic and open-ended rather than representations of a fixed data set.

These projects are produced in a range of contexts: individual scholars, interdisciplinary teams, museums, cultural and/or heritage institutions, community organizations. They tend to be data-driven, exploiting digital or recently digitized archival resources (whether hosted as a part of the project or linked out to external hosts) and designed more as discovery/data-visualisation environments for a range of prospective user groups (academic researchers, schools, cultural heritage organizations, community groups, interested individuals) than as analytical research tools devised to address an individual academic question.

Because these projects arise from a wide variety of traditionally unconnected disciplines and institutional settings there has been no coordination among them and very little sharing of lessons learned. They are still mired in the classic “reinvention of the DH wheel” syndrome, resulting in inefficient project development, high start-up costs, reliance on increasingly unreliable external funding sources, freezing of projects upon launch and exhaustion of development funding (the gravestone effect).

Against this backdrop, the People-Event-Place (PEP) project, conducted during 2013-2014 by researchers at the University of Nottingham and University of North Carolina at Chapel Hill, aimed, first, to establish DH projects’ optimal requirements in terms of platform affordances versus start-up and sustainability costs; and, second, use these insights to inform the design by the Digital Innovation Lab, UNC, of DH Press, a new platform aiming to provide the widest range of functionalities at the lowest possible cost.

To this end, we conducted a review of existing projects and one in-depth case study; organised two focus groups to gather feedback from humanities scholars on their needs, priorities, and perceptions of the benefits, risks and costs of digital engagement; and facilitated a dialogue between users and developers during DH Press development. This paper sketches the context and key findings of the PEP project and then outlines DH Press development aims.

## Environmentalscan

First, in late 2013 we evaluated twenty ongoing DH projects, all of which focused on the nexus of place, events and people, and all of which used visualisations, to identify commonly deployed tools and features, as well as the advantages and disadvantages of different solutions. We identified projects through surveying numerous websites and publications [5, 6, 7, 8, 9, 10].<sup>2</sup> In making our selection, we sought to encompass the widest possible diversity of humanities and social science disciplines, topics and data types, forms of visualisation, and research aims (i.e. to illustrate data; explore/analyse data; enrich/obtain new data).

Our findings suggested that:

- Projects fell into three main classes, based on maps, static visualisations and multivariate visualisations.
- Maps are the most common visualisation, but there are rarer alternatives that are effective for specific research aims, e.g. graphs, charts, networks. The integration of map and timeline is an efficient means of visualising the spatial change over time.<sup>3</sup>
- The most effective platforms are the least prescriptive, with customisation capabilities for researchers and interactive features for end-users (to import, visualise, filter, sort, navigate, select, record, organize, modify, create and share content).<sup>4</sup>
- Numerous open tools are available (SIMILE Timeline, ManyEyes, Flare, Omeka) but all incorporate only a single function, enabling some processes but not others.
- Despite this, most of the projects used open sources to create visualisations. When funding was available, some built their own tools or deployed commercial software for specific purposes. These demonstrated a wider range of functionalities.
- Instances of ‘gravestone projects’ indicated the need to plan for funding for sustainability.
- Most of the projects used Google Maps to provide the base, as a reliable, presumably future-proof solution. Some used open-source maps such as OpenStreetMaps. These can be modified and improved without the expense that commercial services impose.
- Substantial funding is evidently necessary to develop and sustain a project incorporating multiple functionalities and allowing for ongoing development. Among the sample no open

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<sup>1</sup> For an extensive list of DH projects, see

<https://www.zotero.org/groups/humanitiesgis/items/collectionKey/8EB7UQH/C/> [accessed 21 October 2014].

platform provided this.

Our analysis highlighted some of the main challenges facing DH projects and established two guiding design principles for ensuring cost-effective implementation; a rich, adaptable and accessible user experience; and sustainability. These principles are: lean start-up and agile development.

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2 Among the websites reviewed were: <http://dhawards.org/>; <http://adho.org/>; <http://www.stanford.edu/group/spatialhistory/cgi-bin/site/index.php>; <http://journalofdigitalhumanities.org/>; <http://anterotesis.com/wordpress/dh-gis-projects/>; <http://dhcommons.org/projects> [accessed 27/11/2014].

3 The Republic of Letters combines timeline and map to offer an interesting 'flow visualisation': <http://web.stanford.edu/group/toolingup/rplviz/rplviz.swf>. Also see *Going to the Show*, that separates timeline and various map visualisations: <http://docsouth.unc.edu/gtts/map/state>; and *Digital Harlem*, which permits display of multiple layers on the map: <http://digitalharlem.org/> [all URLs accessed 20/06/2015].

4 E.g. ArtMaps: <http://artmaps.tate.org.uk/artmaps/tate/>. For further information, see [14]. Also: [http://www.kulturarv.dk/1001fortaellinger/en\\_GB](http://www.kulturarv.dk/1001fortaellinger/en_GB) [both accessed 20/06/2015]. The *Animated Atlas of African History 1789- 2002* (<http://www.brown.edu/Research/AAAH/map.htm>) uses Flash-based animation that does not allow much interaction or exploration of the data, and therefore the user experience is based on a passive visualization of the content displayed, offering only a single perspective on the data.

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## Genderlatam database

Second, we undertook an in-depth analysis of 'Women and Independence in Latin America', 'a new multimedia community-contributed, community-driven online resource'.

GenderLatAm.org.uk arose from an AHRC-funded project (2001-2006) 'Gendering Latin American Independence: Women's Political Culture and the Textual Construction of Gender 1790-1850', which explored the significance of women in Latin American independence and the reasons for their subsequent exclusion from political culture. Among its key findings were the existence of unstudied writings by women, including letters and educational texts. After 2010 increased public interest was generated by Latin American bicentenary independence celebrations and by women's unprecedented contemporary presence in Latin American politics (e.g. women Presidents

in Brazil, Costa Rica, Argentina, Chile).

The database for the project was created principally as a research tool to enable researchers to explore the roles of women in the independence struggles. To this end the database included data on the people (mostly women) involved, significant life events (birth, marriage, death), and locations associated with the people and events. In the original database design, information on events and places were stored in separate tables. This imposed limitations on the ability to search the database: it was not possible to query the database both by date and location of events. During a second development phase the data in these two tables were merged to create a single table holding all data on events: persons involved and date, location and type of event. In combining the two tables the range of event types was extended to include activities such as fighting, imprisonment and spying. This restructuring significantly improved the ability to search the database for events. Users can now create complex queries combining many search criteria such as who was involved and when, what was the event and where did it happen.

The database was also enhanced by adding new data to other tables. For instance, the longitude and latitude of locations were added thus enabling locations to be shown on maps. Also, Spanish and Portuguese translations of all the stored information were added to make the tool more accessible to non-English speakers. The various changes and additions have considerably improved both the ability to query the database and how data can be presented, providing a more useful tool for researchers. The database is online ([www.nottingham.ac.uk/genderlatam/database](http://www.nottingham.ac.uk/genderlatam/database)) and includes 2359 names/biographies, 3867 events, 340 images; women's writings, family and social networks, group activities, and commemorations. The project home page is <http://www.genderlatam.org.uk/>.

## Focus group findings

The next stage of the PEP project involved presenting the findings of our review and case study to two focus groups of academics, to elicit feedback on their general priorities and needs and to identify their key perceptions regarding potential benefits, risks and costs of engaging with digital technologies. We also introduced the focus groups to a prototype of DH Press, asking to what extent it met their needs and addressed their concerns. Participants in these groups were drawn from a range of scholars across the humanities and social sciences, and included an approximately equal number of those experienced and/or expert in DH humanities and those new to the field and curious about the potential uses of digital engagement in their research. Both practitioners and prospective users included enthusiastic explorers, willing to take risks for high potential

benefits, as well as those who evinced more scepticism and caution with regard to potential returns on investing time, effort and resources in technological innovation. Of course, participation in the focus groups presupposed at least a basic level of interest in DH.

We summarise our findings under the following headings:

### ***-Sustainability-***

Practitioners emphasised that technology moves quickly, so that any investment in DH (in terms of institutional funding and support, and individual time and energy) is as much about keeping up with innovation as maintaining current technologies. Institutions must continuously be alert to technological change, and be able to adapt and develop capacities and infrastructures to take advantage of new functionalities and ensure that existing provision does not become obsolete and a hindrance to initiative. Scholars are much less likely to invest in digital innovation if they lack confidence in the institution's commitment to ongoing support for their work and its structural capacity and readiness to engage in long-term dialogue with them regarding their current needs and possibilities for developing and extending their aims and requirements in light of new technological opportunities. It is crucial that sustainability should be incorporated in project design from the start.

### ***-Impact & Participation-***

In the UK, the 'impact agenda' (i.e. the need for scholarship to deliver demonstrable social, cultural or economic benefits) means that provisions for engagement need to be built into any project as an intrinsic part of the design process. Ideally, platforms should allow not merely for a sharing of research findings with the public or other potential beneficiaries, but for the 'co-production' of research. Technology should not be perceived or deployed solely as a vehicle for dissemination of research but as a mechanism for its collaborative design and implementation. Because many UK funding agencies require evidence to be submitted for the evaluation of a research project's impact, platforms need also to provide tools to measure user-participation and record the benefits accruing to users. The best research and engagement projects are aware of the different interests, expectations and needs of diverse beneficiaries, and seek to respond flexibly and appropriately. Platforms need to be able to deliver different content, different levels of engagement, and different experiences to diverse users and audiences.

### ***-Visualisation & Representation-***

Humanities scholars highlighted the diverse and indeterminate nature of the data with which they work.

Frequently, this is textual in nature, often fragmentary, inconsistent or inchoate, and rarely can be accommodated in proprietary database structures or reconciled with conventional data standards required for statistical processing and analysis by off-the-shelf packages. These scholars stressed the need for platforms to be able to manage 'dirty data'. They also stressed that humanities research deals principally not with clear and concisely delineated inputs and outcomes, but with ambiguity, ambivalence, critique, and process. Accordingly, technologies for the analysis and visualisation of such data must permit both researchers and users to apprehend and engage with indeterminacies of various kinds: individual subjectivities and experience; interpretative and evaluative divergence; deconstruction and 'reading against the grain'; spatial mobility and change over time. They underlined the danger of platforms generating false perceptions of precision and 'truth' or asserting a specious authority through visual persuasiveness, agreeing that software 'could allow a variety of additional re-representational capabilities, tuning the spatial representation to the users' needs at that moment' [11]. By such means, visualisations should stimulate rather than resolve questions, open discussion rather than close it down, reveal lacunae and uncertainty intrinsic in the data, and go beyond 'positivistic' dots on the map [12, 13, 14].

### ***-Interdisciplinary tensions-***

As noted, many humanities scholars stressed that the data with which they work does not adhere to the formal structures required for machine analysis. At the same time, many recognised that digital engagement might prompt new approaches to practice that would be of benefit to their scholarship. The challenge of interdisciplinary research is, here as elsewhere, to find compromise that brings benefits to all. In DH the challenge is to find the balance between modifying humanities practice to meet technological requirements and redesigning technologies to address scholarly needs. A precondition of productive dialogue is to find a common language (all too often humanities scholars were unfamiliar with basic terminology used in computer and information sciences). It is necessary to establish the loci of innovation: does the project aspire to create new technologies, establish new methods, produce new understandings, and in which fields? For computer scientists and information specialists, technology is not principally a tool to conduct or present research, but the object and outcome of research itself. So it is also vital to establish who – humanities and/or technology researcher – defines the aims and outcomes of the project and carries risks and costs, or how these are shared. To do this effectively, all parties involved in collaboration must learn to appreciate the institutional and other constraints, pressures and implicit or explicit incentive systems, within which the others work

(in terms of disciplinary cultures; career progression and reward; research assessment exercises, etc.).

### ***-Design and Delivery-***

We asked participants to reflect on how DH projects might best be designed and delivered to take account of the issues raised above. Scholars working in HCI drew attention to the ‘task-artefact cycle’ [15] as a way of understanding the rhythm of innovation: as soon as an artefact (e.g. software) has been produced, users will find new tasks for it, which in turn generate new demands for innovation. It was agreed that projects should acknowledge and take account of the iterative, mutable and open-ended nature of interdisciplinary work, in terms of aims, activities and timelines, and establish mechanisms for risk mitigation with a carefully calibrated and monitored flexibility. Platforms needed also to allow for adaptation and innovation in the course of a project, while guaranteeing certain basic functionalities. Crucial to ensuring this measured flexibility is the ability of a project to create and sustain genuine interdisciplinary dialogue throughout the research process, from design stage through delivery of the initially envisaged outcomes and beyond.

### **Development of dh press**

Towards the end of the PEP project, Nottingham team- members reported on findings from the environmental review, case study and focus groups to colleagues in the Digital Innovation Lab (DIL) at UNC, who are developing DH Press. Their aim is to create a flexible, repurposable, extensible open-source DH toolkit to facilitate exploration and discovery of humanistic material through a range of data visualisations, including geo-spatial maps, timelines, galleries, SVG-layered pinboards, and network graphs, as well as several visual representations for faceted search. DH Press also features an oral history widget that syncs streaming audio or video to a rolling textual transcript.

DH Press grew out of earlier efforts to create a custom- built mapping platform for heritage organizations to create digital exhibits and virtual walking tours. In the process of testing the prototype in 2011, the DIL began searching for a more sustainable and generalizable solution. Rather than custom coding an entire tool, the DIL investigated a range of existing content management systems that could be leveraged for humanistic data visualisation. Teaming up with the Renaissance Computing Institute, the DIL quickly settled on WordPress, which enabled a robust tool that could go further than digital mapping. The team released a beta plugin in April 2013. While this platform already addressed a range of needs identified by the PEP project, our findings have informed its further design. The DIL released a stable and more extensible version of the plugin in June 2014. Further iterations are continually under development. Each major release features new visualisations and enhanced

functionalities.

The central guiding principle for DH Press is lowering barriers for creating DH projects. The toolkit was designed with non-technical users in mind (technical users are invited to modify the codebase). Creating visualisations does not require prior knowledge of relational databases, GIS technology, or sophisticated data visualisation techniques.

DH Press has been used in a range of applications, including interactive museum exhibits, public history projects, and as a tool for hands-on experiential learning in college classes. While not explicitly designed for any single project, DH Press is especially well suited for geo-spatial representations of individuals’ experiences of cultural/social practices in particular spaces, place, and times.

The most significant hurdle to using DH Press is creating an appropriate data set. It can be difficult to determine and configure data for a particular tool’s idiosyncrasies. For humanists not trained in data-driven approaches, conceptual and analytical challenges will still arise when trying to translate ‘traditional’ humanistic material into data that is consistently structured and formatted for use with tools.

In addition to conceptual challenges, there are several practical mapping limitations. For instance, DH Press cannot display multiple markers located at the same point in space. As a workaround, the DIL manually adjusts duplicate latitude/longitude pairs to produce clustering effects at various zoom levels. However, this workaround can be misleading, suggesting positivistic dots on the map that contribute to ‘false’ perceptions of precision and ‘truth’. The DH Press team now hopes to develop a mapping solution that visually suggests uncertainty or ambiguity and reveals what Drucker refers to as the process of creating and representing “capta” [16], or Coughlan et al conceive, with reference to the locational indeterminacy of cultural artefacts, as the challenge of capturing a ‘spatial footprint’ [14].

### **Postscript**

The preceding section was written in late 2014. By the time the revised version of this paper was submitted for publication (late June 2015), DH Press had undergone substantial further development, in part responding to issues raised by the PEP project as well as by other users.<sup>5</sup> DH Press, currently in Version 2.6, is now being widely deployed, and will continue to be developed in response to user feedback.<sup>6</sup>

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<sup>5</sup> For details of DH Press development, see: <http://digitalinnovation.unc.edu/projects/dhpress/dhpress-updates/> [accessed 17/06/2015].

<sup>6</sup> For a survey of the uses of DH Press, see: <http://digitalinnovation.unc.edu/projects/dhpress/about-dhpress/> [accessed 17/06/2015].

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# Collaborative Research through Design

## A Case Study in Mobile Augmented Reality

### Dr Paul Coulton

Lancaster Institute of Contemporary Arts  
Lancaster University  
Lancaster, UK  
p.coulton@lancaster.ac.uk

### Dr Emma Murphy

School of Design  
Glasgow School of Art  
Glasgow, UK  
e.murphy@gsa.ac.uk

### Abstract

**In this paper we outline the challenges and preconceptions that we have experienced in “Taking the Artwork Home”, a collaborative research project across art, design and technology. The project uses Mobile Augmented Reality (MAR) to explore ways to enhance engagement with the arts and in this paper we present the challenges relating to performing this type of research more generally as well as specific insights for the sector relating to image based applications.**

### Keywords

**design; research; Mobile Augmented Reality; arts; technology; museums**

### Introduction

The UK research agenda frequently calls for more cross-disciplinary research, and now emphasizes the importance of impact beyond academia by directly engaging with stakeholders through research in the wild [1]. This paper exemplifies this approach to research in that it is a collaboration between an arts organization, design research academics and a technology developer to investigate challenges of creating a novel Mobile Augmented Reality (MAR) application to engage new users with gallery content.

The innate diversity of these collaborative endeavors can result in novel findings from the research itself (in this case, about the development of an MAR application to engage users and develop new curatorial strategies), as

well as new insights into the design and practice of such a research approach (in this case, the complexities of doing research in the wild). In addition, such an interdisciplinary workspace can reveal preconceptions from edge audiences, which emphasizes the importance for researchers to collectively reflect, bolster and clearly articulate their approaches and outcomes.

