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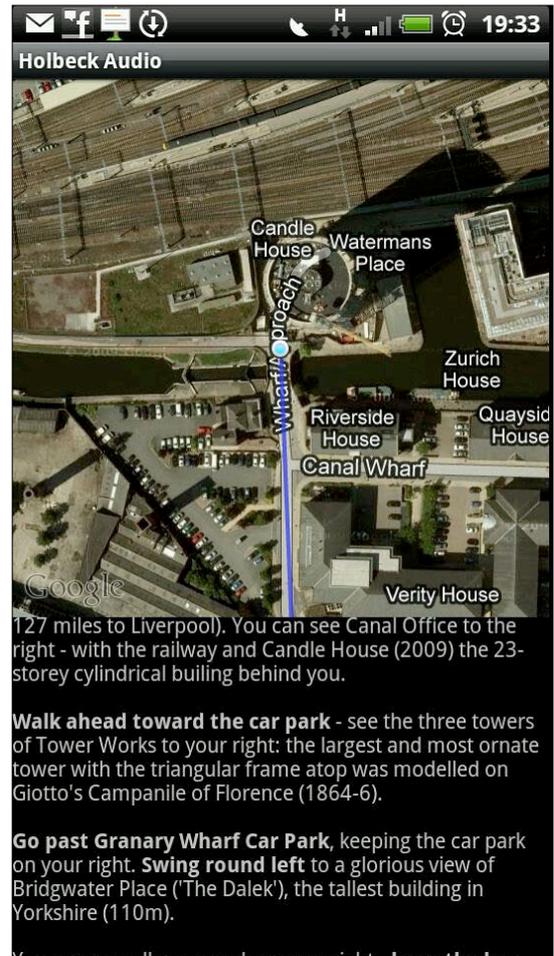
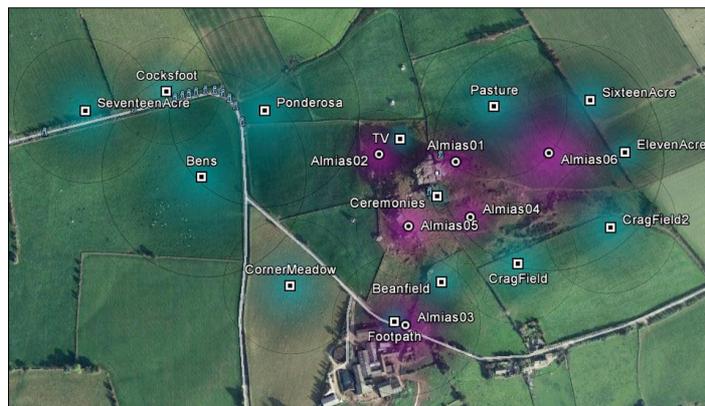
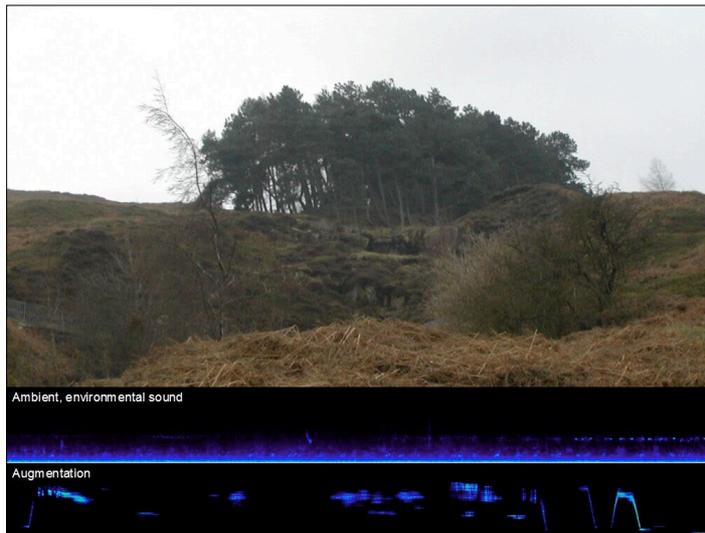
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LOAM: Towards the Development of a Platform for Locative Audio & Oral History



Phil Legard

Presented toward the completion of a
Masters in Enterprise (MEnt)
at Huddersfield University
2014.