This paper will firstly describe the complex nature of this project, in terms of funding landscape, diversity of partners and audiences. It will then outline the research process, challenges experienced, and the implications for such projects in the future. It will conclude by detailing the novel insights that the project has generated in terms of application development, and future plans beyond the current project funding.

### Research proposition

Our initial research aim was to identify the potential of digital technologies and social media – with a particular focus on MAR - to engage the public in art collections through curation of, and responding to their personal exhibitions. We also wanted to identify how user-generated content could inform future curatorial and collections strategies. In addition, we wanted to understand the implications this would reveal for the wider arts sector, particularly regarding access, rights management and intellectual property (IP).

## Research methodology

The project was funded through Nesta Digital R&D program which aimed to support the use of digital technology to build new business models and enhance audience reach and therefore this project needed to demonstrate aspects of both research and development. This necessitated flexibility within the research approach and with the creation of the artefact, in this case the MAR mobile application. The research approach adopted closely aligns to Sir Christopher Frayling's definition of 'research through design' [2, 3], in that research into the possible implementations of MAR were evaluated with different user groups as part of the design process and that the research reports and papers produced primarily reflect on this process to suggest approaches that are both desirable and productive for future practice [4] rather than analyse the artefact itself. The project can also be considered as 'research for design' [2, 3] in the sense that the end product is a prototype artefact in which all the thinking that went into producing it is embedded, and in the sense that it is not simply a finished ready-to-market app, but more an artefact in perpetual beta with implications for designers to take further. One could argue that the artefact represents more divergent thinking of 'what could be', as opposed to a developer or consultant view of something most possible or practical. Furthermore, whilst the development of the artefact is able to produce a series of insights once it is released 'into the wild' many others are likely to emerge [1] as the project uses Agile development these insights will influence new versions and the project effectively remain in perpetual beta.

As one of the aims of this project was to produce a radically new experience for a general audience, their role in the process has to be considered carefully. To quote Marshall McLuhan from his book *The Medium is the Message* "We look at the present through a rear-view mirror. We march backwards into the future" [5]. In other words our views of what could be are highly influenced by what we have experienced. This view seems very applicable when considering the current state of public, and indeed many cultural organisations, understanding of AR as we encountered very few people during our evaluations that had ever experienced AR and of those that had, the vast majority had only experienced simple sensor-based AR systems such as Layar or Wikitude ([//www.layar.com](http://www.layar.com), [//www.wikitude.com](http://www.wikitude.com)) which provide a very different user experience than vision-based approaches used in this project [6].

Therefore we decided not to utilise a co-design approach, because rather than act as facilitators for the users who would design the application, we developed the system using an iterative participatory design approach whereby a number of prototypes were presented to a range of potential user groups of between 8-20 people for feedback and

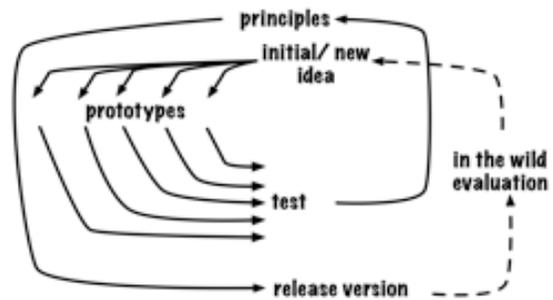


Fig 7 'To See & Hear' 20 Novels, 2013 Owen Hetrich

discussion as shown in the figure 1.

The challenges and insights in the forthcoming discussions are derived from these sessions involving five versions of the application and 80+ volunteers. Note the figure 1 also indicates the 'in the wild' evaluation phase in which we will use feedback from those who have downloaded the app to provide further improvements of the application.

## Challenges

There are a number of key challenges which were addressed during the course of the project. Such challenges could be valuable to others considering collaborative research through design – particularly when there needs to be balanced between research and development for both academic and non-academic stakeholders. Challenges are summarised in the table below.

*Challenge 1: Defining desirable outcomes (e.g. tangible product outcomes versus intangible research outcomes). This challenge came about because of the different expectations of outcomes in this kind of research project: e.g. research through design. Learning about the process of research through design is important, as many new and pioneering research calls are geared towards enabling and encouraging this kind of collaboration. We know we should work in this way, e.g. using research findings to inform design – but also learning through the design process, but how does it actually happen? How is it communicated in a way that makes sense to multiple stakeholders when doing research "in the wild"? If research projects involve the development of an app, how do we ensure this is research about what could be, as opposed to the development of a market ready project, which could arguably be classed as consultancy. We overcame this challenge through regular communication with our stakeholder groups, but also being clear from the outset that the purpose of an academic research project was*

very much about the research processes which lead to the creation of prototypes that represent proof of concept and potential, rather than finished and developed solutions. When the outcomes were clarified, we found that all partners were indeed

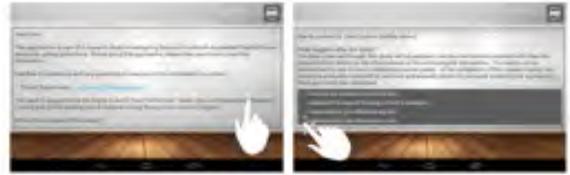
Challenge	How this was overcome
Defining desirable outcomes	Open and frank discussions about what outcomes are required for all members to benefit from the project
Research ethics and IP and how these can negatively impact the scope of the research	Inclusive discussions throughout the project with all stakeholders about both the choices to be made and the potential impact of such choices
Overcoming preconceptions about this kind of research from potential audiences.	Prototyping to learn not simply testing functionality

Table 1: Key Challenges

happy with proof of concept and prototypes as outcomes – it was more about being clear with expectations.

Challenge 2: Research ethics and IP and how these can negatively impact the scope of the research. When academic research is done, there is inevitably ethics approval needed, and procedures to follow. During the course of this research project we have been confronted with a number of interesting questions about ethics. Participatory research practice can be viewed as being, in itself, an ethical approach to research in that it involves a high degree of accountability and responsibility towards the research participants. The approach requires ongoing reflexivity and sensitivity to emergent ethical issues. However, difficulties can arise in addressing the structured requirements of ethical review processes particularly in relation to ensuring informed data protection when some activities are conducted in the wild and the researchers may not have direct contact with the users of the application. Whilst from a cultural organisation perspective it could be that the more information available from users the better insights they may have, from a university ethics perspective we should only collect information that is directly relevant to the project for which informed consent from the users should be obtained.

To this end we deliberately obtained much less personal information through the application than we did through the participatory design process and through discussion with the university ethics committee developed a set of terms and conditions that effectively provided the



#### Informed Consent

information that would normally appear on the physical form given to users. The users also have to check boxes to say they have read and accepted this information before they are able to use the application as shown in Figure 2.

Challenge 3: Overcoming preconceptions about this kind of research from potential audiences. As highlighted earlier people have very little experience of what they may encounter in the future and their answers are usually based upon what they understand today. Therefore part of the challenge for this project was how we could concretize the concepts of MAR for potential users in such a way as it allowed their views and opinions to be drawn on to consider the potentiality of these futures. Therefore, the prototyping performed in this project, particularly within the early stages, should not be considered as not simply creating an early version of the application functionality to be released but as a thing to be learned from by all of the stakeholders within the project. In this way the stakeholders evolved beyond simply experiencing a 'cool' technology to one whereby they could explore the future potential.

## **Conclusions and novel insights**

The paper will conclude by describing some novel insights, useful for designing for users with disabilities, as well as the implications for future research.

### **Novel Insight 1: Open Source**

During the course of this project, we are observed through interacting with the other Nesta R&D projects that there was often a great deal of internal politics regarding IPR in doing this kind of research, especially in instances where for example, the partner organisations weren't preformed (unlike ours) and had undergone a matchmaking process. We managed to avoid such issues – as we were a group that pitched the project together – and agreed from the outset that we wanted to make as many of the outputs open source as possible to enable as many organisations to benefit from the work. For the academics involved this required a discussion with the commercialisation manager prior to the project to agree that while the project is very innovative from a research perspective because we were deliberately using commercial devices to ensure others could re-create the work and thus were unlikely to create outputs that were patentable. Whilst we could cover the software with copyright if we wished to exploit it commercially, it was felt that most benefit to a wide range of users would come if we enabled as much of the project as possible to be used by other organisations without charge. This was a key interest for the gallery, coming from a sector that encourages support and sharing of knowledge Taking the Artwork Home provided an opportunity to give access to technology that would otherwise be out of reach for most institutions which are too small to instigate this type of innovation.

### ***-Novel Insight 2: Cross-Device Compatibility-***

Despite concerted effort over recent years to consolidate the market for creating mobile applications it still remains fragmented. When developing very technical applications, such as the one produced for this project, choices have to be made as to what devices will be supported. Whilst Apple and its IOS operating system are arguably the most well-known, according to the International Data Corporation report of smartphone sales in 2013, Apple had a worldwide market share of 13.2% while Android achieved 79.3% with the remaining share going to the likes of Windows Phone and Blackberry (Note very similar figures were also presented by Gartner for this period). Although this alone might suggest Android is obvious choice it is not that simple. All these operating systems have evolved over a number of years and many systems and features are not backwards compatible and the actual smartphones that users' possess will be spread across this evolution. All this means that choices have to be made as to which versions of the operating system will be supported and all of these

will need to be tested before release. Beyond the operating system there are also features that vary from device to device such as screen size, processor speed, memory etc. As there is no common agreed standard, the look and feel of the application may be different on every device. The overall effect is that even for a fairly modest coverage of devices the application needs to be tested across 10-15 different models to ensure correct operation.

### ***-Novel Insight 3: Publication and Copyright-***

It is evident that the creative industries built upon traditional media have struggled to adapt to the implications of the digitization of their content after becoming reliant on laws relating to publication and copyright that were established in a very different era. Whilst many in the technological world may regard these laws as archaic, they are the expectation of galleries and artists. Therefore any augmented reality application intending to use images of artwork must take these conditions into account if the application is to be used in the public domain.

The laws relating to Copyright and Publication Right obviously directly affect a gallery's ability to include artworks from their collection in an AR application. Specific permission had to be obtained for all the works featured in this application that were still subject to copyright law. In terms of publication right, the situation becomes more complex in cases where copyright expires during the time period that the artworks are being used by an application. For example, if an artwork is used for an AR application, then publication rights would reside with the gallery if they published the application. If the gallery publishes the application on an app store but uses the account of the developer who created the application, then publication rights would transfer to the developer. This latter scenario suggests that by default galleries and museums should publish applications using their own app store developer accounts to ensure they do not risk losing the publications rights of their artworks.

### ***-Novel Insight 4: Image Resolution-***

It quickly became apparent during our discussions with the gallery that whilst there were digital images for many of the artworks, the resolution was quite varied, as the primary use of these images had been for recording and cataloguing the collection. One of the clear results of the user testing was that the users particularly enjoyed the ability to explore the fine details of the images such as brush strokes within the paint. This was very evident with the students with physical and learning disabilities as one of college assistants remarked that the students on the whole, engaged more with the gallery content using the MAR, as opposed to when they physically visited galleries – because they could “get more involved” with the pieces – zooming

in and out, rotating etc. Further commenting that when moving through a gallery space, they may just acknowledge “that’s a painting” passively, whereas the college assistants felt that the students on the whole were far more engaged by using the app. As an example of this level of detail, Figure 3 shows a photograph from the Chambers Bequest at the Peter Scott Gallery which was used as in the prototype to evaluate resolution. During these evaluations a number of people mentioned that they see the fingerprint present on one of the boys’ faces, which is also highlighted in the Figure below; an aspect which is not readily apparent when viewing the image in its entirety. To accommodate the desire for high-resolution images the gallery had to arrange for artworks to be re-digitised for the application. This new way of handling images has been adopted as a standard practice within gallery’s collection management and will allow the wider collection to be used within the application.



*Advantage of High Resolution in AR*

### Beyond the project

In the short term, The Peter Scott Gallery is preparing and negotiating additional artworks to enrich the application content. They are able to add this directly themselves without the need to modify the application on the app store using the support tools developed. It is our hope that by the Peter Scott Gallery showing this technology to their peer organizations they will encourage others to do the same. We are also considering adding support for the major social media platforms within the app to help raise awareness as part of our publicity efforts.

We are pleased that the project app is already acting as a living archive for the Peter Scott Gallery, and providing them with real time information on its use among the community and overall we believe that the insights developed from this research will prove invaluable for the sector as a whole.

### Acknowledgment

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# Case Notes: Turning crowdsourced information into evidence trails for collection metadata

**Marcus Winter, Lyn Pemberton**

University of Brighton Brighton, United Kingdom

**Phil Blume**

Adaptive Technologies Ltd Brighton, United Kingdom

**Susan Lambert**

Arts University Bournemouth Bournemouth, United Kingdom

## Abstract

Crowdsourcing is becoming increasingly popular in the cultural heritage sector as a way to improve, complement and extend digital collections while at the same time engaging new audiences. A key problem, particularly in crowdsourcing efforts that ask participants to contribute complex information, is how that information can feed into the collection metadata without the risk of compromising professional standards. This paper discusses how the problem was addressed in the 10 Most Wanted project and linked to the recognition and attribution of volunteer contributions. It presents Case Notes as a mechanism for curators to credit contributors and validate contributions in an integrated process that results in a persistent evidence trail for newly discovered facts about collection items. The concept proved controversial in a small-scale formative evaluation, indicating that more research is needed on the aspect of integrating crowdsourced information with professionally curated collection metadata.

## Keywords

**Crowdsourcing; collections; metadata; verification; validation; data quality; user-generated content**

## Introduction

Crowdsourcing is commonly understood as the practice of outsourcing work to a large number of individuals (the crowd) via the Internet [10]. Used extensively in natural science research projects under the name of “citizen science”

[6], crowdsourcing is also becoming increasingly popular in the cultural heritage sector, where it usually has a strong secondary agenda in reaching new audiences and promoting public engagement with collections [7, 17].

A key advantage of crowdsourcing is that it combines audience engagement with the production of useful outcomes. In the context of cultural heritage, this can translate into sustainable models for maintaining and extending collections by delegating some aspects of curatorial research to members of the public. Oomen and Arroyo [14] identify six specific aspects where crowdsourcing can support the digital content lifecycle in museums, three of which focus on improving and complementing collection metadata.

As crowdsourcing initiatives typically involve unpaid volunteer work, they can offer an economically viable alternative for heritage organisations to improve their collections, while at the same time involving audiences in a more meaningful way and demonstrating their relevance to the community.

A potential downside of this approach is that the public usually lacks the expert knowledge and skills of professional curators. While it has been suggested that crowdsourcing can lead to solutions superior in quality and quantity to professional efforts [3], there are widespread concerns among professionals about data quality. Some of these concerns are highlighted in Alexandra Eveleigh’s [8] discussion of participatory archives:

“User participation initiatives in archives are haunted by a fear that a contributor might be wrong, or that descriptive data might be pulled

out of archival context, and that researchers using collaboratively authored resources might somehow swallow all of this without question or substantiation.” [8]

From a curator’s perspective, data quality and verification are critical to avoid compromising quality standards for the collection as a whole. Introducing invalid data would not only impact on the collection’s value as a research resource but also undermine the institution’s authority, which is a distinguishing aspect particularly for heritage organisations [14].

Data quality is also important from the perspective of volunteers, who want to be reassured that the outputs of their efforts are useful and academically valid. It is important

therefore that projects are clear about their quality requirements and transparent about their quality assurance processes [7].

Many projects combine several different approaches to quality assurance depending on their specific needs. Eveleigh [8] describes this as a “metadata-processing assembly line” involving several steps in a “hierarchical chain of command” to arrive at valid high-quality data, with professional quality control usually as the final step in this process. In this model, quality control is not a separate process but instead is part of the overall workflow of collecting user-generated content and integrating it into professionally curated collection metadata.

This paper discusses how quality control was integrated into the process of crediting, validating and archiving volunteer contributions in the 10 Most Wanted project. 10 Most Wanted explores a game-based approach to encouraging and sustaining volunteer engagement in complex crowdsourcing. Unlike many previous crowdsourcing projects, which typically involve simple tasks like tagging images [1, 4, 13, 16, 20] or transcribing pieces of text [5, 18], participants in 10 Most Wanted take on complex, open-ended and collaborative tasks involving tracking down and verifying missing information about collection items, in particular plastic artefacts held by the Museum of Design in Plastics<sup>1</sup>. As this type of task requires sustained engagement, several quantitative and qualitative reward schemes are used to keep volunteers motivated. One qualitative reward is to credit contributors by name, which has been shown to be an effective motivator in crowdsourcing [12, 19]. As recognition and attribution increase a participant’s reputation not only in the immediate context of the project but also outside via the publicly available 10 Most Wanted website, they are closely linked to diligence and data quality. Case Notes, which credit contributors and document validated findings in a persistent evidence trail for newly discovered facts about collection items, put to use this link between attribution and data

quality in a transparent manner open to public scrutiny.

The following sections discuss the different approaches to improving data quality in crowdsourcing projects described in the literature, explain how Case Notes are integrated with the information-flow and with curators’ facilitation practices in the 10 Most Wanted project, and report on a formative evaluation of the concept. The paper concludes with a brief outlook on future research directions.

## **Background**

While data quality is often mentioned as a potential hurdle for the adoption of crowdsourcing mechanisms, project reports rarely discuss the problem in great detail. Many reports do, however, describe implementation details in crowdsourcing projects that are clearly aimed at reducing error rates, encouraging quality contributions and verifying submitted information in various ways.

Measures suggested in the literature to improve data quality in crowdsourcing projects can be broadly grouped into four approaches:

### ***1. Make the task easier***

Holley [9] suggests that increasing the quality of the materials volunteers work with makes errors less likely. This is a specific form of the more general concept of making the task easier, which is a key idea at the root of crowdsourcing: breaking down complex problems into small, simple tasks that do not require any specialist knowledge.

### ***2. Train and inform volunteers***

Cohn [6] suggests training volunteers in order to give them a better understanding of professional standards and practices. A more lightweight approach might be to just inform participants of the organisation’s needs: Kidd [11] describes how citizen journalists during the Arab Spring met the requirements of broadcasters by using establishing shots to verify their positions and timings.

### ***3. Crowdsourcing quality control***

Raddick et al. [15] describe how user-generated classifications of galaxies in the GalaxyZoo project are “written into a database and compared with the findings of other volunteers”. This approach can also be made explicit: Brooklyn Museum’s Freeze Tag game [2] involves players in the clean-up of user-generated tags created in another crowdsourcing game.

### ***4. Professional quality control***

<sup>1</sup> Museum of Design in Plastics <http://modip.ac.uk>

Eveleigh [8] points out that curators play the role of gatekeepers when user-generated content is integrated into collections. While professional quality control has led in some cases to allegations of censorship, most users accept the organisation's decisions as guided by professional expertise [8].

While the first approach, making the task easier, is problematic in 10 Most Wanted, where a key research question is whether crowdsourcing is an effective mechanism to outsource complex, open-ended curatorial tasks to the public, the project combines several of the other approaches discussed above to increase the quality of contributions and ensure that evidence for findings meets professional standards. It trains volunteers by providing guidance and research tips written by curators on where to look for information, how to reference materials and how to document personal testimonies. As part of its facilitation process it encourages participants on social media channels to critically assess and verify each other's findings. The main responsibility of quality control rests, however, with professional curators, who screen contributions on social media channels and piece together key information from validated contributions into an investigative narrative (case notes) that evidences newly discovered facts about an collection items.

The next section gives an overview of the information flow in 10 Most Wanted and discusses how Case Notes, besides providing a persistent evidence trail for findings, help to address a range of other aspects in the project.

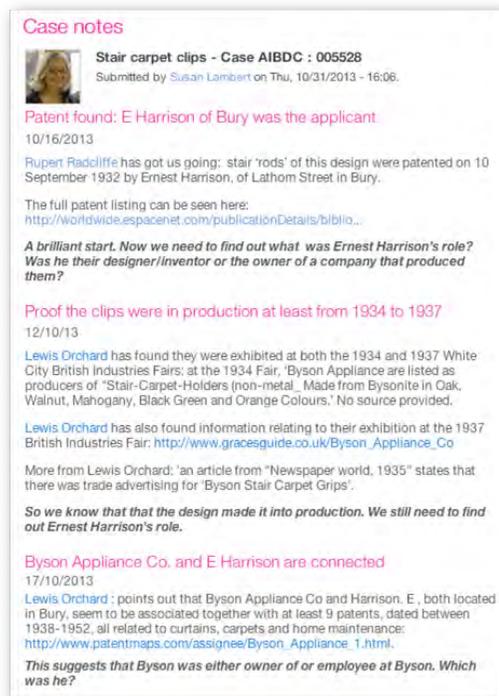


Fig. 1. Screenshot from the 10 Most Wanted website of Case Notes for an on-going investigation seeking to identify the designer and manufacturing dates for a specific kind of Art Deco stair clips. The Case Notes show the Case Officer (curator) facilitating the investigation and parts of the narrative documenting findings and crediting individual contributors

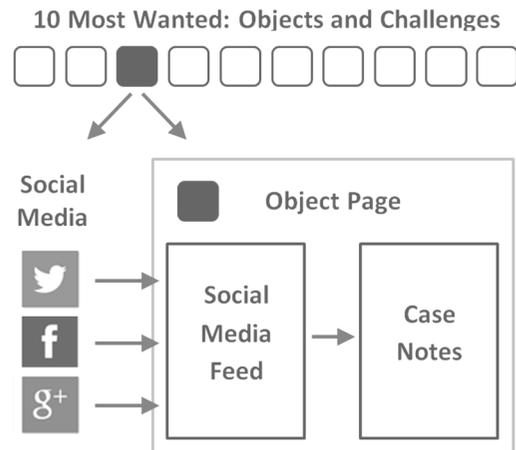


Fig. 2. Information flow from social media channels to curated case notes evidencing facts about collection items

## Case notes

Case Notes are presented on each object page on the 10 Most Wanted website (Fig. 1). Object pages explain what information is sought about an object, provide contact details for the Case Officer (curator) facilitating the search and show social media feeds covering the ongoing investigation for the object. Curators monitor these social media feeds and select key contributions for integration into the Case Notes presented next to the feeds on the same page, where they are attributed to the contributor and related to the aspect under investigation.

The information drawn together in Case Notes is the product of a complex process involving the advertisement of objects and related challenges (cases) on the 10 Most Wanted website, the promotion, investigation and eventual solution of cases taking part on the project's social network channels, and the aggregation and curation of contributions into persistent and publicly accessible evidence trails for discovered facts (Fig. 2).

Besides their overarching purpose to document and validate crowdsourced information for integration with professionally curated collection metadata, case notes address several other crowdsourcing related aspects in the project:

- They provide an up-to-date summary of the ongoing investigation enabling participants to check

for progress in specific cases without the need to search and connect individual social media posts on various channels, and they give visitors exploring the website and overview of the player activities and their results.

- They record key discoveries in the museum's own domain, reducing dependency on social networks and making the project less reliant on their data storage and access practices, which might change in the future.
- They summarise and validate evidence from volunteer contributions in a museum context by relating information to specific questions about collection items and constructing an objective narrative of findings.
- They provide a platform to publicly credit contributors for their work and thereby help to sustain motivation.

Case notes provide a well-defined check point where curators assess the quality of contributions and construct an investigative narrative to documents findings in a way that meets professional standards. They are archived in a Solved Cases section on the 10 Most Wanted website when all missing information about an object is found and can be linked to from the collection metadata in order to provide a publicly accessible evidence trail.

## Evaluation

Case notes have been used in 10 Most Wanted for over twelve months to date, evidencing a wide range of newly discovered facts about collection items in a total of 15 solved cases. The process of maintaining case notes is well integrated into the workflow of facilitating on-going investigations on social networks and meets the requirements of curators involved in the project.

The concept was formatively evaluated in a small-scale survey involving 11 cultural heritage professionals working with collections. The survey results show that while most respondents agree that 10 Most Wanted is a useful approach to engage people in new ways with collections, the developed mechanism for validating and documenting contributions in the form of Case Notes is controversial among professionals, with three out of eleven respondents being not sure about or disagreeing with the statement "I feel comfortable about the way 10 Most Wanted converts user-generated information into formal documentation". While this is in line with the survey responses to the more general statement "I feel comfortable about crowdsourcing the documentation of collection artefacts", which four out of eleven respondents were not sure about or disagreed with, it suggests that Case Notes did not sufficiently address concerns about this aspect among professionals.

While these formative evaluation results are not representative due to the small sample size and are limited by the depth of questioning, they indicate that more research is needed on the aspect of validating crowdsourced information and integrating it with professionally curated collections.

## Summary and conclusions

This paper discussed data quality as a key problem in crowdsourcing efforts where participants contribute complex information. It has presented case notes as a central mechanism in 10 Most Wanted to validate and integrate contributed information into evidence trails, while also addressing a range of other aspects relevant in a crowdsourcing context. Case notes are being used successfully in the 10 Most Wanted project, but there were some concerns about the concept in a small-scale formative evaluation. The results suggest that a more detailed evaluation is required to assess the validity of the concept and its acceptance among professionals.

## Acknowledgment

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# Engaging Museum Audiences in a Performance Way

**Licia Calvi**

Academy for Digital Entertainment  
NHTV University of Applied Sciences Breda, NL  
calvi.l@nhtv.nl

**Jocelyn Spence**

Digital World Research Centre  
School of Arts, University of Surrey Guildford, UK  
j.spence@surrey.ac.uk

## Abstract

**In this paper we examine four approaches to engaging audiences in traditional museums using performance practices in combination with technology. We identify different gradients in the use of performance with technology that we relate to an existing taxonomy of performance. We apply this taxonomy to the four approaches in order to compare the potential for visitor engagement. Our examination reveals that the key to increasing audience engagement with museums using performance and technology is to transform a physical space into an experiential place imbued with meaning for each visitor.**

## Keywords

**performance; performative interactions; traditional museums; audiences**

## Introduction

Over the last several years, a lot of research has been done on the adoption of new technologies in traditional spaces like museums, to engage visitors and enhance their visits [4,5,15]. To achieve this, it is important to transform physical spaces into experiential places, that is, into places that are meaningful for visitors. This is precisely what the technology can help achieve by allowing visitors to interact with exhibit objects or to leave traces of their visits in the form of pictures or notes to be shared digitally, often via social media.

While this change in living museums seems to appeal to many visitors because it transforms their visits into playful and interactive experiences (with the added value of getting museums closer to potential new audiences like the younger public), it cannot explain how the barrier to participation can be overcome. In other words: how can audiences effectively be engaged? How can they be transformed into active audiences? Is technology enough? And which technologies are most effective?

In this paper, we investigate ways in which digital technology and/or performance practices are used to engage audiences with traditional museums. We look critically at four existing practices: the Cockroach Tour of the Science Museum of London [12], which is performance-based and uses no digital technology; the Van Go Yourself online project [14], which uses digital technology to create ‘performance documentation’ [1] without live performance; Riot 1831@ Nottingham Castle [11], which uses digital technology and performativity to extend the visitor’s experience in the museum space; and the ‘Capture The Museum’ at the National Museums Scotland [3], which is a smartphone-based team game. Using the theory of ‘heightened attention’ [8] from performance studies and a taxonomy of performance in human-computer interaction (HCI) [13], we compare the potential for visitor engagement in each approach.

Our analysis reveals the ways in which particular combinations of digital technology and performance transform a museum from a physical space to an experiential place [10] imbued with personal meaning for individual visitors. Museums might therefore use technology and performance to address the unique needs, motivations, and expectations of their many visitors, who can find at the

museum both an emotional and a cognitive experience. In our analysis, technology is ‘empowered’ by performative interactions, and digitally augmented performance can open a space for visitors to share a meaningful place.

## Background

Several studies [7,15] on access to culture indicate that there is a consistent decrease in public engagement with cultural institutions: almost 60% of the public across Europe never attend a live performance or visit cultural heritage sites, and less than 20% actively engage in artistic activities [7]. The percentage of Americans visiting art, science and history museums and galleries has also decreased, dropping by over a fifth since its peak [15]. These figures refer to all possible visitor typologies including culture vultures (those with a specific and explicit cultural interest [5]) and the wider group of cultural sightseers, (those with a general interest in ‘must- see’ locations [5]) who would “tour(ing) a park, monument, building, or neighborhood for historic or design value” [15]. Their number has decreased of more than one third since its peak [15].

What emerges from these and similar studies, however, is that these figures do not express a loss of interest in culture from audiences, but rather a disaffection with the traditional modalities of culture delivery. It is the way in which cultural artefacts are presented and shared that is no longer attractive for the audience because it is perceived as too distant, too high, too static, too cold, too impersonal. In this paper, we investigate new modalities for cultural institutions to broaden their access and to better engage audiences.

Various recent examples from several artistic disciplines (e.g. theatre, music) demonstrate the growing importance of audience participation as a means to experience and connect with artistic or cultural artefacts at an emotional level. This is possible if the artwork becomes alive first. And this takes place when a visitor sees, experiences and interacts with it. How the word “participation” is then defined varies from discipline to discipline, and within each discipline, from case to case. Canto Ostinato, for instance, is a ‘lying’ concert because the performers believe that only by lying down can audiences truly feel the music and intensify their experience. This is experience both as Erlebnis and as Erfahrung, as a physical / perceptual and as a cognitive state. But there are other examples in which the audience has a more active role. In theatre, for instance, the fact that the public was traditionally placed into dark spaces reinforced their passivity. Nowadays companies like Punchdrunk create immersive theatre such as The Drowned Man in which the audience is free to move and to choose what to see and where to go. Their notion and use of the physical space is very different from traditional theatre and is reinvented by

actors, for actors and the public.

## Perspectives

To address the question of how to engage museum audiences, we combine two approaches. One is performance, which can refer to anything from a traditional play staged in a regular theatre to performance art, participatory performance, or site-specific performance. Closely related to performance is the concept of ‘performativity’, which can refer to the ways in which people present themselves to others, often unthinkingly [9], or to the idea that identity is formed through an ongoing process of discourse outside the full, conscious control of the individual [2]. Our other perspective is human-computer interaction (HCI), which studies how people interact with digital technologies. This discipline is rooted in more of a postpositivist epistemology, though many design-oriented approaches provide common ground for working with both disciplines in tandem [13].

TABLE I. TAXONOMY OF PERFORMANCE IN HCI [13]

Category	Elements identified	Key focus
Portrayal		Communicating narrative
Enactment		Embodiment Social constructs
Staging		Collaboration, movement Public setting
Engagement		Engagement of different roles with interactive system

Table I presents a taxonomy of the ways in which performance is used in the HCI literature, a small but useful lens into the intersection of digital research and the arts. Different researchers latched onto different meanings. ‘Portrayal’ refers to instances in which HCI researchers invoke performance when communicating concepts or narratives without any digital technology. With ‘enactment’ they use performance theory to focus on the embodied and social nature of performing an interaction. ‘Staging’ is the term for looking at multiple users engaging with a system or device in a public setting. ‘Engagement’ takes ‘staging’ one step further by recognising the different roles people play: some perform, while others spectate or are bystanders.

This taxonomy is useful because performance is a useful framework for understanding audience engagement over the course of a durational event, such as a visit to a museum, and so many recent approaches involve digital technology. Therefore, even though the projects analysed in this paper do not necessarily claim to be performances,

looking at them as such reveals insights into precisely how audience engagement works in various situations and how it might be developed.

### The analysis

The four examples we analyse fit neatly into the above taxonomy. The first is not digital at all ('portrayal'). The second is primarily digital but does not engage with multiple co-located users ('enactment'). The third offers digital technology to multiple users but is fairly passive and engages more with performativity than performance ('staging'). The fourth uses multiple performers, multiple types of spectators, and a digital system ('engagement'), though it is contextualised as a game.

#### A. CockroachTouroftheScienceMuseumofLondon

In the Cockroach Tour [12], audiences wear cockroach costumes and follow around a guide, also in a cockroach costume, who addresses them as if they were cockroaches, explaining human science from a cockroach's perspective. This is 'portrayal': the tour involves audiences in narrative and context without any digital technology. The tour guide performs and invites his audience to perform as well, even if only through their costumes and their imaginations.



Figure 1. The Cockroach Tour [12].

#### B. VanGoYourself

Van Go Yourself [14] is an online project where participants re-enact famous paintings and upload photos of their re-enactments. They can do this entirely from the website's representations of paintings from around the world, and can take their photos in any location. Therefore, they need not physically attend any of the museums whose work they re-enact. This is an example of 'enactment', where digital technology is used to make audiences aware of their physical bodies and how they are represented, without concern for any specific or co-located audience. This project supports

audiences to rediscover classical paintings, engage with them through playful interactions, and connect emotionally to them.



Co Figure 2. The Milkmaid by Johannes Vermeer, 1658, Rijksmuseum, Amsterdam – and its re-enactment [14].  
ckroach Tour [12].

#### C. Riot 1831@Nottingham Castle

Riot 1831 @ Nottingham Castle [11] is described as a 'promenade performance', although we would argue it is a promenade 'staging', according to the taxonomy. Museum-goers can view augmented-reality animations based on personal histories connected to various museum objects associated with the riot. A linear narrative connects all of the objects, starting with news of the Reform Bill's rejection in Parliament and ending with the castle on fire, but visitors can access individual stories in a non-linear way and stitch the individual pieces together to make sense of the whole story. In this example, a number of users interact with digital devices to move through a public space. Although visitors can move the device around to see from different angles and move from one clip to another, each clip is primarily a cinematic experience. The technology does not focus on how museum-goers interact with each other or with the museum as a whole.

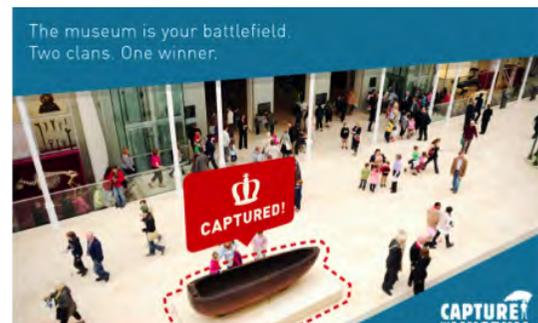


Figure 3. Museum-goers at Nottingham Castle, and a screenshot from the app [11].

### ***D. Capture the Museum***

Capture the Museum [3] is a game for visitors to National Museums Scotland to play. They form two teams who have 30 minutes to solve puzzles for points that will help their team capture different areas of the museum. This is an example of ‘engagement’, with multiple visitors using the public space in collaboration with each other – performing the role of team



Figure 4. Promotional image of Capture the Museum [3].

### **Heightened attention**

Performance theorist Erika Fischer-Lichte [8] describes ‘heightened attention’ as a way in which an audience engages with a performance event. It functions on three levels: heightened attention to objects (‘conspicuousness’), heightened attention to human actors or spectators (‘intensity of appearance’), and heightened attention to the structure of the whole event through deviations from that structure (‘deviation and surprise’). By applying the three categories of heightened attention to the four examples in the analysis, it becomes easier to see what audiences are actually engaging with.