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Response to Comments from Examiners

The materials associated with this submission were received positively by both internal and external examiners. Neither examiner suggested any revisions, although Dr. David Pinder highlighted a number of typographical errors that required correction. These have all been actioned following receipt of his report.

Submission Statement

This project crosses a number of disciplines (oral history, technology and enterprise). As a consequence, submission has been split into three parts, comprising:

1) A Written Report

Comprising of:

- a) A literature review on the use of new-media in oral history;
- b) An overview of technologies used to deliver aural experiences in the heritage industry;
- c) Details of the software development process involved in creating a number of prototypes related to the theme of heritage and 'augmented aurality'.

2) Software CD

This CD contains apps, suitable for installation on mobile phones using the Android operating system, as well as supporting digital media (such as video examples), and project development files (e.g. Java code).

3) Enterprise Plan

It is proposed that the meeting of heritage and technology would be an area of interest for many potential clients. This plan presents a proposal for a heritage-focused digital development consultancy with the concept of 'augmented aurality' at its heart.

Note:

The apps developed as a consequence of this research are location-specific. This means you will have to be in the right locations to test some of the prototypes (*Almias*; *Holbeck Audio Walk*). For testing the LOAM app, you can create your own KML file using Google Earth, or else contact the author to request a demonstration tailored to your geographical location.

Software CD: Summary of Contents

Apps/

Prototypes/

Almias/

Holbeck Audio Walk/

KMLTest/

Concordia Displaced/

Angelystor/

LOAM Player/

Example/

Holbeck Audio Walk LOAM/

Code Projects/

Almias/

Holbeck Audio Walk/

KMLTest/

Concordia Displaced/

Angelystor/

LOAM/

Unity/

Report and Plan/

Videos/

Introduction

Within the last 15-20 years, digital technology has become ubiquitous as a component of how history is presented in the public domain. Within museums, for example, we find the presence of touch screen computers and the use of digital reconstructions. The online world presents us with diverse educational applications and archives, while, more recently, iPhone and Android apps have been released that are tied in with heritage and popular historical themes.

This dissertation explores the area of mobile phone apps in relation to oral history, particularly the potential that they have for further contextualising oral narratives by presenting them in the physical environments to which they relate, as part of a 'curated' sonic experience.

The focus for this work is largely technical and theoretical, since to also engage in further fieldwork, research and composition within the domains of oral history and sonic arts would likely extend this project far beyond the reasonable scope of a masters-level project. To this end, the work presented here concentrates on developing prototypes from existing work in the domains of oral history and sonic arts as steps toward a more fully-fledged system for geolocate oral histories.

This report is divided into three sections. The first is a background, clarifying the role of new media in both oral history and heritage. A literature review provides an overview of the historical involvement of oral history with new mediums of presentation (CD-ROM, the Internet and so on). Given that the focus of this work is predominantly on the sonic aspects of oral history, a general overview of audio technologies currently used in the heritage sector is also provided as the first part of a technological survey. The second part of the technological survey examines developing technologies – both in terms of oral history work and in the proposed area of locative media.

The second section explores the development of a software platform for realising locative works, primarily audio-based, which incorporate elements of oral history and augmented

reality. A general functional specification is proposed and several prototypical apps based on existing works are realised as 'proof-of-concept' pieces.

The final section discusses the resulting software platform developed from the earlier prototypes, providing a technical overview and evaluation with regard to future developments in the area.

A number of appendices support this work, largely concerned with technical aspects – in particular detailing how to use the LOAMXML language, and how elements of the libraries developed for the project can be used in the context of libraries within the Android SDK.

As a component of the University of Huddersfield's MEnt award, a counterpart enterprise plan has been separately published, which examines a proposal for an consultancy based around a fully-fledged web and app platform for locative audio, much of which has been informed by insights gained during the period of study and prototyping discussed herein.

I. Technological Contexts for Oral History and Heritage Presentation

I.i. Literature Review: Oral History, Digital Technology and Emergent Interdisciplinary Practice

Technologies common to public history and oral history presentations have historically included CD-ROM/multimedia publications, audio guides and searchable databases. In 1998, Graham Smith provided an overview and critique of several CD-ROMs that relate by varying degrees to oral history.¹ These include *Marjory Bridge Farquhar - A Family History* produced by the Regional Oral History Office, UC Berkeley and The Open University's *Project Reports in Community and Family History*. Although the CD-ROM format has been superseded by other physical media such as DVD along with improved bandwidth and connectivity to the Internet, many of the observations made by Smith present fundamental issues for the consideration of anyone developing software in the area of oral history. Smith touches on the possibilities for the original interview material playing an important part as an element of presentation in what was a hitherto text-driven genre, dependent on transcribed materials. This is a theme that would become a hot topic a decade later, highlighted later in this section by Michael Frisch.

In summary, Smith points out that in order for the CD-ROM to be useful to both general users and academics a rigid methodology needs to be put in place, particularly in regard to editing processes and in the selection of representative media from a large and complex set of data. Smith is enthusiastic about the possibility of using 'the new technology to present, and contextualise, life stories in a way that would be cumbersome, even impossible in printed form.'² With the notion of new modes of presentation and contextualisation in mind he favours CD-ROMs like *Think Positive*, an HIV/AIDS multimedia guide with interactive interviews, photographs and sound files, over more conventional linear approaches. In his concluding remarks Smith states that 'there is too little discussion of what oral historians

1 Graham Smith, 'Mega-Memories on CD-ROM' in *Oral History*, Vol. 26, No. 1, Talking and Writing (Spring 1998), pp. 93-95.

2 *Ibid.*, p.94.

3 *Ibid.*, p.95.

would like software to do to help in our work.’³ This appears to indicate that the potentials offered by new media to oral historians are a serious consideration, but since many lack technical knowledge beyond that of audio recording the bar to successfully deploying new technology in the presentation of an oral history project is far beyond that of the production of a book or booklet.

Writing in the following issue of *Oral History*, Stephen Brier uses the development of *Who Built America?* - a CD-ROM companion to CUNY’s two-volume textbook of the same name - to reflect on the suitability of technology for delivering oral history.⁴ Brier raises a number of philosophical and methodical issues surrounding what was a highly successful, award-winning production and is an enthusiastic evangelist for new media, particularly with regard to its strength in powerfully and directly contextualising oral histories alongside audio-visual content.

Brier is also prescient in highlighting the importance of the web as a medium for public history, highlighting a number of then-pioneering projects. Ironically, although obsolescence and preservation are touched upon with regard to preserving media upon which original interviews were recorded, it may also be worth considering that the web itself is not a permanent medium. With this in mind it is sobering that a number of the projects that Brier cites have since vanished from the digital aether leaving barely a trace. However, his vision for the future of oral history on the web as a network of autonomous, but interlinked, resources developed through the common effort of the scholarly community is a grand one, echoing the optimism of the web pioneers of the period, and, with the increased connectivity available in the present, it is now also more viable than ever.

Recently oral historians have acknowledged that there are subtleties in speech that cannot be captured by the transcription, upon which much of the subsequent research and analysis traditionally depend. In 2010 Steven High published a paper in *Oral History* evaluating his experiences with using new media and reflected upon where this takes the practice of oral

3 Ibid., p.95.

4 Stephen Brier, 'Looking Backward, Looking Forward': A Life in Public History' in *Oral History*, Vol. 26, No. 2 Memory, Trauma and Ethics (Autumn, 1998), pp. 73-81.

history.⁵ High acknowledges that many of the most exciting possibilities for oral history are emerging ‘after the interview’.⁶ He acknowledges that this attitude is something of a hangover from the fact that traditionally the transcripts have been favoured because they are what might be called ‘random access media’ (we can easily search and browse a transcript) as opposed to analogue recordings which could only be accessed sequentially. Despite the uptake of digital sound and video formats by oral historians (see section I.iii, below), the transcript has still been the favoured approach for engaging with interview material. This is undoubtedly due to the fact that - although there have been promising developments in the technology - computer speech recognition is still a hit and miss affair requiring a great deal of tutoring and calibration before any reasonably accurate output can be yielded. This is itself out of the question for an oral history project which may contain tens or even hundreds of individual voices.