#### ***A. Heightened attention in Cockroach Tour***

The cockroach tour creates high conspicuousness of the museum objects because it invites the audience to take a new point of view. It also makes them more intensely aware of their own appearance in their cockroach costumes. They experience a great deal of ‘deviation and surprise’ compared to the rest of their day, but in the context of the Cockroach Tour, that deviation quickly becomes normalised.

#### ***B. Heightened attention in Van Go Yourself***

Van Go Yourself makes people aware of the details of the photo of the painting they have chosen (‘conspicuousness’). While they recreate the photo, they

doubtless perceive themselves with intensity [6], as might any passers-by. What they create is not a structured event with its own rhythms and tropes but rather an action or activity, so there is no opportunity for deviation or surprise in the sense of theatrical performance. However, because a certain degree of reinterpretation of the painting is allowed in the moment that it has to be recreated, surprise or deviation from the original painting may occur.

#### ***C. Heightened attention in Riot 1831***

Riot 1831@ Nottingham Castle might make the museum objects more conspicuous, or the objects might fade into the background as triggers for the augmented reality stories. Participants perceive themselves more intensely when they use the shared technology in public, and bystanders may notice the interaction, but these perceptions are unlikely to cause an intensity of appearance comparable to dressing up as a cockroach or playing a fast-paced, collaborative game. If the historical narrative is taken as the performance structure, any non-linear experience of that structure may be considered as deviation; however, as with Van Go Yourself, the lack of a predetermined performance structure makes it difficult to create opportunities for deviation or surprise.

#### ***D. Heightened attention in Capture the Museum***

Capture the Museum is similar to Riot 1831 in the sense that it might heighten attention to museum objects, or the game might subordinate the objects to its own mechanics. It is similar to the Cockroach Tour in making audiences perceive each other more intensely, even more so because they must actively work together. Because this is a time-bound event with expected behaviours, deviation and surprise are possible in the idiosyncratic responses of different audience members.

Capture the Museum achieves significant levels of conspicuousness, intensity of appearance, and deviation and surprise through its use of the museum’s physical space. Even the Cockroach Tour does not support such an appropriation of the building, because its audiences follow a predetermined and chaperoned journey. Capture the Museum is similar to the Van Go Yourself approach in the sense that users re-appropriate elements of the museum experience – reproduced images in Van Go Yourself and the National Museums building in Capture the Museum – for their own use. By ‘celebrating the museum space’, audiences use digital technologies to engage with heightened attention to museum objects, each other, and the shared time-bound event.

### **Discussion**

If it sounds reasonable to heighten audience's attention in all these areas, what would we have? Something that heightens the conspicuousness of objects, as with the change of point of view in the Cockroach Tour. Something that intensifies the intensity of the appearance of the humans involved, possibly through creating a group identity, piquing interest, and encouraging people to take initiative. Something that gives the experience a sense of unity as an event, so that it can have something from which to deviate and create surprise.

We argue that at least in the context of cultural heritage, there should also be an explicit consideration of the concept of space / place and the social component derived from transforming space into place.

The Capture the Museum case demonstrates the potential of re-appropriating a museum space and making it personal to visitors in a new way. Then it becomes a 'place' [4,10] because it adds a personal meaning with each individual experience. Also in Van Gogh Yourself we can see a similar intent, but in this case, space is non-physical and requires the re-appropriation of an existing context (the painting) to physically produce a personal reading of it (this context, so the painting).

To different degrees, all four projects discussed allow audiences to transform physical spaces into experiential places, whether by infesting them with their cockroach-ness, or imagining their photo of Vermeer's Milkmaid hanging in the Rijksmuseum, or finding their own path through the augmented reality story of the 1831 riots, or racing through the National Museum to solve a puzzle.

In a related way, these projects also demonstrate that a performative engagement with technology can bring a work of art or cultural heritage closer to the audience by changing the audience's point of view – in other words, changing their experience of the place based on their performative engagement with that space. A cockroach sees science differently than a sixteen-year old does. Vermeer's Milkmaid is not so elevated that I cannot make my own version. The riot of 1831 is not so distant if I can participate in the story through augmented reality in the actual building that burned. The National Museum is not so lofty if I can play a game in it. These performative experiences imbue cultural heritage spaces with personal meaning, which is even more powerful when the experiences heighten the visitor's attention to objects, people, and event as well as place.

## Conclusion

In the course of doing this analysis, some questions arose. Can a digital technology create a shift in audience point of view as the Cockroach Tour guide did? How might we present the stories behind objects more interactively?

What exactly are we getting people to engage with – physical objects in a museum, or their representations online, or the interesting facts behind them? Essentially, what are museums for?

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# Use of creative tools, technologies, processes and practices in the sectors of Art, Media, and Architecture: State-of-the-Art and desired future scenarios

**Munir Abbasi**

University of Surrey, UK m.abbasi@surrey.ac.uk

**Lampros K. Stergioulas**

University of Surrey,  
UK l.stergioulas@surrey.ac.uk

**Annette Payne**

College of Engineering, Design and Physical Sciences  
Brunel University,  
London, UK Annette.Payne@brunel.ac.uk

**Panayiota Vassilopoulou**

University of Liverpool, Liverpool, UK yiota@liv.ac.uk

**Margaret Matich**

University of Liverpool, Liverpool, UK hsmmatic@student.  
liverpool.ac.uk

**Carl Smith**

Ravensbourne,  
London, UK c.smith@rave.ac.uk

## Abstract

The aim of the paper is to analyse and present the preliminary findings of the EU FP7 funded CRe-AM project for the Art, Media, and Architecture sectors. This project bridges communities of technology providers and innovators with the creative industries, with the aim to build sector-specific dynamic roadmaps for the future of the European creative industries by examining the current state-of-the-art tools, technologies, processes and practices supporting the creative process against the future scenarios envisioned by stakeholders in these sectors.

## Keywords

**Creative tools, technologies, visions, desired future scenarios**

## Introduction

The ICT revolution evidenced in recent years has opened up a new landscape of creative opportunities for the creative industries, driven by the emergence of tools, technologies, applications, processes, systems and interfaces with entirely new capabilities for creators and users. The emergence of powerful tools, applications and technologies (e.g., virtual 3D immersion/visualisation, 3D printing, animation, augmented reality, drones, 3D robotics, 3D projections of artworks, digital video art, virtual tours

of artists' works, new tools for sharing and creating art, e- video, visual effect, 3D or 4D architecture etc.) have given rise to new forms of socially connected, interactive and collaborative creative processes as well as new ways of experiencing their outcomes [1] [2] [3] [4] [5]. The interaction of the creative sector with such technologies has led to the gradual transformation of the production and reception of the created object, but this transformation presents considerable challenges for individual creators and for the creative industries to maintain their competitive edge.

In order to address these challenges, there is a great emphasis today on the need for new creative tools, technologies and processes to be developed, but also, and perhaps most importantly, for increased awareness of already existent technologies that might not be accessible to the creative sector communities, or for their translation into engineered artefacts that are suitable for commercial markets. However, this is not possible without engagement and face-to-face communication [6].

With the creative industries thriving and generating £57 bn per year in the UK alone, and €626 bn in Europe in 2007 [7] [8], it is of paramount importance—not only for the creative sector, but also for the economy as a whole—that the creative communities are able to influence and shape the future of technology and its applications in the creative sector according to their present needs and desired visions. Therefore, tools, technologies and best practices for forecasting and planning such future(s), most notably

future visions, scenarios and roadmaps, are essential to the enhancement of creativity through technology.

In response to this need, the EU FP7-funded project CRe- AM bridges communities of technology providers and innovators with the creative industries, with the aim to build sector-specific dynamic roadmaps for the future of the European creative industries empowering them to maintain and further develop their own roadmaps in the future.

The paper presents and analyses the preliminary results and findings of the project for the Art, Media, and Architecture sectors and the methodological and theoretical approaches employed to engage stakeholders, obtain data and thus substantiate the roadmapping effort. This is done through a brief examination of the ways in which the project has researched and illuminated the current state-of-the-art tools, technologies, processes, and practices used to support the creative process. The paper then outlines the methodological approach to stakeholder engagement and data collection, and how this directly corresponds to the aims of the CRe-AM project. Visions and desired future scenarios envisioned by stakeholders from each sector (with particular focus on individual creators, innovators and SMEs) are then outlined, from which findings are discussed, and conclusions are drawn.

### **State of the art tools and technologies**

Technologies have become commonplace and ubiquitous in the creative industries, and often contribute to the enhancement of creativity, and in so doing, contribute to the life and culture of society as a whole as well [9]. The interaction of the creative sector with technologies has led to: (a) new forms of artistic expression and entirely new genres of art (e.g. new media art, video art, internet art); (b) new understandings of creativity (e.g. in-museum and in- gallery apps); (c) new materials and tools for creative practice; (d) new business models, markets, consumer groups and distribution channels, as well as entirely new ways of selling creative products; (e) new forms of user-producer interaction; (f) new virtual communities of creators; (g) new forms of creativity itself, such as human-free and computational creativity. The profound influence that technological advancements and tools have on the creative industries is particularly pronounced in the Art, [10] [11] [12] [13] [14] [15] [16] Architecture [17] [18] [19] [20] and Media [21] [22] 23] sectors. In light of this, the CRe-AM project is targeted at investigating these sectors further, and initiating discourse between creatives and technologists working within them.

The emerging trends and the strong/weak signals scanned, detected and captured from various resources provide a valuable opportunity to go out into the respective sectors and verify and solidify this information with

professionals working in industry, and cross-analyse this with their needs, visions, dreams and desires futures with regards to the development of future technology.

### **Methodology for the compilation of visions and scenarios and stakeholder Engagement strategies**

The active involvement of stakeholders very early in the roadmap development process, that is, in scenario building can play a decisive role in the success of initiatives such as CRe-AM. Stakeholder engagement is vital to the roadmapping effort, and must be carefully considered in both the planning and adoption phases. Further, it is key that the stakeholders targeted are carefully selected to represent all the respective sectors, and also to represent the key professionals within each industry. The methodology used for the visions, scenarios and roadmapping centred on several interdisciplinary activities bringing together several experts and stakeholders. The project is therefore aimed towards the engagement of individual creators/workers and professionals, SMEs, creative groups, communities and organizations, who currently use ICT tools in their creative practice, as well as investors, venture capitalists, and policymakers in a collective dialogue with ICT researchers and developers, in a manner that provides sector-wide coverage and geographic spread.

This forms an integral part of the stakeholder engagement strategy, but is also key in data collection and the formulation of strong and weak signals. Stakeholder participation has consisted of five main approaches: (a) Future Cafés (Foresight sessions) during CRe-AM stakeholder consultation events with the participation of creators and ICT experts/technology providers, including DELPHI sessions during CRe-AM events with the participation of creative stakeholders and Creative Industry experts; (b) interviews with stakeholders; (c) Analysis of the desk literature, text mining and aforementioned technology trend reports regarding emerging trends and weak signals in new emerging technologies affecting the Creative Industries; (d) pooling of information from online resources, social media, such as Facebook and twitter; (e) CRe-AM online road mapping space and online events.

This engagement with stakeholders was then translated into the collection of data in the form of the strong and weak signals identified and outlined for each sector. To obtain valuable, informative data which enriched the findings from desk research, two methodological approaches were employed. Firstly, the future café/ foresight sessions provided information as to what technology stakeholders predicted would become available in their sectors. Secondly, the DELPHI method was used to ascertain what technologies or outcomes stakeholders hoped and wished would emerge

in their sectors. The combination of these two methods allowed for cross-analysis and gap analysis between actual predicted technological advancements (extracted from desk research and future café sessions), and what individuals within the sectors vision, want and desire, contributing rich, dynamic findings to the road mapping effort. This lies at the very core of the aim of the CRe-AM project to unite creators and technologists, such that technologists are aware of what creators want and need, and that creators are aware of what technology is available, emerging and which technological advancements are feasible. Thus, the methodology approach to stakeholder engagement was developed to provide data that directly addressed the aim of the project. It is also important, when dealing with the creative industries that the timeframe is clearly communicated, and was therefore outlined as relatively small-scale (1-2 years) and in the near distant future (3-5 years). This is particularly pertinent in the current climate, when innovation is based on using these new technologies in order to build applications fast, aiming to achieve several transient advantages (easily abandon and re-invented), rather than long-term developments of standalone products. McGrath in her article [24] argues that “In a world where a competitive advantage often evaporates in less than a year, companies can’t afford to spend months at a time crafting a single long-term strategy”. Although it is obviously difficult to precisely plan the future, it is equally obvious that the future does not simply happen: a diversity of future visions and alternative desired future scenarios on the use of technologies, tools and processes can indeed influence the way future will happen. As previously illustrated, the CRe-AM project aims at bringing the communities of creators and technology providers together. As stated, the stakeholders’ engagement strategy was developed with this objective in mind. The aim is to collect data, analyse and map desired futures and scenarios which clearly identify the technological innovations and tools that the creative industries desire and need to have available in the future [25].

This paper provides the initial visions and detailed scenarios based on the visions and desired future scenarios as they were discussed and sourced from the CRe-AM organised events, interviews and online feedback received at the portal. The CRe-AM community was consulted to provide input on visions/future dreams and scenarios in the process of the collective scenarios development for each sector Art, Architecture, Media, e-publishing, design and games. We are presenting the initial visions and scenarios for Art, Architecture and Media in this paper. The participants were asked about new technologies and tools they envisage using in their creative practices in the next 1-2 years and 3-5 years and asked to describe more technologies/tools that would fulfil their expectations for the future. To achieve this, we invited a broad range of stakeholders in the creative industries. Questions were asked regarding visions, desired

futures scenarios (picture • of the future), reflection on the scenarios, tools, technologies and trends. A further question was asked; “If these technologies/tools were available, what do you dream of creating?” Questions were also asked about the barriers to implementing new technologies/tools, to clearly identify and assess the needs of the stakeholders and what are the Strengths, Weaknesses, Opportunities and Threats (SWOT) for the proposed solutions/possible features and collaboration issues between the technologists and creative professionals. In this paper, we discuss the visions and scenarios only.

## **Art visions and desired future scenarios**

The following is the data captured for the visions and scenarios from Art Stakeholder consultation and roadmapping workshops held in London on 19th January and 23rd February 2014.

### ***A. Art Visions***

- New Digital Technology closer to the physical world
- ICT creative environments and cloud platform for artists
- More interactive virtual technology that will take full advantage of 3D environments and which the artist will use for immersive experiences for their audiences
- Broader applications of augmented reality, art that will provide the audience the ability to smell and even taste in the form of interactive environments (Multisensory Art)
- Technology/application that allows the artist to control who can print out their work, and get the income directly when the work is downloaded/printed

### ***B. Art Desired Future Scenarios***

- Technology to not dilute the experience but to intensify it including Virtual reality
- “Imagination machine”: Technology would bridge the gap, creating the art work faster and more realistic
- Creating dream-like imagery that can be projected in 3D. Interactive images that you can touch, etc.
- Permanent digital data storage for Artwork and easy exploration
- Interactive work, taking the best of old technologies mixing them with new interactive technologies

- Miniature arts pictures that replace for the first time the abstract QR code
- Augmented technology for sharing and co-creation of art
- Image and music scanning, creating a global database for authorship and IPR tagging
- Scanner for digital content that trawls the web looking for artists/creators'
- Virtual studios to allow collaborative work and Virtual Gallery made more physical, taken off the computer screen Interactive dancing (e.g. with clothes containing sensors with which artists can change colours and lights while performing)
- Interactive film – allowing direct audience participation
- More immersive audio-visual experiences
- “Gestural” computing.

### **Media visions and desired future scenarios**

The CRe-AM project has organized several workshops for the media communities in order to capture their visions and future scenarios. The following is the initial media visions and scenarios input from three Stakeholder consultation and roadmapping workshops: (a) Open Playground: The future of gaming, (Liverpool 28th March 2014); (b) Trending Stories, (Liverpool, 23rd May 2014 ; ) and (c) Media and e- publishing workshop (Media City Manchester 10th July 2014).

#### ***A. Media Visions***

- Real-time creative content production
- Live content other than text-based media
- Use media to enhance community cooperation and empathy building
- New multisensory tools that facilitate creation, development and access to media contents
- Users at the center of the editorial process
- New forms of narratives and self-presentation, tools for creating, processing, and communicating narratives and stories.

#### ***B. Media desired future scenarios***

- Development of perceptive media, especially in community contexts
- Use tech for compassion and empathy building
- Personalised keyboards, new ways to physically interact with hardware

- Interactive exhibition with virtual reality / oculus rift in order to offer users a full and real experience
- Writing & recording short stories that are location based – GPS, MP3, Mapping, physiological monitors
- Mobile projectors, hologram technology, ‘holographic projection using lasers’, i.e. projections for watching films- ‘pocket projector with sound system to take ‘cinema’ where it’s never been before’
- Single sign-on to allow media companies to give users one login and collect data for the production of users’ profiles
- New IPR management technologies
- 4K-8K broadcasting/streaming
- On-demand players that will allow freedom of choice of content and connects various media such as social, purchases, information/wikis and the like – a total interconnected service
- Open-source, searchable, traceable and rich archive
- Technologies for Preditors (consumers who also producers and editors of existing material) and technologies for user manipulation in live streaming
- Interactive web videos that will allow users to select the content continuation according to their needs
- Technologies that will enable co-writing and editing with multiple writers simultaneously without IPR issue.

### **Architecture visions and desired future scenarios**

The following is the data captured and analysed from the event “Factory Futures: Future visions, scenarios and needs & the role of ICT”, held in London on 12th September 2014.