High outlines his engagement with four types of new media as part of his work surrounding the *Montreal Life Stories* project. First, he discusses collaborative project management environments, before moving on to the concept of digital storytelling. One gets the impression that High’s approach to digital storytelling incorporating audio material is linear, described as it is as “using widely available image editing software [sic] such as Adobe Premiere or Power Point ‘to blend together digitised still photographs and narrative to create short, evocative, and informational multimedia pieces’.”⁷ However, High acknowledges that ‘digital storytelling’ is a broad area most often related to non-linear media like hypertext fiction, computer game narratives and artist-led narratives.

High also assesses the value of databases to fellow oral historians and students, telling us that the advantage of preserving the audio of oral narratives is that ‘the effect of close listening to the testimonies [...] afforded by the new media format is evidenced by how well students remember details of the narrators’ stories’.⁸ However, he also highlights the need for sound user-orientated design principles to contextualise the recordings, particularly with regard to

5 Steven High, 'Telling Stories: A Reflection on Oral History and New Media' in *Oral History*, Vol. 38, No.1 Power and Protest (Spring 2010), pp.101-112.

6 Ibid., p.101.

7 Ibid., p.105.

8 Ibid., p.107

life history context. Students using the database, which lacked such contextual matter, unsurprisingly found themselves ‘disorientated and disconnected from the life stories before them.’⁹

Although the projects related to Concordia’s Oral History department discussed by High are successful within their own communities, access to the materials outside the university appears limited. Of the sites visited (*Stories Matter, L’Abri en Ville, Mapping Memories*) there was no apparent way to get access to the primary material, which - while undoubtedly recorded using digital media - does not have an online presence. Engagement with the material is very much mediated by the curators on their own terms.

Away from the computer terminal, Toby Butler's concept of memoryscapes deserves recognition. A ‘memoryscape’ as defined by Butler ‘brings together works from music, sound art, oral history and cultural geography as a starting point to understanding how such trails can give us a more sophisticated and nuanced experience of places’.¹⁰ While the technology to deliver this kind of multi-media sonic experience could be analogue, digital workflows make the editing and assembly of such material far easier, while the web and MP3 players provide a highly efficient delivery of the audio resources.

The concept of the memoryscape has made an deep impression upon some oral historians who are involved in re-evaluating the value and role of the original audio material in post-transcription work. The memoryscape has obviously made an impression on High who dwells on the topic at length, particularly on the way it has helped him further contextualise the oral histories he was collecting at the time of writing (for the *Sturgeon Falls Mill Closing Project*). The website for the project perhaps indicates a step in the right direction in methodological terms: the first page immediately presents us with a multitude of faces that who we can not only see, but also hear. Unfortunately the sounds are only short clips, and clicking through redirects the user to a less dynamic experience which lacks the immediacy of the initial page of the site. In terms of this project High’s own interpretation of the ‘memoryscapes’ theme appears to be realised predominantly as recordings ‘tagged’ to images

9 Ibid.

10 Toby Butler, 'Memoryscape : How Audio Walks Can Deepen Our Sense of Place by Integrating Art, Oral History and Cultural Geography' in *Geography Compass*, No. 1, 2007, pp.360-372.

of the places they relate to - again a presentational method that lacks an immediate 'hook', but since the mill was demolished during the project itself these photographs and memories relating to their locales are all that remain.

The presentation of oral narratives and their connection to place in the *Sturgeon Mills* project could be contrasted with the presentation style of David Lynch's *Interview Project*.