#### ***A. Architecture Visions***

- Tools, which facilitate the generation of market research data. Projections of predictions of the availability or cost of materials
- Software tools as catalysts of social interactivity around design projects
- Integration of existing technology to develop new tools to better control the architecture workflow

- Technologies that facilitate the architect to have a more holistic view of a project. To act as a director. Perhaps the ability to control technologies remotely, or to extend the abilities of human interaction with the built environment by controlling a virtual object you control the real environment
- Technologies that will facilitate creators to know what tools are out there i.e. more transparency of the available technology
- Tracking components or elements of the build, with ID's that corresponding to a 3D space
- Technologies that democratise the information and knowledge involved in the processes of designing and building
- Technologies that facilitate dynamic modelling, so ideas can be realised before they are fully formed and the disseminated to all stakeholders involved in the process.

### ***B. Architecture Desired Future Scenarios***

- Software that can process various file formats in order to move towards universal applications and file formats (interoperability and interactivity)
- Create open software tools where each architect can insert and share their creativity: creative communities (hives)
- Need for customizable software tools that align with the vision of the architect and fit the needs of the specific project
- LASER guided construction. Greater use of LASER technology on site to guide accurate construction
- Hyper accurate GPS or equivalent to facilitate the placement of objects on site
- RFID for tracking components and elements of the build
- A Holographic projection or AR realization of a building in its design phase presented at the site.
- 3D visualisation, rendering and Site based with portable 3D printers.

## **Findings**

From the findings of the these sector events, it seems that the Art, Media and Architecture stakeholders are all interested in the visions of the creation of real-time virtual collaborative environments, extended cloud sourcing platform, more affordable and accessible technology that will merge the physical and digital worlds and provide

the artists, architects, and media creative professionals with virtual studios, as well as the use of tools to enhance community cooperation, seamless connectivity and empathy building. The cross-sectoral common visions identified include the use of 3D virtual reality, 3D scanning, 3D printing, Augmented Reality, new forms of narrative and self-presentation, new software and hardware to enhance narration in the future technology, technology for real-time creative production, motion and gesture- controlled interfaces and writing short stories that are location based through GPS applications, and technologies that will enable co-writing and editing with multiple writers.

The identification of weak and strong signals (which were used to develop the visions and scenarios) proved to be a complicated process. In order to demonstrate this complexity we will outline one example from the Architecture sector. This example attempts to justify why BIM is a key strong signal and VR and AR may actually be weak signal. According to Sean Hicks who is Project Leader and BIM Co-ordinator at Levitt Bernstein there are not going to be dramatic changes in architecture in the next 5 years. Architecture is being transformed by Building Information Modelling (BIM) and as a result VR+AR will remain a side show because immersion doesn't help the architects cause. This is because the architect wants the client to see glimpses or sketches of the architectural vision. The architect wants the client to agree to a concept. They could have used much more realistic ways of rendering ideas in the past to provide the vision but they didn't want to go down that route because the more access to info the client has, the more the client can ask to change. It is the architects that are meant to be making the building. The architects have vested interests in the client not constantly analysing the buildings before they exist.

On the other hand, BIM is a game changer as it fundamentally changes the way people work. Architects have not been truly collaborative up until now but when they work on the same model in the BIM environment they are forced to collaborate. There will no longer be this grey area of debating who's responsibility it was when things go wrong because they are going to be working side by side so it automatically becomes everyone's responsibility. Once they make BIM work properly it is going to become a standard like Computer-aided design (CAD), it is not going to be an option. When you can change any part of the model and produce the cost benefits analysis in real time there will be a lot less latency in decision making which the industry is absolutely ready for.

This technology fulfils a need that has been required for a very long time, communication between all the sectors involved in architecture. This technology has existed for 25 years already but now the societal pressures are far greater, efficiency is more important due to financial pressures. How

quickly you can do something and how accurate your plans are dictates whether you get the contract or not. VR+AR does not have this clear business benefit but BIM certainly does.

By creating these technologies, one is inevitably pushing new ideas and shunning old ones, and thereby the danger is you disenfranchise people who have good ideas (even though they are set in their ways) and you devalue them dramatically. For instance, architects may be limited when they apply for a new job because they may not have the right software skills. But ultimately should we not be looking for the best design, rather than the best technology? Therefore, it is important to create gradual adoption of these technologies with real tangible benefits for the community otherwise we will see technology coming in that risks destabilising or losing what works already.

## Conclusions

This paper presents some initial visions and scenarios produced by the CRe-AM project. After analysing the initial results, the findings of the roadmapping process will be continually revised, so as to lead to the final visions and technology recommendations for a successful implementation of the technology roadmaps for the Creative Industries of Europe. Moreover, we will address the need and importance of developing a practical framework by identifying stakeholders' requirements and by studying new emerging tools and technologies, such as: augmented reality, 3D visualisation tools, cloud sourcing platforms, technologies that can facilitate the generation of creative ideas, 3D virtual environment, 3D robotics, interactive tools, digital cameras, use of drones for reporting, wearable smart watches to present news in a quick way, digitized contact lenses, cardboard headset and phone integrated options providing virtual reality media experiences to a wider audience, apps which allow smartphone users to recreate and dub their favorite movie scenes, television dialogues or music videos with cross- platform sharing, new apps allowing users to send data and texts offline, even without a connection to the Internet, by using Bluetooth and Wi-Fi technology, virtual reality news and entertainment from a media perspective offering a 360- degree experience and innovative practices in order to make positive and significant impact on the creative output etc.

IPR, privacy, other policy and legislation issues also need to be addressed as they are still in their infancy for the creative industries.

Our future work will also include further exploration and visualization of feedback/responses from creative experts and stakeholders, and the further testing and refinement [26] of recommendations on technologies, tools and

processes that the creative community aspires to use in the future creative processes and environments.

Finally, we will develop dynamic and interactive roadmaps that will serve as "process models" based on recommendations for future creative tools, technologies, applications, processes and methods.

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# Technological cognitive embodiment and the digital ‘other’

**Dr Louise Douse**

Department of Performing Arts and English  
University of Bedfordshire  
Bedford, UK  
louise.douse@beds.ac.uk

## Abstract

**This paper extends on Don Ihde’s theories of human/technology relations in order to clarify the affective interactive experience of self with ‘other’ as mediated by technology. It offers a new conceptualization of world, technology and other within digital performance research. The paper argues that technologies such as motion capture can be utilised in the storing and representing of embodied cognitive skills as in dance improvisation, in which knowledge in the body is articulated through motor skill. This ability to store and manipulate enables interaction with the world, and thus with an ‘other’ via a digital double.**

## Keywords

**embodiment; technology; digital other; Ihde; hermeneutics; motion capture**

## Introduction

Over the past two decades, research in the area of contemporary European performance has focused on a resurgence of interest in embodied practice through technological innovation. Many practitioners and theorists explore the convergence of technology and embodied practice, investigating the effect technology has on the body. Much research documents the various practices which experiment with technology in performance, and a pervasive quest for interrogating the relationship between body and technology is central to much of this work. This

particular area of research, as a result, calls into question a set of oppositional structures including art/science, and thus necessitates a reconsideration of those structures. Such practices and theoretical investigations can be considered to depart from dualist narratives around art and science and the mind and body, with creative practices increasingly imbued with technological artefacts and methods. From this perspective, the world is viewed as being negotiated by a technologically mediated body.

However, it is argued in this paper that this particular conceptualization of world, technology and body is only one way of interrogating the art/science divide. A conceptualization which is largely missing from digital performance literature is that of the body negotiated by a technologically mediated world. This is, for example, a method prevalent in many of the sciences, including dance science, where technologies are used to translate the body for research, such as the x-ray machine or the fMRI machine which isolate measurable phenomenon of the body in order that an understanding of the body be made available. What is encapsulated in this formulation is how the objectively defined body is interrogated and interpreted through a technological medium.

The lack of articulation of this view within the creative arts is significant as it further enforces the art/science divide by privileging certain methods over others within both art and science. While the arts privilege the subjective and unknowable, the sciences typically privilege the objective and knowable. Therefore, this paper proposes a third formulation in which a subjective embodied being is interrogated and interpreted through a technological medium.

The paper draws on the authors PhD research [1] in which motion capture technologies were used to translate embodied subjective responses for the purposes of human understanding. The thesis was concerned with the exploration of the notion of 'flow' from both a psychological and dance analysis perspective in order to extend the meaning of flow and move beyond a partiality of understanding. The main aim of the thesis recognised the need to understand, identify and interpret an analysis of the moments of flow perceivable in a dancer's body during improvisatory practice, through technologically innovative means.

Two methods were constructed for the collection and interpretation of the experience of the dancer. Firstly, through reflective practice as defined by Donald Schön [2]. Secondly, and of the focus of this paper, an argument is made for the use of motion capture as an embodied tool which extends the dancers embodied cognitive capabilities in the moment of improvisation. Further the research theorizes that the embodied empathic intersubjectivity experienced in flow [3] does not require a direct identification of the other's body but can be achieved through technologically mediated objects in the world; through the motion capture visualisations.

The project consisted of two dancers who were asked to respond to a series of six image based improvisatory tasks for three minutes each. The shortness of the task allowed the dancers to be introduced to the variety of tasks without exhausting the task. The dancers were then asked to choose one of the tasks to improvise to for a longer period of time. This was in order to facilitate flow in the dancers choosing a task which they most enjoyed and providing them with an element of control over the task, a key component of the flow experience. The dancers performed these improvisations within the motion capture system so that their experience of flow could be 'captured' and digitized. The dancers were then asked to identify the moments of flow within the recordings in order that I as researcher could compare my own readings of flow within the data visualizations to the dancers own identification of flow.

## **Embodied relations**

### ***-Transparency-***

A philosophical understanding of embodied technology can be approached through Don Ihde's theory of 'embodied technics.' Ihde's theory of embodied technics is based largely on his understanding of Merleau-Ponty's phenomenology, citing many of Merleau-Ponty's examples within his own writing [4], [5], [6], [7], [8]. For Ihde, the human/ technology embodiment relation reflects the way in which an individual engages in the world by perceiving through such technologies and thus the way this perception

transforms an individual's perceptual and bodily sense. For Ihde, there are two important components to embodied technics.

The first characteristic of "the embodiment relation can be more precisely described as one in which the technology becomes maximally "transparent." It is, as it were, taken into my own perceptual-bodily self experience" [4, p. 73]. In this relation, the individual embodies the technology so that the individual experiences the world directly through the technology, as in Ihde's example of the eye glasses [4, p.73]:

(I – glasses) – world

My glasses become part of the way I ordinarily experience my surrounding, they "withdraw" and are barely noticed.

This, Ihde states, can be applied to all sense relations within the world, drawing on Merleau-Ponty's examples of the blind man's cane and the automobile. In order for the technology to 'withdraw' however, the technology needs to be 'good;' if, for example the rim of the glasses was too thick, it may impede on an individual's vision and thus their experience of the world.

The motion capture phase of the research project began by considering the motion capture suit and its impact on the dancers. Appropriate materials were found which allowed for free movement but also enabled stability for the markers. This stage was based on a trial and error process, in the first instance the dancers wore the motion capture suits provided with stick on markers and it was only through the process of doing, that the suit was acknowledged as problematic. For example, in the first session the dancers were asked to improvise to the six set tasks and, in so doing, encountered problems with markers falling off or becoming stuck to the floor. This was resolved with the use of Velcro attached to the markers using heavy duty adhesive, and, the use of a full body hosiery garment, which the Velcro attached to. This proved very successful.

Another problem which arose through the process of doing was connected with the placement of the markers. Initially, the markers were placed based on the Helen Hayes marker set placement model [9, p. 152]. The Helen Hayes model was provided in the manual for the motion capture software, a program called EVaRT produced by Motion Analysis who developed the particular motion capture system used at the University of Bedfordshire. The placement model includes markers on the lower leg shank and upper thigh, as well as numerous markers on and around the joints. However, a problem arose with regards to the placement of the markers in relation to the movements performed by the dancers. For example, if a dancer chose to roll across the floor, the markers on the shank in particular became quite

painful as they were pressed into the floor and the shin bone. The same applied with some of the other markers, such as the outer knee markers and the ankle markers.

Initially it was thought that the size and style of the marker was problematic; the marker was 12.5mm on a rubber pedestal which sat away from the skin. After ordering some 9.5mm markers on a soft leather base pad, the workshop was tried once more, however, the same issues ensued. While there are smaller markers (as small as 4mm), the already small size and closeness of the marker to the body caused further problems with regards to the capture. For example, it meant that certain markers became less visible to the six cameras and there was greater interference with the capture. The resolution came with the adjustment of the marker positions. After a period of trial and error, the number of markers were reduced and the marker positions fine-tuned which enabled the dancers to move freely on the floor without pain or fear of marker loss or damage.

### *Extension of Abilities*

According to Ihde, however, a second characteristic is present, that is the ability the technology must have in extending an individual's bodily abilities. Ihde notes a "double desire;" on the one hand "a wish for total transparency, total embodiment, for the technology to truly "become me"" [4, p. 75]. On the other hand, "the desire to have the power, the transformation that the technology makes available." [4, p. 75]. He believes this 'double desire' both acknowledges the positive role technology has in experiencing the world, yet rejects the essential nature of the technology by dismissing its presence.

Phillip Brey, a critic of Ihde's embodied technics, suggests many of his examples do not fit his definition of embodiment relations as instruments to better perceive the world. Ihde, in his example of the car does not address the issue that while the individual's bodily capabilities may be extended, their experience of the world is not tacitly embodied; "although the driver of the car may have a tacit understanding of the location of the car relative to structures in the environment, it is not normally the case that the driver can feel these structures through the fender of the car." [10, p. 48].

Brey therefore extends on Ihde's conceptualization of embodied relations to define three further types of human/technology embodiment; perceptual, motor and cognitive. For Brey, perceptual embodiment is the only type of embodiment expressed by Ihde. In these instances the experience of an individual's world is mediated through some technological artefact. Motor embodiment, on the other hand, addresses "[a]rtifacts that mediate motor skills [which] become part of the body schema by becoming a medium through which motor skills are expressed." [10,

p. 53]. These skills can be mediated in at least two ways; navigationally and interactively.

Brey described the interactive artefacts as mostly hand-held, however, within Susan Kozel's research [11], it could be argued that the motion capture system acts on the digital environment in which an individual's avatar exists. For Kozel this was a two-way interaction in which the avatar entered into an affective relationship with her [11, p. 227]:

I entered into a duet with the pile of cubes. My movement gave it life, but it was more than my movement. The pile of cubes had a spark of autonomy: it was cheeky, it experienced pain, indecision, and pathos. I found myself reacting to it as if it were a life-form.

This affective interaction, for Kozel, enabled an experience of self as 'other;' "intercorporeal exchanges across beings of differing materiality." [11, p. 230].

Returning to Brey's articulation of embodiment relations, the use of motion capture in this study, as a means of capturing embodied experience, falls into both an interactive motor embodiment, and a further category he defined as cognitive embodiment. In terms of the interactive embodiment, unlike Kozel's experience, the interaction is one way, for the dancers do not encounter their digital double, however, it is still rendered for manipulation.

### *Cognitive embodiment*

The cognitive embodiment which Brey addresses enables an extension of "cognitive abilities, such as abstract thought, memory, problem solving, and language use." [10, p. 55]. However, for Brey, these cognitive artefacts, such as the calculator, through their embodied use, transform the cognitive task "into a perceptual and motor task." [10, p. 55]. It is only through interaction with the technological artefact that cognition becomes embodied. It could be argued however, that another cognitive embodiment relation could be manifested, in which "cognitive artefacts... that are able to represent, store, retrieve, and manipulate information" [10, p. 55] mediate embodied cognitive skills, such as improvisation in dance which demonstrates knowledge in the body, articulated through motor skills.

There are many practitioners who write about dance improvisation as a way of theorising practice and in so doing consider notions of embodied knowledge [12], [13], [14], [15]. In this research, a focus is placed on understanding improvisation as a skill which relies on a practical knowledge in the body for creating new movement in the moment of performance. The argument is further elaborated in the forthcoming chapter 'Flow in the dancing body: an intersubjective experience' [3]. Drawing on the work of phenomenologists Maurice Merleau-Ponty and Martin Heidegger the chapter posits that 'flow,' an example

of such an embodied knowledge, is a intersubjective experience in which individuals can understand the embodied experience of the other through observing the body of the other. The following section therefore details a methodology for hermeneutically 'reading' flow in the motion capture data of the 'other.'

## Hermeneutic relations

In *Technology and the lifeworld*, Ihde begins discussing hermeneutics in relation to writing. He argues interpretation is always the reading of something, such as the reading of something written, and that all writing requires technologies: "[w]riting is a technologically embedded form of language." [4, p. 81]. Whether chalk and slate, pen and paper, or word processor and computer screen, writing requires technology to mediate language. However, this mediation is embodied; "[i]t implicates my body, but in certain distinctive ways." [4, p. 81].

Ihde refers to an example of a map, or 'chart,' which represents the landscape. In this instance, the map is read from a "miniaturized bird's-eye perspective" [4, p. 81] where the map refers to the landscape through isomorphic representation. However, unlike in embodied relations where the technology withdraws to become transparent, the map is the visual terminus. Ihde therefore argues for a different kind of transparency which he calls 'representational transparency' in which the map refers beyond itself to what it represents. Ihde therefore articulates a different formulation within hermeneutic relations:

### I – (Technology – World)

In this relation, the reading is dependent on the transparent connection between the instrument and the referent object.

To compound this new formulation, Ihde draws on an example of a nuclear power plant, in which no isomorphism exists between the object (the pile) and the control panel. The object referred to is also not immediately available to perception; there is "no face-to-face, independent access to the pile or to much of the machinery involved." [4, p. 85]. What is immediately perceived is the instrument panel itself, and thus "[i]t becomes the object of my micro-perception, although in the special sense of a hermeneutic transparency, I read the pile through it." [4, p. 86].