Reviewing Lynch's work in *Oral History Review* Brooke Bryan observes that although it is questionable that the work could be considered "an oral history project" (there is not historical question or methodology), the project has value for oral historians in the way it presents "the connection between place, person-hood, and narrative".¹¹ The site promises - and maintains - the directness that was suggested by the opening page of the *Sturgeon Mills* project. We are instantly presented with the face of an interviewee. We can listen to their narrative directly, while we also have effective presentations of other information: a short biography and - critically - a map. The map shows the circular route of the interview team around 20,000 miles of rural America. The interviewees are tagged on the map, giving them some context in terms of place, although more detail in the map (such as satellite photography or place names) would greatly enhance the experience in terms of being able more readily to situate Lynch's subjects in terms of their local geography. In terms of presentation and engagement there would seem to be much that oral historians might learn from the presentations of such narrative and their applications to projects that often need to straddle both scholarly concerns and an engaging, meaningful legacy.

A notable observation by High is that, rather than coming from the field of geography, the most 'experimental and exciting work using sound and spatiality has come from the art world.'¹² Toby Butler's *Drifting* and Greame Miller's *LINKED* are cited in this regard, while it appears that Concordia have recently increased their engagement with artists for example with the *Lamentations* dance production by Matralab, which is based on a gestural analysis of Montreal residents who have been displaced from their homes by war, genocide and human rights violations. Indeed, outside the immediate field of oral history there has been an increasing post-millennial trend among artists to relate their their work to 'place' - not just

11 Brooke Bryan. 'Media Reviews: Interview Project' in *Oral History Review*, Vol. 37, No. 1, 2010, pp.71-77.

12 High, p.109.

amongst the environmental sculpture school of Andy Goldsworthy and co., but more radically (and in the urban context) amongst authors and artists that flirt with the term 'psychogeography' - a word coined by the Situationists, providing an umbrella term for all manner of playful and artistic association with place where experimentation may freely take place.¹³ Integral to historical psychogeography are the concept of *dérive* (an aimless wandering, or 'drift') and the figure of the *flâneur* ("the gentleman stroller of the city streets"). The popularisation of psychogeographical concepts from the mid-90s could also be seen as informing part of the revival of interest in walking evidenced in the popular reception of academic Frédéric Gros' *A Philosophy of Walking*¹⁴ and exhibitions such as *The Walking Encyclopedia* (2013, AirSpace Gallery), academic conferences like *The Art of Walking* (2013, École Normale Supérieure de Lyon) and the work of Dr. Claire Hind and her Footwork research group and Walking Artist's Network.¹⁵ There is, therefore, a healthy interest in walking in the artistic community, suggesting that work may be sympathetically received that develops at the interstices between oral history, new media, audio walks and artistic response or curation.

The most complete discussion of the relationship between oral history and new media is the 2012 paper by Simon Bradley.¹⁶ Methodologically Bradley's approach is akin to Graham Smith's 1998 piece, in that it surveys a number of projects - many of which are not explicitly announced as 'oral history' but regardless contain elements of oral history or of a significance to oral historians. Along with High, Bradley sees new possibilities for the raw interview material post transcription - and like High recognises the role of the memoryscape or audio walk as an important tool for engagement not only with the public, but also in terms of cross-disciplinary collaboration.¹⁷ Indeed, such a philosophical *and aesthetic* shift may result in 'existing audio archives [being] seen in a fresh light when considered as source material for new, located memory audiowalks'.¹⁸

13 For an overview of the field see Merlin Coverley, *Psychogeography*, London, Pocket Essentials, 2006.

14 Carole Cadwalladr, 'Frédéric Gros: why going for a walk is the best way to free your mind' in *The Observer/Guardian*, 20 April 2014. Available online at <http://www.theguardian.com/books/2014/apr/20/frederic-gros-walk-nietzsche-kant> (Accessed 22/04/14)

15 For the work of Footwork and Walking Artists Network see: <http://www.walkingartistsnetwork.org/>

16 Simon Bradley, 'History to go: oral history, audiowalks and mobile media', in *Oral History*, Spring 2012.

17 *Ibid.*, p.100.

18 *Ibid.*

The contribution of artists to the audio walk genre, as it is presented and interpreted outside the heritage industry, notably the works of Janet Cardiff who started producing her own dramatic audio walks in the early 90s, are acknowledged by Bradley - along with artistic use of binaural recording, a tool to create truly immersive recordings using two microphones positioned in the ears of either a virtual - or real! - head. The concept of immersion and the engaging artistic aesthetics exhibited by many of the pieces that Bradley discusses would seem to point oral historians toward radically new conceptions of the way they present their work beyond static webpages with embedded videos, or linear memoryscape and audio walks, and into highly immersive even interactive experiences that, when done successfully and in conjunction with a physical place, can be profoundly affecting.

Under discussion are Mike Pearson's *Carrlands* (2007), the previously mentioned *LINKED* by Graeme Miller (2003), Butler's *Drifters and Dockers* (2005) and the powerful *Ground Zero Sonic Memorial Soundwalk* by SoundWalks (2002). The *Ground Zero Sonic Memorial* is 'multisensory' in that it mixes a guided narration with archival recordings and oral documents. As an organisation, SoundWalks has been developing a high profile reputation as a provider of audio walks for more than a decade and has also made the connection between sonic (and visual) arts and the audio walk concept as is demonstrated by the impressive list of installation works on their site which play with narrative, audio and space in creative ways: hear the Gyuto Monk's Tantric Choir as you ascend the escalator of the Centre Georges Pompidou and so on. However, forward-thinking as they may be, none of these virtual installations actually incorporate oral history into their narratives - they are the product of artists and their insitutional collaborators.

Nor have SoundWalks yet moved beyond the linear audio walk format: all of their productions thus far are based on either a single recording or a sequential set of MP3 files. Bradley, however, suggests that the use of 'geotagged' recordings - anchored to physical coordinates and accessed via a phone with a pair of headphones and Global Positioning System (GPS) capabilities - can make the experience of an audio walk both less linear, more interactive, and also adaptable to changing environments.¹⁹ I would also posit that an enhanced involvement with the material may also occur due to the fact that the 'system'

19 Ibid., p.108.

knows where the listener is. They do not, therefore, need to pause their MP3 player between sections or rewind if they get lost. They are also free to progress at their own pace, since it is only their proximity to the geotagged data that triggers the next stage of the audio walk.

This possibility of an interactive, ‘non-linear’ narrative also relates to Bradley’s concern with what he calls ‘fragmented narrative’: ‘akin to montage in cinema where individual elements need not have a linear or logical relationship with one another, but the whole composition is designed to produce a specific impression.’²⁰ The importance of fragmented narratives is seriously considered because it is a theme common to all the works under discussion by Bradley and as such allow the authors, or composers, editorial control but also allow ample interpretive space for listeners depending ‘partly upon the walker’s own perceptions, emotions and memories, but [...] also determined by the looseness of fit between the audio and the fluctuating circumstances involved in the work’.²¹ Fragmented narratives, while hardly the bread and butter of academic research, are a powerful artistic tool and also in step with the ‘fragmented’ way we habitually engage with new media. Indeed, it was the fragmentary aspect that made the opening page of the *Sturgeon Falls Mill Closing Project* so immediately engaging (and the material that followed it less so) in the context of contemporary web presentation.

The use of a fragmented narrative as an interpretive and editorial layer, more suited to oral history than the grand narratives of the popular history book, is perhaps the closest Bradley comes to highlighting a possible link between sonic art and the audio walk/memoryscape concept. Although both involved in sound, however, the approaches used in presenting the sound to an audience and using it as the basis of research are radically different - an appreciation for audio and an ability to ‘think in sound’ being two very different things, as High notes. However, in terms of developing an artistic and interactive situation for oral history it is vital that these two audio-worlds overlap one another.