Research has been conducted regarding the observation of biological movement from point-light display animation and how this can be considered empathetic [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30]. Johansson's research within the field of visual perception of biological motion [16], utilises a technique called point-light display in which light emitting

or reflective dots are attached to the joints of the body in a darkened room so that "a very good recording of the motion tracks of the different joints [is given] without revealing any traces of the background or the body contours." [16, p. 202]. More sophisticated techniques have been developed since this research utilising motion capture data. However, the results remain the same; point-light animation "evoke a compelling impression of human walking, running, dancing, etc." [16, p. 201].

Further to the apparent action understanding of perceived 'cold actions' in biological motion, it has also been suggested that individuals "can judge the emotional implications of an action when viewing [point-light] animations of the whole body." [31, p. 51]. They suggest that this ability to understand human affective motion is, however, only possible in fluid motion [31, p. 49]:

With all of these techniques, [mocap included], static frames of the resulting animation typically appear as meaningless assemblages of dots, with little hint of an underlying configuration. But when successive [point-light] frames are shown in rapid succession, naïve observers experience compelling apparent motion depicting a human form engaged in a specific activity.

This suggests that human affective motion is motional and task oriented. Merleau-Ponty further supports this in his theory of intersubjectivity. Merleau-Ponty's conception of intersubjectivity relies on the individual's directness toward a shared world, in which an understanding of the other arises from a reflexive reversibility and a shared narrative of the world. Empathy is thus possible, not only through embodied interaction with the other, but also in the experience of the other within the embodied objects of world: [32, pp. 142-143].

What is open to us, therefore, with the reversibility of the visible and the tangible, is – if not yet the incorporeal – at least an intercorporeal being, a presumptive domain of the visible and the tangible, which extends further than the things I touch and see at present.

The paper therefore extends on Ihde's theories of human/technology relations by identifying the problem of 'other' minds in the I – Technology – World formulation. In Part Two of *Phenomenology of perception* [32], titled 'The world as perceived', Merleau-Ponty's opening chapter title explains 'The theory of the body is already a theory of perception' [32, p. 235]. Merleau-Ponty's aim is to show that consciousness and the world are mutually dependent. He writes, "[t]he world is inseparable from the subject, but from a subject which is nothing but a project of the world, and the subject is inseparable from the world, but from a world which the subject itself projects." [32, p. 499-500]. There must therefore be both a subject and world, which

interact through perception. However, there is a further dimension to an individual's existence in the world; each individual inhabits a world that is shared with other people, thus a human/human relationship must consist of the following formulation:

#### I – World – Other

This paper theorizes that human/technology/human intersubjectivity can be achieved and the following formulation could thus be articulated:

#### I – [Technology – World] – [Technology – Other]

In this formulation the subjective embodied 'other' is interrogated and interpreted through a technological medium. As researcher, 'I' was able to identify when the 'other' experienced flow by reading the motion capture data of the 'other'. The first bracket identifies a hermeneutic relation between the researcher and the data of the 'other,' however, the motion capture technologies used in this research also extend the 'others' capabilities to enable the mediation of the others embodied cognitive abilities, which, through its ability to store and manipulate the information enables interaction in the world, and in this case, with the mind of the researcher.

The use of motion capture as an embodied technology therefore not only allows for the storing and extending of embodied cognitive skills, but further allows such data to be read. This paper has proposed a new formulation of human/technology/other relations. Motion capture technologies have been used to translate embodied subjective responses for the purposes of human understanding, drawing on Ihde theories of both embodied and hermeneutic technics. It has been argued, that when viewing the digital visualizations of the captured motion, what an individual sees is the body it refers to, the limbs already suggested in the data points, and further the intersubjective experience of the 'other'. This conceptualisation of the other informs the methodology for the research in enabling an understanding of the other through the artefacts of experience [32, p. 142-143]:

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# **A Sonic Art Book**

## **Little Red Riding Hood'**

**Giorgio Klauer**

Sound and Music Processing Lab Conservatory of Music "C. Pollini" Padova, Italy [giorgio.klauer@conservatoripollini.it](mailto:giorgio.klauer@conservatoripollini.it)

**Annalisa Metus**

Artist and Paper Designer Freelance  
Trieste, Italy [annalisa.metus@gmail.com](mailto:annalisa.metus@gmail.com)

### **Abstract**

**A Sonic Art Book (Little Red Riding Hood) is the first output of a cross-sectoral research in the field of movables, artist books, sonic interaction design and electroacoustic music. Dealing with paper artifacts as narrative tools, the research aimed at developing a prototype by augmenting a pop-up book through sound and interaction, realizing a device which may easily be connected to a pc or laptop computer. The prototype has been developed from user experience design paying particular attention to visual and auditory display, basing on a specific tale with the purpose of inducing a feeling of childlike wonder. The abstraction from specific narrative content is finally assumed, envisaging sonic movables as an alternative mean for communication.**

### **Keywords**

**narration; experience design; sonic interaction design; augmented books; pop-up books; sonic movables**

### **Introduction**

The aim of the project here discussed is to explore the narrative potential of artifacts allowing to communicate through alternative means, obviating written media and avoiding a predetermined language, yet conceived coherently with the book object.

The tradition of artist books lends itself to this research, and even more movables do, being historically an unlimited testing ground for flexibility in incorporating

technological solutions and in following trends, without becoming an elitist product.

Artist books are rarely subject to market practices and they historically encourage individual experimentation; self construction is a widespread practice and mechanical reproducibility is not required. Rather than a confined category, artist books can be better described as a zone of activity where formal means are integrated with thematic or aesthetic issues [1]. The choice of approaching the tradition of artist books legitimizes poetic choices which would otherwise be inconvenient in a pure industrial design and marketing perspective.

Respecting the playful halo that surrounds them since nearly three centuries, movable books do not usually synthesize, generalize or make the experience universal. For they try to make the experience as unique as possible, they are particularly suitable for narration, even more than illustrated books. Three-dimensional objects which rise suddenly from the page when the book is opened (pop-up books) create a world apart and significantly transform the narrative object as it has been presented so far.

Narration occurs in movables through simulation, which is fulfilled through few unavoidable steps:

- distancing: the movable is accessible only opening it and getting close to it, since it is limited in space. Once opened, the movable behaves as a scenario that can be explored;
- analogy: the movable implies knowledge of the rules of behavior allowing the exploration and the comprehension of symbols created by the illustrator or the paper engineer;

- representation: the moment in which illusion is realized and reality is replaced by fiction.

The peculiar tactile sensation felt by opening a pop-up book is in most cases increased by the sound produced by the paper mechanism itself.

### ***A. Sound-Augmented Paper Artifacts***

Since the interaction is direct, physical and essentially continuous, movables have been identified as ideal applications for augmentation [2]. The main strength of adding a sonic display to a paper artifact as for instance a pop-up book is the temporal dimension that is created [3]. As usual with movables, the user can administer the time it takes to open the book, but the unfolding of different sonic elements at different times makes the experience closer to narration.

Sonic movables were manufactured already in the nineteenth century (the most outstanding example is *Le livre d'images parlantes*, 1885) and since then research has continued either in the context of artist books and publishing field [4].

The great revolution, not yet accomplished on a commercial scale, is to apply continuous sonic interaction to movables, namely to make sure that user's gestures do not only trigger the sound but control it, greatly amplifying what is already happening with the movable as a paper interface. Continuous sonic interaction, moreover, fosters a certain complexity leading the user to generate different scenarios through the sound; he may render them as imaginary variants of a tale, becoming director and spectator at the same time.

A Sonic Art Book Little Red Riding Hood

### **Prototyping a sonic art book**

The development has been characterized by precise aesthetic requirements leading to technical challenges which influenced both paper engineering and interaction: the aim of the project is to design a user experience that inspires a sense of childlike wonder, proving to be magical as may be the narration of a fairy tale for a child [5,6].

### ***A. Narrating Fairy Tales***

Classic and worldwide known fairy tales have been considered, for they are part of the social imaginary and offer an easily detectable topos (e.g. the forest in Little Red Riding Hood, the gingerbread cottage in Hansel and Gretel). The narrative leads the user in recovering consciousness of data he already knew, suggests different interpretations and introduces variants that are perceived as such precisely because of the well known structure of the original.

The choice of Little Red Riding Hood as first output of the project is based on the interesting implications, for both sound and paper design, of rendering the intrinsic richness and complexity of its locus, the forest.

### ***B. The Role of the Visual Display***

The meeting of Little Red Riding Hood with the wolf has been identified as the most significant moment of the fairy tale. Characters are positioned in the innermost of the forest in a way that one impedes a clear view of the other, suggesting the user to move around the book and leaving the narrative suspended (Will they meet? Will the wolf immediately devour Little Red Riding Hood?).

Conceived as a single static scenario, the tableau enhances the unity of place, while the forest represented in its entirety suggests the existence of an external environment, allowing the introduction of an external world, alien to the classic fairy tale.

Few solid colors contribute to the minimalist aesthetics for which elements should be evoked rather than described: characters stand out in the scene, being the only colored elements. The rigid geometry of structure has been circumvented depicting the forest with bare trees, maintaining a naturalistic representation of a tangle of trunks. The white base lends itself to suggestive shadows. The technique of orthogonal supporting planes allows the paper forest to open up and fall on the page compactly [7].

### ***C. Experience Design***

The main instance of the project is to preserve the fact of having to deal with books, not to be confused with generic performative objects or installations. Also referring to Jakob Nielsen's concept of usability heuristics [8], staying focused on the book makes the affordance very intuitive and instructions (potentially) dispensable: for the interaction to begin, the user has to open the book; to stop, just close it.

Since what one is aware of and his own knowledge (phenomenal field) varies from user to user, the choice of renowned fairy tales allows a wide audience to identify and comprehend the scenarios, making the project A Sonic Art Book addressable both to adults and children.

***A typical usage scenario has been imagined:***

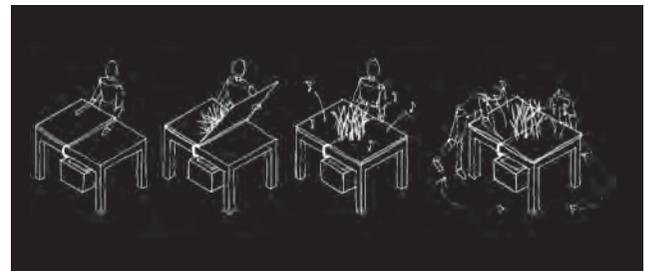


Fig 1. Usage senario.

- users find the movable closed on a table;
- opening the book users start the interaction: a large pop-up emerges from the page while the sonic display changes with movements and gestures providing a sonic characterization of the scene;
- the closing and the opening of the book switch from one sonic scenario to another;
- while users move all around the table where the book lays upon and bend over it to better listen and observe, sonic interaction discloses all its narrative potential.

It is fundamental that the interaction occurs in a silent environment (e.g. at home or in a library) and in adequately wide space to allow the user to move comfortably around.

Having regard to the exceptional size of Little Red Riding Hood book, in addition to the noise of the paperboard slipping into the correct position, the tactile sensation is increased by the considerable weight of materials, unexpected as the three dimensional volume that is going to be created.

#### ***D. Sonic Interaction Design***

Sounds are related to movements and gestures in a not obvious way, inviting to a fruition which lasts reasonably in time, in contrast with the immediate recognition of the visual display [3]. A demonstration can be viewed on the website <https://vimeo.com/92193054>.

Realistic sounds make the communication accessible to everyone, changing from being iconic (easily recognizable) to indexical (encouraging mental associations once placed in relation with one another, facilitating the user's imagination).

Sounds are related to eight categories:

- Little Red Riding Hood's actions;
- Little Red Riding Hood's state of mind; □ wolf's actions;
- wolf's intentions;
- animals or people in the forest;
- landscape;
- weather;
- external elements.

Several scenarios are implemented on the basis of simple directions (e.g. a childish or a teenager Little Red Riding Hood's point of view; a public park; a winter forest; the wolf's point of view): in each of them a different matrix of transition probabilities helps composing the sonic display,

interleaving with varying degrees of unpredictability the samples belonging to the eight sound categories.

A detailed sound field is realized embedding several miniature speakers in the book, greatly increasing the unity and coherence of experience. The very low amplitude of sounds contribute to the sense of privateness, so as to an ecology-aware listening.

### **Implementation**

The implementation was approached maintaining the conceptual framework of the whole project, trying to manufacture an object that inspires a sense of childlike wonder.

#### ***A. Structure***

The book consists of 14 disassemblable foamboard panels. The pop-up and the paperboard surfaces are disassemblable as well. This design, which is due to the generic purposes of maintenance and transport, may become specific.

One analog electrical circuit is embedded in the foamboard as well as eight high-sensitivity miniature loudspeakers and eight light dependent resistors. Cables run in grooves digged into the foamboard.

The size of the open book is 140x100x50 centimeters. Materials used are black/white/red/grey cellulose paperboard, foamboard, black fabric, straps, and tape.

#### ***B. The movable as an interface***

Embedding and technology were the main concerns in prototyping the artifact.

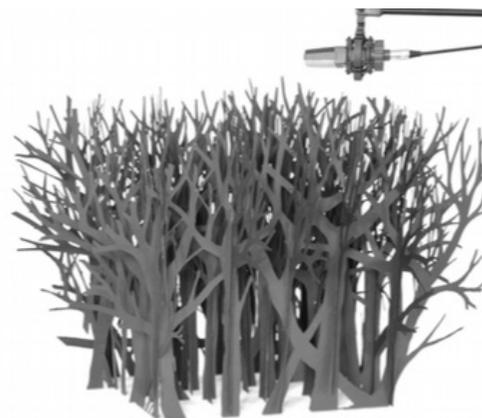


Fig. 2. A Sonic Art Book (Little Red Riding Hood).

Moving the sound around the surface would imply an embedded multichannel audio interface, and retrieving data from sensors, an additional interface or microcontroller. The use of an embedded single board computer could make the movable a complete stand-alone system.

However, considering the openness of the narrative and the potential complexity of the interaction taking place, the prototype was envisaged as an extremely simple plug-and-play device containing merely the circuitry for sensing and projecting the sound.

Moreover, the view of a passive analog device connectable to almost any computer seemed far more attractive for conceiving the augmented movable as a book.

As an external object the computer remains an easily accessible narrative storage, providing all the needed computational power for narrative modelling.

### ***C. Electronics***

Since most of built-in sound cards are based on chips supporting full duplex stereo, eight audio channels are interleaved in the software and then streamed as one amplified audio channel. The signal is boosted and demultiplexed in the movable. Using a 96 kHz audio sampling rate, each channel has sufficient bandwidth for the specific project purposes. A second audio stream from the computer provides the synchronizing signal.

The signals of the sensors are multiplexed accordingly and fed to the computer as an audio source. The sensed signal has in this way much more bit depth than most widespread microcontrollers.

A passive LDR net provides high accuracy in retrieving the shadows projected by users moving around and interacting. LDRs also have the advantage of being completely invisible under the white paperboard surface of the book.

The circuit embedded in the movable is powered by a battery or through the computer USB port.

### ***D. Interaction***

In the implementation here described samples are triggered by sudden light fluctuations, typically generated by the user's light or dark clothes, and shadows.

When the interacting user remains still, samples succeed one another overlapping more or less irregularly, as if a quite linear story was told. Body movements are detected and the sound is spatialized accordingly (the sound "follows" the user).

Sounds are activated also when a user is continuously bending or moving. These sounds are spatialized independently from user's displacements for

thickening and complexifying the sonic texture.

An advanced peak-picking applied to the sensed signal permits to correctly estimate the position of up to three people moving around the book, if the users are interacting quite distant from each other. The thresholds implied by the algorithms managing the interaction are updated continuously.

## **Evaluation**

The prototype has been exhibited as an interactive installation in international conferences to test both the implementation and user's qualitative response.

The changing of the lighting due to weather and other factors had no impact on the operation, showing that the simplest technology such as, for instance, LDRs may be actually used for the purposes described. In darker environments the system is slightly more responsive, furthering visitor's involvement and making him return to the artifact after a while.

Sound level measures resulted slightly above the background noise of a typical domestic or equally silent environment. All the visitors bent and got closer with the ear to better distinguish the sonic texture: the interactive system then complexified the texture and increased the sound; both artifact and users became a scene for people waiting to interact at their turn.

First evaluations show that user experience is more context- dependent than expected. Some users approached the book with deictic gestures towards the wood and the two characters, suggesting the knowledge of specific sensing techniques. In this case, the low amplitude of sounds encouraged to bend closer to the surface of the page for their better perception and localization, consequently putting the user in the condition of discover the most fruitful behavior.

## **Perspectives**

The perspective in creating sound-augmented paper artifacts - namely sonic movables - with relevant narrative potential conceives the artifact as a neutral tool in respect to the content but flexible in relation to narrative structures.

At the time of writing the prototype has been presented within exhibitions of movables and artist books in the frame of a historical retrospective on World War I. On these occasions the visual display was essentially the same (just characters have been removed); transition probability matrices were adjusted to a radically different auditory display using shots, breaks, human, industrial and natural soundscape excerpts. The behavior of the users and their positive feedback seemed to confirm the solidity of the

design.

The Sonic Art Book project foresees a series of fairy tales to be illustrated and provided with original sounds. Within the project progress, an experimental approach to the qualitative evaluation of the artifact's experience will foster the research on the narrative potential. Free and constrained verbalizations will be collected firstly, to select the descriptors to be used for subsequent insights on semantic differential [9].