20 Ibid. p.107.

21 Ibid.

The relationship between audio-visual material non-linear modes of delivery was also theorised on by Michael Frisch.²² His notion of a ‘post-documentary sensibility’ within oral history resonates with the idea of ‘fragmented narrative’ as teased out from artistic works by Bradley: “With accessible, meaningful, fluid, and non-privileged access to the content of oral history, the authority of the mediating intelligence or documentary authorship is displaced by a shareable, dialogic capacity to explore, select, order and interpret. In this mode, the privilege of a fixed documentary version that necessarily marginalizes other meanings or stories in the material [...] is displaced by a notion of documentary as process; that is, as *an ongoing, contextually contingent, fluid construction of meaning*’.²³ While I suspect that Frisch may have in mind something less ‘granular’ than the fragmented narrative, the philosophy behind the two is the same: that when presented with contextual and archival materials in a non-linear manner, listeners are capable of constructing meaning without recourse to heavy handed narrative or editorial control on the part of the producer. However, the issue of losing editorial control and also the technological bar to implementing a ‘non-linear’ path through the material which does not feel itself limiting or contrived are perhaps issues which have caused such approaches to stall, the exceptions being the work of the artists discussed above who, despite working with linear mediums, have allowed room for reflection via their more relaxed, less curatorial relationship with their oral history material.

The concerns that appear to have arisen from this survey of the engagement with oral history and digital technology over the last decade centre on the presentation of oral history, seeking a manner which is both immediately engaging, yet provides a deep experience. In such a nonlinear or hypertextual form, the person experiencing the presentation can potentially explore deeper levels of complexity as part of the process of constructing their own meaning and dialogue with the material. Writing about the current state of oral history in 2006, Alastair Thomson outlined four “paradigm transformations”.²⁴ Of these, the third - the emergence of interdisciplinary practice - is still very much a current concern, while we are currently in the midst of the fourth paradigm transformation: the implications of the ongoing

22 Michael Frisch, 'Oral History and the Digital Revolution: Toward a Post-Documentary Sensibility', in R. Perks & A. Thomson (Eds.), *The Oral History Reader*, Routledge, London, 2006, pp.102-114.

23 Ibid., p.113 - italics added for emphasis.

24 Alistair Thomson, 'Four Paradigm Transformations in Oral History' in *Oral History Review*, Vol. 34, No. 1, 2007, pp.49-70.

digital (and communications) revolution. Thomson highlights the work of Michael Frisch and the notion of a “post-documentary sensibility”, which breaks down the distinction between oral history sources and documents. The basics of what Frisch first proposed in 2004 are networked archives in which the documents are somehow ‘tagged’ so that meaningful paths can be plotted between items in response to queries by researchers. As Thomson rightly points out, how to generate indexes for material that is primarily audio and video-based is problematic and he also mentions that - if such ‘post-documentary’ reinterpretations are on the cards - this might significantly affect how participants in oral history projects respond to interview questions. Furthermore, Thomson asks whether the digital revolution is also a cognitive revolution: this is uncertain, although the aesthetics suggested by concepts such as the post-documentary sensibility, fragmented and non-linear narratives do seem analogous to the way in which we have come to predominantly experience new media as engaging and engrossing, but also at heart fragmentary: as typified by the parallel activities we engage in and which crowd the tabs of our web browsers.

The above survey indicates that with ever increasing data storage and access methods new technology is giving life to old archives. The notion that archival sound and video recordings could be powerful contextual tools began with the popularisation of the multi-media CD-ROM as a platform for historical presentation in the 1990s and continued through the popularisation of the World Wide Web and to the present day with the uptake of mobile computing platforms.

Alongside the re-evaluation of how to deal with audio material is the reconsideration of how to actually present oral narrative in an engaging way beyond the ‘collected reminiscences’ genre of publication. Many of the projects that appear to have the most promise, particularly within the genre of the memoryscape, are creatively curated and presented by either a sensitive historian or by way of collaboration.

The developing theories about the value of emergent, fragmented or non-linear narrative not only suggest a strategy for creative presentation of material but suggest a deeper way of engagement with both oral history material and the place. The underlying suggestion appears to be that place, memory and the listener are codependent elements. The possibility for the

construction of meaning and personal experience from, for example, perceived synchronicities and connections arising from the meshing of audio augmentation and the physical environment is a powerful one. However, such deep experiences may be hard to manufacture, dependent as they are on some element of chance, the disposition of the listener and the psychological awareness of the creator/curator as it applies to setting up ‘windows of chance’.