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# Subjective Epistemologies: Inconsistent Artefacts in the Redesign of Medical Devices

**Teresa Almeida**

Culture Lab  
Newcastle University  
Newcastle upon Tyne, UK  
t.a.almeida@newcastle.ac.uk

**Gabriella Arrigoni**

Culture Lab  
Newcastle University  
Newcastle upon Tyne, UK  
gabriella.arrigoni@newcastle.ac.uk

## Abstract

**In this paper we explore the potential of post- disciplinary practices to contribute to designing technologies that are in alignment with the fluidity of the female body and the non-fixity of objects. We describe a combination of methods for a deeper understanding of medical devices, and the challenges of prototyping bodily-centred technologies.**

## Keywords

**Technology; body; design; health; care; women**

## Introduction

The nexus of technology and the body has long been at the interdisciplinary crossing between the humanities and science. In this context, design offers an increasingly effective knowledge of the body that contributes to its integration with technological apparatuses. This paper focuses on the notion of interdisciplinarity to conceptualise an ongoing project (Pelvics) that revisits medical devices designed to help care for the female pelvic floor. The example of a device that, to be functioning, needs to be mapped onto the body is the opportunity for re-framing discourses of body and technology in their proneness to change. On this ground, we draw on Knorr-Cetina's concept of epistemic object to explore the permanently incomplete nature of designed artefacts [1], and Akrich's notion of script [2] to stress how culture and subjectivity are embedded in technology, and how this is making scientific devices more

similar to artistic artefacts.

A call towards interdisciplinarity has recently been reinvigorated by the experiential and user-centred turn in human-computer interaction. Research such as [3] places an emphasis on methods that contemplate empathy, and [4] on health and technology. While there is a growing body of work that suggests good practices in terms of how to work across disciplinary fields [5][6], the research we describe in this paper provides an instance of how working in a post- disciplinary environment might be [7]. A number of artistic projects, often adopting the approaches of speculative design, already address different issues related to health, illness and medical practice [8][9][10][11]. In this paper, we introduce Pelvics and explore a combination of different methods (participatory design, critical theory, ethnography, speculation) to achieve a set of artefacts that might simultaneously behave as objects for reflection, influence existing practices, prelude to a new prototype, raise awareness and motivate new practices of care; to critique traditional quantitative approaches to medical practice and to articulate a specific approach to empiricism and the adoption of scientific methodologies in the arts and humanities. We contribute to the discourses on digital art and health technologies and highlight the subjectivity of experience as pertinent to make 'empirical beliefs'.

## Pelvics

Pelvics is part of an ongoing research that looks at practices of care in the body and the future of medical devices. It advances [12], an embodied exploration for self-awareness that looks at technology and body literacy as a

means to promote a preventative health practice: female pelvic fitness. *Pelvics* is an inquiry into the construct of esteem, touch, and diagnosis. It looks at medical devices as epistemic objects, and draws on speculative design as a method to further explore current care practices. Finally, we identify opportunities for design that can affect positive change in female intimate care and advocate the re-scripting of existing medical devices.

### ***A. Body Knowledge, Technology, and Contemporary Health Care***

Historically the human body has been perceived and represented in many different ways. A significant transformation took place in the late eighteenth and early nineteenth centuries following the emergence of modern science [13]. Medical models appeared showing evidence that made sense of sexual differences between the female and male anatomy and physiology. Further on, as cultural values and constructions of the body evolve, the body becomes the ally of sexual difference [14] and plays a role in social, cultural, and psychical life. The body is our primary interface to the world. “The body - what we eat, how we dress, the daily rituals through which we attend to the body - is a medium of culture [15]”. Conceptualizations of the body as “a physical body acting and experiencing in a specific sociocultural context; it is body-in-situation [16]” are advanced by feminist theory and this ‘lived body’ encompasses concepts of embodiment, which promotes “an understanding of the ways in which particular kinds of bodies are produced through experience [15]”.

Embodiment, therefore, positions the body as a site of production of both the social and the self. In addition, and for much of the history of western philosophy, the body has been conceptualized as a possible source of disruption to be controlled [17]. The loss of a limb or a breast, for example, can affect “not simply corporeal integrity, but also the sense of who we are [18]”. Technology developments applied to care of the body have certainly provided for prevention of illness and surveillance to manipulate self-identity [19]. However, we look at the design of medical devices currently in use for caring of women’s bodies, which tend to neglect or attend to the fluidity of the body. We give the example of the speculum, and how its design is “lacking in innovation and concern for the patient [20]”. The speculum is a medical device used to perform the pelvic exam: its “purpose is to retract the vaginal walls to allow a clinician to visually examine the cervix and obtain culture specimens for tests, such as the Pap smear [20]”. It is the controversial invention of a male doctor [20] and dates back to the nineteenth Century. Since then, it has seen little design improvements. It simply gets the “job done” and has not been affected, so far, by contemporary reflection on gender, subjectivity, wellbeing. As noted in [22], there is “a blind spot as to how

gender differences affect what people care about, what motivates them in everyday lives and the way they desire to live with technology.”

### ***B. Objects of Ethnography and Speculative Design***

To explore the inadequacies of existing medical devices for pelvic care, we delivered a design workshop in which we wanted to “hack” common biomedical technologies and explore the materiality of technology in use. This was intended as a collaborative speculation and the aim was to explore possible, fictional objects as alternative to the present ones. It was an exploratory study to help us identify requirements and preferences in order to redesign and re-script those existing medical devices.

The workshop took place in an artist’s studio and there were four female participants aged 29-38 years old. The artefacts available for observation were varied: different specula (vaginal, Sims) and pelvic floor exercisers (intra-vaginal probes), a reusable sanitary pad (figure 1). The presence of these artefacts stimulated a discussion around a variety of issues, such as:

#### **ergonomics and materials:**

“... useful to better understand how it’s used, what is that design doing? Can’t imagine, understand what it’s really doing.”

“designed to be ergonomic for the people using it rather than the people receiving it”

#### **the sensitivity of the topic and sense of normalcy:**

“get ourselves to feel comfortable with even talking about our private parts and looking at them so we could know if something is not normal for us, to then talk to a doctor or...”

#### **the origin of the devices:**

“word play speculum and speculative”

#### **the use of the devices:**

“adds level of embarrassment”

“dirty as woman”



*Fig.1. Medical devices for pelvic health care. Betagrams: Exhibition, Newcastle, UK, 2014*

The participants were invited to re-think these contemporary technologies in ways that would improve the woman's experience of both receiving or giving care to this intimate part of the body. As noted in [23], speculative design is not only aimed at innovating and suggesting directions towards technological futures but can also provide a system for analysing, critiquing and re-thinking contemporary technology. We apply this design method to instigate debate rather than to create a final product to bring to the market. The design solutions for proposals dealing with sensitive subjects are complex and contradictory [23], and all the same, Pelvics is situated within the area of research and design of such troublesome topics. Some proposals coming out of this workshop were: a gene-based diagnosis to detect levels of collagen and health of connective tissue; a gym for women in which there is a specific space and 'equipment' available for pelvic fitness; a parallel between the use of the speculum to that of a fairy tale (figure 2); to market medicalised devices and products as a lifestyle rather than a remedy. Based on the resulting proposals and oral testimonies throughout the workshop, we created a series of narrative embroideries. This hand needlework is a form of visual storytelling and narration (figure 2). It is also an accessible, tangible medium that we used to preserve and communicate sketches, thoughts, and written notes, and we envision to be using them as prompts for interviews at a later stage.



*Fig. 2. Narrative embroidery. 2014*

### ***C. Epistemic Object and the Medical Artefact***

Recent debates in the fields of Research Through Design, practice-based research and the Digital Humanities [24][25] [26], have pointed at the co-existence of different kinds of knowledge, challenging the traditional scientific approach to research and introducing alternative logics of dissemination and validation. Variably defined as tacit, experiential, non-conceptual, non-propositional, in action, situated, and even ineffable, these new notions of knowledge are contributing to the introduction of not only new research methodologies but also alternative epistemological conditions. Pelvics can be understood precisely within this context and signals how the hierarchies between different definitions of knowledge, rigor, validity and truth are becoming dubious. Its methodology places an emphasis on experience, subjectivity, aesthetics and empathy and brings the creative languages of artistic and design practice within the field of medical science. As noted by Young in [16], "The lived body is particular in its morphology, material similarities, and differences from other bodies". Similarly, Shildrick's notion of the body as fabrication and inconsistent artefact is suggestive of a productive parallelism between the fluidity of the body and the non-fixity of designed objects [18]. The process of redesign implies that artefacts, even when established in practices of use and after a long-lasting presence in the marketplace, cannot achieve a stable condition. In a way all designed artefacts can be as potential prototypes for redefined versions of themselves. The case of medical devices however is made complex by their embeddedness within determined scientific system, guidelines and rules. These devices relate to the body as much as they relate to fixed parameters and measurements. In this context it is instructive to explore Karin Knorr-Cetina approach to the objects of scientific research (epistemic objects), that contribute to a broader strand of literature questioning the absolute and objective nature of scientific knowledge [27] [28][29]. Epistemic objects are intended as inherently incomplete and constantly unfolding because of their relationship with the evolving nature of research, and their capacity to generate questions and develop new problems and responses. Similarly, tools for the care of the pelvic floor muscle are objects in flux, whose evolution depends not only on their mapping onto the body, but on developing paradigms and values that links definitions of disease to a set of conditions. Whereas traditional approaches rest on a quantified and measurable correspondence between disease and body performance, Pelvics suggests more subjective and variable attitudes to assessment and care. These devices are therefore part of a trajectory of becoming that responds to a shift in the notion itself of knowledge and its processes of production.

In parallel to a redefinition of knowledge, the design process of any technological device is also subject to changing value and cultural systems. Literature on STS has thoroughly addressed the reciprocity between the technical

and the social [30][31], but Akrich notions of script and re-inscription are particularly relevant to describe the process in which both designers and users attribute values to the device, shaping the device itself. While script is intended to what users are asked (from the designer) to imagine about a specific device, re-inscription consists in a feedback movement that introduces conflicting visions on the object, not initially foreseen by the designer. The dynamic between inscription and re-inscription can be adopted as a framework to understand how participants and designer, in Pelvics, cooperate on a modification of devices and values.

### **“Buying into a lifestyle”: re-scripting technologies**

Technology has a profound mediating effect on the way we relate, obtain knowledge, and contribute to society [32]. The design knowledge of the body turn to self-awareness and self-care consequentially creates opportunity for change in approaches that were once inaccessible or institutionally bound technologies. As we incorporate self-diagnostic devices and medicating technologies, new frontiers need to be re-scripted. With the dissolution of boundaries between the body and technology - implantable, genetic, biologically enhanced, or contraceptive – the intersection of materiality and care become apparent. The space created by a possible medical condition, body knowledge, and the design of a technological artifact becomes personal and marks a shift in understandings across digital and physical health, material science, and design.

There is a richness of terminology to address ways of working across disciplines. Beyond multi-, inter-, trans-, and cross- disciplinarity, we found the notion of post-disciplinarity more attractive because it considers the division in disciplines as a contingent, historical phenomenon. While interpreted by some as a complete rejection of disciplinary separation [6], we prefer to embrace [7] approach based on a constant renegotiation of disciplinary boundaries. The post-disciplinary dimension of Pelvics relates both to the problem addressed (situated across design, health, culture and identity issues) and to the hybrid methodology adopted, drawing on design, STS, sociology, medicine, education. In this perspective, art practice can be seen as a territory of convergence, rather than a disciplinary area in itself or a component of the project.

### **Conclusion and future work**

Pelvics epitomizes the responsive relationship between objects and knowledge and, on the basis of their reciprocity, advocates the notions of unsettledness and inconsistency to approach even the most accustomed practices of use. Artefacts are shaped by culture and have

an impact on life in its social, cultural, economical, and political contexts. This research considers the future of medical devices and offers new possibilities to redesign and re-script them at the intersection of technology and the body. We applied varied methods to explore self-awareness and to craft self-understandings of such intimate care practices and products. Through this, we inquired how bodily technologies could benefit from research and development that is in accordance with both users and designers; evaluated how current designs and design speculations are or could be in tandem with the fluidity of the body and the non-fixity of objects. Avenues for future research could explore ways for technological artefacts to contend for post-disciplinarity approaches to design. Nonetheless, combining a multitude of practices – artistic, scientific, technological – allows for the exploration of adequacies of bodily materials in anticipation of alternative futures. However, the challenge of post-disciplinary work remains on assessing the quality of the artefact, as methods of evaluation resist to traverse disciplines.

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# Body-movement-interaction: perception in interactive audio-visual installations

**Ken Byers**

PhD Practice led research  
University of West Scotland.UK  
ken@interactionalmedia.com

## Abstract

This paper summarizes my own arts-practice as research on body-movement-interaction in interactive digital 3D audio-visual installations. In this research I developed a series of interactive 3D audio-visual installations that were informed by body-perception theories, embodiment theory, new media philosophy, cultural theory and virtual reality. The interactive designs for these installations explored body-movement perception, which is a form of embodied movement awareness. The interactive designs were created to alter an experiencers' body-movement sense perception to focus upon how body-movement perception affects creative imagination. I explored this to see what affects the changes and adjustments made by the body caused by the interactive environment might instigate in terms of a heightened awareness and perception towards a more creative imagination from the experiencer. These interactive installations also explore human computer interaction (HCI) from an embodied psychological perspective.

## Keywords

**interactive, audio-visual, Human Computer Interaction (HCI), body – perception, perception and consciousness**

## Introduction

This project focuses upon body-movement perception and body sense perception within body-movement interaction installations exploring new media

aesthetics and technologies. Within this arts-practice as research, I created a series of interactive installations that explore different methods of stimulating a more creative experience in the engagement within the interactive 3D audio-visual environment. This active realization of body-movement perception is an alternating or parallel manifestation of reflective and immersive moments, which I have shown in the non-Cartesian Interactive installations.

I position my critical and artistic practice within the field of contemporary new media practice and explore Bergson's theory in my own practice; that the body is the 'Centre of in-determination' that 'enframes' the image. This 'Centre of in-determination' is a framing function of the body in cognitive perception that perceives what itself needs, out of the universe of images surrounding it. By altering body-movement in the digital audio-visual interactive environment, would a more creative cognitive experience be achieved in the creative imagination? Body-movement perception in the digital interactive environment is not thought here to aid creative professional performance or dance. It is the subtle changes in body-movement that affect perception and consciousness in the creative imagination in interaction with the audio-visually, that is central to this research.

The dialogue between my experimental practice and the theoretical concerns in the interactive designs focus on how new technologies can have an impact on the body's consciousness and perception. The affect of digital media and virtual reality on the body raises issues on embodiment, presence, perception and consciousness. The first section of this paper discusses my quasi 'Non-Cartesian' interactive installation in the 'Emerging technology Exhibition' at Asia

Siggraph 2012. This was an art installation for the purpose of exploring how interactive design digital media can enhance imagination by effecting consciousness of body movement, that are embodied in audio-visual media.

I explored interrupting body-movement perception as the 'Centre of in-determination', in the interactive digital environment. The starting point for these interactive designs were experiencers' accounts of their own experience of the non-Cartesian interactive installations. These are accessed and recorded, by video documentation and video-cued interviews. Later I found my own subjective experience more valuable, and the later section of this paper discusses my findings in relation to body-perception and embodiment theory drawing upon phenomenology and cognitive science with the aim to discover if a new aesthetic or language to experience an interactive digital artwork, via body-movement, can be achieved to enhance creative imagination. This practice-as-research developed its inquiry through parallel conceptual and experimental frameworks. The conceptual frameworks of body perception theories informed the interactive designs. The experimental frameworks were the series of experimental interactive designs for the body-movement interactive audio-visual installations.

### **Non-Cartesian interactive installation**

In the Asia Siggraph 2012, 'Emerging Technologies Exhibition' I created an interactive installation focussing upon interactive audio-visual perception and its affect on the experiencers' creative engagement with the audio-visual environment. This was one of a series of investigations in interactive design exploring perception, consciousness and embodiment in audio-visual digital environments. This particular installation focussed more on interactive sound, in combination with interactive 3D visuals.

The visuals in this interactive installation were projected as a virtual non-Cartesian digital environment within the physical, spatial environment of the 'exhibition'. It formed a dialogue between the experiencers' known stasis of the body and the non-Cartesian virtual environment. The non-Cartesian environment was chosen and designed to transform known feelings and experiences of Cartesian dualism space within the digital interactive virtual space. One of the reasons for this is that we are embodied into an architectural world of verticals and horizontals and its relation to our anthropological state of being. The interactive 3D audio surround adopted a dissociative meta-language of sound for interaction in combination with the 3D visuals, forming a quasi-non-Cartesian sound environment.

The single channel projection with surround sound had three adjacent walls surrounding a dark open space, large enough for body-movement-interaction. In the virtual

simulated non-Cartesian projection were quasi-tectonic 3D forms that had transparent, laser-ray like structures that formed a non-Cartesian aesthetic. The body-movement xyz Cartesian 'live-data' of body motion and gestures of 14 body-limb nodes' could manipulate the 3D virtual non-Cartesian structures, as well as the surround sound.

Within the large space I used 'Kinect' sensor technology with a Max MSP programming environment to track position, velocity and gestures of body joints. Max MSP translated live xyz spatial and orientation data from body-joints, so that experiencers could engage, by body-movement interaction, including head and limb-mobilisation with the virtual and quasi-tectonic forms within the quasi-non-Cartesian space.



*Figure 1: Non-Cartesian (2012) © Ken Byers*

Experiencers' walked into a darkly lit space (Figure 1) within the 'Immerging Technologies Exhibition'. They began to interact by body-movement with displaced images and surround sound within the embodied environment, which affected a parallel or divided attention, of consciousness in the experienter. These non-Cartesian spatial images seemed incongruent with their own embodied movement and the organic and analogue synth sounds (Figure 2). This formed a new environment for the experiencers' to relearn body movement, breaking from their past-embodied experiences of the world.

The experiencers' body-movement interaction of 3D visuals could zoom in and out, rotate, change velocity, change direction and distort. The experiencers realized that their embodied movements did not correspond fully with what they had expected from the visual and surround sound (Figure 3), yet they still felt a sense of presence and meaning. The reason for this is that unconscious processors are convinced of this quasi-non-Cartesian reality, a virtual reality, whilst being embodied within the physical space.

The dynamics of the interactive design algorithms cause interruptions of body behavior and gestures for the

experiencer, randomly changing every three minutes. This caused the experiencer to re-engage their proprioceptive habitual movement within the construction of the audio-visual, forming a new kind creative engagement. Creative transformation of the audio-visuals and aesthetic engagement are made possible by the alternating or a parallel manifestation of reflective and immersive moments. This draws the attention of the experiencer to the temporal continuity of their embodiment, whilst in parallel the newly obtained 'virtualized subjectivity' is projected. By 'virtualized subjectivity' I mean the subjective state of the experiencer is mirrored onto the screen.

The 'live body data' of body limb gestures were translated to control parameters of a 'Max MSP' poly-synth. Gestures control the synths filters, reverb, velocity, frequency, and pitch. The interactive body-gestures of the experiencers' cause the sound to have a displacing affect on the body, which in turn affects body-movement perception. It's here that striking disparities of the sound cause an effect of movement and posture, as well as change in visual perception. Body movements could consist of full body motion, and movements from all body limbs. The live-data body-movements from all body limbs engage with the non-Cartesian.



Figure 2: Non-Cartesian 'Warped Space' Topographical (2012) © Ken Byers

The installation was sufficient to cause body-movement awareness and aesthetic distance during the interactive experience. The experiencers naturally relearned or preformed interactive movements in relation to the movement of the 3D structures and sound. The embodied affect of the combination of both 3D interactive manipulation and sound in the 'disruptive' non-Cartesian forms a new aesthetic, a dialogue between the body's movement and the cognitive perception of the experiencer's imagination.

### **Interactive body: 3D audio surround**

In the body-interaction, non-Cartesian installation experiencers' could interact with the predominance of sound or visual fluctuations, to develop a more integrated meaningful aesthetic in the interactive environment. This particular installation was predominantly set up and designed for audio interaction. However the complexity of audio-visual perception in these digital environments caused a more meaningful result for the experiencers.

Experiencers interacted and perceived the digital surround sound from where the speakers were positioned, the digital relocation of the meta-language sound and the form of their own body movements. Six speakers were positioned around the space at different heights. In the non-Cartesian installation, spatial information, and spatial content, in combination with the 3D non-Cartesian caused dissociated feelings, within the experiencers. The dissociated feelings described by the experiencers caused a more active engagement with the interactive art installation. Although in visual perception we are aware of space, with audio perception we are aware of things in space. For example, if a high note is generally associated with verticality but is heard lower down, it causes dissociation in the body. Temporal aspects of sound, such as time being suspended or moving forward, slow or fast, at a distance or in close proximity or with upbeats and downbeats, feedback to the interactive body in motion. In this way the dissociated interactive visuals were explored in conjunction with the interactive meta-language of surround sound.

I have experimented with the dissociation of embodied meta-languages within the interactive design as a method for challenging the experiencers' hearing and visual perception. Verticality for example is commonly understood in the realms of pitch and harmony i.e. the perception of high notes and low notes. Within these parameters there are rhythms, upbeats and downbeats, rhythms that can be grounded or floating, as well as the sense that time can be suspended or moving forward. Embodied meta-language was included in the interactive design to enhance the virtual non-Cartesian environment. As sound affects the sensation of bodily position, presence, and reciprocity, interactive body limb movement may also affect synthesized sound. The bridge between the body's re-embodiment and the fraction of time it takes to preform a movement in relation in the audio-visual-visual non-Cartesian triggers the creative imagination of the experiencer.

To make clearer what I mean by this, in Dancing with a Virtual Dervish Diane Gromala and Yacov Sharir demonstrate a method of incorporating body perception theory into contemporary artists' work. Gromalas' Virtual Reality HMD project incorporates an enormous simulation of inside the human body, including rib cage, kidneys, heart and so on 'that allows the participant to dance through the inner spaces of the 3D body parts, via a non-Cartesian

interface that transforms the body as a geometric volume into a dimensionless topological intuition' (Hansen, M. 2004: 180). 'Gromala goes on to explain, that her project aims to exploit proprioception, (the inner sense of what we are in our bodies) as the basis for "re-embodiment", a 'reconfigured and enhanced experience of [the] body' (Hansen 2004:180). Gromalas' VR project was thus the first to consider Virtual Reality as an embodied experience by traveling into the deep space of the body was the desire of escape of the body. Previously Virtual Reality where previously Virtual Reality had encapsulated the desire to escape, to enable it to travel or fly through outer worlds through an immersive disembodied environment.

My own project and contribution to knowledge exploits proprioception in body-movement interaction with audio-visuals, as a means of designing better interactive installations. Through a series of live-data new media interactive audio-visual installations that cause the experiencer that cause the experiencer to aesthetically reflect, on their movement and interaction. It places perception and consciousness outside the body into the aesthetics of the audio-visual non-Cartesian so this thus is not one of immersion that explores the inner feelings of the body, like Gromalas'. In Figure 2, many complex structures are attached to the various limbs of the body of the experiencer and are drawn, moved, rotated, through interaction. Whilst the surround sound is played by their control of gesture. The skin of the body, the extremes of the limbs, reaches out, beyond the body into the techno-aesthetic environment of the non-Cartesian structures, forming a new configuration between body-movement and the aesthetic of the non-Cartesian.

Most of the technological advancements in audio technologies have been designed with particular regard to creating the effect of immersion, or presence, as in cinema and virtual reality (Dyson, F. 2009: 140). It is only when the recipient experiences immersion that they can experience presence. The experiencer alternates between experiences of presence and reflection. In these interactive audio-visual installations I have explored what happens when sound is dissociated from the usual cognitive perceptions of sound. The dissociated digital sound forms a new aesthetic on perceiving the environment, in which the physical body is momentary 'stalled' and is in a state of cognitive perception and consciousness, because it is not used to such disparities. It is during these preformed states of interactive movement that an aesthetic reflection takes place, when the experiencer is not immersed.

Sound affects the sensation of bodily position and presence just as the body position or movement of an experiencer may also effect sound associations. Sound combines a sense of spatial dimension and extent. For example, surround headphones can blur vision just as sound

and vision can zoom in and out, alternating between figure and ground.

As Francis Dyson states:

'Sound or rather audio, surrenders its intimate relationship to the body, it's unquestionable access to the interiority and truth, it's camaraderie with the un-representable, the emotional, the mystical' (2009).

In this sense, sound has a more immediate impact on the emotions and feelings of the recipient than a visual aesthetic, as it is more direct and immersive. In this way the experiencers can have a more intuitive body response to the interactive sound installations (Rokeby, 1998).

In this way body-movement interaction intuition is more natural in the interactive sound environment and naturally responds to sound, rhythms, beats, and cadences. Even so, it is still questionable whether the body is more able to en-frame sound than visual information as it is more direct. The directness of sound is another form of aesthetic realization, or 'immersion'.

In this research I incorporated an approach that causes the body to be conscious and therefore in a status of aesthetic reflection. This is caused by the body-movement interruptions of proprioceptive interaction and by the algorithms in the interactive design. The main difference and complexities that arise that cause this interruption to the body is the inclusion of both visual and audio interaction. This method had measures of success and failure, which has now led to further research of interactive design and new methods of 'disrupting' body-movement-interaction.

The 'active realization' of body-movement perception is an alternating or parallel manifestation of reflective and immersive moments. By 'disruption' of the experiencers' body-movement perception through algorithms in the interactive and combined interactive audio-visual perception techniques. This method was employed to create a flexible body-movement aware state where proprioception has to be relearned with a real-time response to the interactive aesthetics of the non-Cartesian audio and visual media. It causes 'presence' and a virtual enhancement of the senses, and also the alternating awareness of their body-movement interaction (Lombard & Ditton, 2006) This in turn allows experiencers to interact in a more meaningful way, broadening their understanding of the parameters involved.

My art practice-as-research explored the question: By affecting body-movement and by turning the body inwards in an embodied interactive audio-visual installation, can a more creative aesthetic experience be gained? This has been shown to be true in the video-cued interviews and my own experience. It is known that the body's kinesthetic

sense is capable of continually updating in micro-changes, via proprioception's ability to relearn and store this in memory. The interventions of body-movement produced by the interactive design flushes and de-stabilizes kinesthetic memory. A new body condition results, causing the experiencers awareness of their proprioceptive full-body-movement and in comparison to the virtual audio-visual environment. These micro-kinesthetic changes stored in proprioception allow a reflective perception that causes us to reflect on our body sense and state of being in the designed non-Cartesian world, which activates an aesthetic imagination.

### **Body Perception Theory**

In *New Philosophy for New Media* (2004) and later extended into *Bodies in Code* (2006), Hansen conjectures that the body becomes a more active framework for the image in the digital environment. Hansen goes on to maintain 'that the body continues to be the "active framer of the image", in the digital realm'. (Hansen, 2004: 3) Hansen states: 'On Bergson's account, the body functions as a kind of filter that selects, from among the universe of images circulating around it and according to its own embodied capacities, precisely those that are relevant to it' (Hansen, 2004: 3) Hansen defends Bergson's philosophical theory stating that the body is the 'Centre of In-determination', which emphasizes the role of the affective, proprioceptive and tactile dimensions of experience within the constitution of space and by extension, visual media.

My intention within my artistic research was to explore this theory in relation to the complexities of digital media. Hansen turned to contemporary artists to develop his 'Bergonist vocation' of redeeming the body as the 'Centre of in-determination'. In my own research the complexities of the audio-visual environment, as well as the complexity of 'full-body-interaction' with 'audio-visual', are unaccounted for in Hansen's research. I have thus demonstrated that affectivity in the forcefulness of movement within the embodied interactive digital environment becomes even more emphasized and is open to further research, within this new media arts practice.

In his view of 'affectivity' as an active role of the body in the perception of the image and more so the digital image in its own in-determinacy, Hansen writes:

Motion functions as the concrete trigger of affection as an active modality of bodily action. Active affection or affectivity is precisely what differentiates today's sensorimotor body from the one Deleuze hastily dismisses: as a capacity to experience its own intensity, its own margin of in-determinacy, affectivity comprises a power of the body that cannot be assimilated to the habit driven, associational logic governing perception (2004: 6).

Hansen's claim that the body becomes a 'more active framework of the image' in the digital environment does not take into account the complexity of body-movement perception of audio-visual materials, especially within the interactive live-data environment. Within this context, important issues surrounding perception and body-movement interaction with audio materials have largely been placed aside.

My own research into body-movement interaction within audio-visual perception has shown that complex relationships within the body take place and can reciprocally confound the body, especially in full-body-movement interaction. For example, vision can lose its priority when it is disrupted by sound, where shifting occurs, creating a zooming in and out between figure and ground. Immersed in sound, experiencers can therefore lose themselves 'in creating interiority', since 'sound destroys the subject/environment and interior /exterior distinctions' Therefore the body as 'en-framer' of the image that Hansen conjectures reduces its authority in the audio-visual environment. The bodies own volition in the making of perception of the image and the affect of sound on the body-movement in the interactive audio-visual environment therefore can be understood to have several complex relationships.

Cultural theorist Brian Massumi has shown far reaching implications of a shift in perceptual modality to a more 'haptic', mode of perception, grounded in bodily feeling. He discusses proprioception, stating that: 'the hinging of the proprioceptive on the visual in the movement of orientation is a synesthetic interfusion (2002: 188). Within my work I have shown how sound affects body-movement first before body-movement interacts with the visual components of the installation. He has suggested that there is a missing period of time between the bodily beginning of an event and its completion as an outwardly directed expression of emotion. The missing period of time is the affective duration during which bodies sense a sensation. He continues: 'Another way of putting it positionality is in an emergent quality of movement' (2002: 8).

Following on from this premise, I propose that it is the body's 'proprioception' in motion that is important to the interactive projections of the body translated by computer algorithms. The interactive designs within such research are thus co-created interactive digital environments that cause the mind/body to perceive within a state of changed perception and perspective. This is most likely because there are both unconscious and conscious states of proprioception. Proprioception can be made conscious through body awareness techniques. Theorists have argued for the importance of proprioception as a kind of 'sixth sense' than enables the body to orient itself through its habitual movement within space. In this sense proprioception can be thought of as the recurrent patterns that form as the body's

sensory motor system generates microscopic 'kinesthetic' transitions while simultaneously negotiating time and space within the world.

In this research I have therefore focused specifically on the relation between disrupting proprioception and interaction within audio-visuals installation as an aesthetic departure. I do so not as a means to understand the aesthetics of body performance or dance but as a means to uncover a new relationship between body-movement interaction and audio-visuals media.

Seeing proprioception as an internal memory and not a spatial memory, choreographers and performance theorists attest that dancers may sometimes make mistakes based on body misrepresentations: 'a dancer might proprioceptively perceive his or her knee as perfectly straight, when it is in fact bent,' e.g. (Montero, 1999: 239). Such phenomena tend to occur when the dancer cannot see a reflection of their body in a mirror. This shows that proprioception is an internal awareness that does not necessarily relate to spatial awareness.

Proprioceptive perceptual mistakes are also evident in perception of interactive installations within my own research, as the experiencer's body relearns complex movements within its awareness of the virtual and physical space. What is more important is that previous learned body-movement reactions are transformed by interaction with the audio-visuals. The stalling of body-movement is a 'performing' action that takes place between the aesthetic of the audio-visuals and the cognitive creative imagination.

The aim within my interactive installations was to extend the 'centre of indeterminacy' via the bodies framing function of body perception by going beyond what's 'important to itself', to explore a more 'creative cognitive imagination' via the body within the interactive digital environment. By 'creative cognitive imagination' I mean the experiencers' mind state of creative cognition, as co-author of the art piece and access to meaningful insight or as Lesley Stevenson states: 'the ability to create works of art that express something deep about the meaning of life' (2003: 238). This leads the experiencers' to explore a changing and evolving cognitive perception in real-time. This is a form of 'virtualized subjectivity' – the creative imagination of the experiencer, which is stimulated by the interruptions of body-movement that in turn formulates the virtual environment. I have shown that these interactive installations cause the participants' aesthetic subjectivity to be stimulated by the provocations of embodied interaction, generating a constantly renewing, changing body perspective. This arises from the newly obtained kinaesthetic memory and proprioception, which is continuously evolving. This causes the experiencers' awareness and perception to form a virtualized subjectivity. It also challenges cultural body inscriptions that inform our thought systems, making us

aware of 'embodied perception' for the purposes of creative imagination. Most of our bodily actions are governed by proprioception, so by designing interactive environments with the intention of disrupting habitual body movement, a new type of creative engagement can be experienced.

## Conclusion

The project has examined the theory of body memory perception, proprioception, for the development of contemporary new media body-movement-interactive installations. These full-body-movement-interactive audio-visual installations explore body perception, techno-aesthetics and digital technologies. The human condition is embodied, and is affected by our surroundings; socio-geographical, socio-political and socio-cultural models and the digital technological environment. The installations explore disruption of proprioception, from an embodied psychological perspective. Interruptions of body-movement in the interactive digital environment cause a momentary aesthetical re-consideration or reflection of preformed movement in relation to the interactive virtual imagery and surround sound. The body's inscriptions are brought to awareness during this brief moment. The interactive installations concentrate on aspects of the body in the way it moves to achieve perception, imagination, and consciousness.

## Notes

Body-Movement-Interactive is my own term, derived from full-body-movement interaction that includes gestures from the head and all limbs of the body, which is distinct from body-motion and motion-tacked technologies, that only track the whole body, with a center of gravity usually being at the lower region of the stomach.

Body-movement perception is all the fine motor movements of the body that aid visual perception, auditory perception, bodily awareness and self-regulation. Body-sense perception is kinesthetic and proprioceptive perception of the body's movement. This is not to be confused with body perception as a source of socially relevant information about other individuals.

3 'Centre of In-determination': Bergson conjectured that the body was the 'center of perception', that it selected out of the universe images, those that were important to itself, which he termed as the 'Center of Indetermination', where past and future collide, and determines action in the present. Bergson, H. (1908) *Matter and Memory*, New York, Zone Books.

Non-Cartesian can be defined in this interactive installation design as a quasi-virtual non-Cartesian space in the interactive digital environment. The interactive spatial

area is a physical Cartesian space, which is the same as the world we grow-up in and our bodies have adapted and used to. Cartesian co-ordinates are mathematical grids that often used in virtual reality systems.

5 Sherrington C 1906; Bergson 1911; Heidegger 1955, Hansen 2004;

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## Biography

Ken Byers is a multi-media digital artist from Newcastle. His interests include art, science and technology, philosophy, human machine interaction, interactive media and embodiment. He has shown his work in both the UK and internationally in the USA, Russia, Eastern and Western Europe. He studied for an M.A. in Fine Art at the University of Northumbria and later an M.A. in Media Production (Film & TV) at University of Sunderland. He is currently completing a Ph.D. in 'Body-Movement Interaction: perception and consciousness in digital audio-visual installations'. His current interests are in interactive installations, 3-D moving image, new media installations & sound art. He has shown work at Asia Siggraph 2012, in the 'Emerging Technologies Exhibition' and is currently working as an artist/researcher with special interests in perception and consciousness, embodiment and technology, interaction design, human-computer-interaction and new media aesthetics.