L.ii. Technology Review I: Heritage Presentation, Audio and Mobile Technologies

Outside oral history and the memoryscape, the use of audio for historical context has generally been associated with museums and other heritage attractions, often mediated by dedicated technologies. The two most common of these – the static sound store and the hand-held audio guide – have become familiar fixtures to many museums. The mass adoption of mobile technologies and the ubiquity of the 'app' will not necessarily render these technologies (summarised below) obsolete, but rather provide a range of choices for those involved in the aural representation of history, highly dependent on the context of the presentation.

The sound store is a common sight in museums and other heritage attractions and allows visitors to select audio which is either played back on an embedded speaker or through attached headphones.



Museum sound store by Blackbox-AV.²⁵

25 Blackbox-AV. 2011. *6 Button Self Standing Museum Sound Store*. Online at: <http://www.blackboxav.co.uk/6-button-self-standing-museum-sound-store>. Accessed 12/06/13.

The sound store is an efficient way of delivering audio to visitors in contexts when the loci of the presentation is fixed. This makes the sound store particularly appropriate to museum situations, but less so in the context of architectural heritage as may be seen in the example of the sound store in Burnsall Church, Wharfedale:

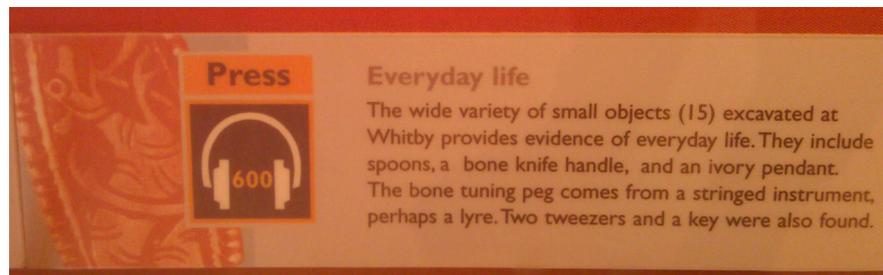


Sound store at Burnsall Church.

With a built in speaker, rather than headphones, the above pictured sound store is ill-suited to the context of the place. As a church, still in use by parishioners, it should ideally function as a place of sanctuary, reflection and silence as well as being a piece of architectural heritage. Unfortunately the use of a sound store in this context seems to come across as something of a rude, electronic intrusion into the sanctity and quietness of the place.

More appropriate to such a context would be the use of a mobile, handheld audio guide. At commencement of this project (2012) the use of ‘mobile’ technology in heritage and cultural contexts was (and continues to be) dominated by the audio guide: a portable handset programmed with a series of commentaries for the visitor to listen to. Often the handsets are fairly rudimentary: visitors key in a code to hear further interpretation with regard to specific

items or locations – as shown in the image below from the visitor centre at Whitby Abbey, North Yorkshire:



Audio guide cue, Whitby Abbey, North Yorkshire.

The Orpheo Group, a company based in the USA with offices and partners globally, has been a leader in the market for this technology. The organisation was an early adopter of using RFID technology as a proximity sensitive trigger, and have more recently integrated GPS into their Orpheo NEO device. The NEO also has a high resolution colour screen. Combining the use of RFIDs for indoor proximity tracking and GPS for outdoor usage would suggest some interesting possibilities for the platform.



A range of Orpheo handsets, the NEO is in the centre.²⁶

As can be seen from the above image, the Orpheo NEO itself looks very much like a contemporary smartphone and, as would be expected from a technologically proactive organisation, the Orpheo Group have begun to explore the possibilities of smartphone apps in conjunction with the technology they already offer. Under the 'MyOrpheo' banner, the group develops for their own iOrpheo and DroidOrpheo platforms. These platforms represent a framework which can easily be populated with information about a particular exhibition,

²⁶ Orpheo Group. 2013. *Audio Guides*. Online at: <http://orpheogroup.com/products-services/audioguides>. Visited 12/06/13.

museum and so forth. It also has a 'keyboard' tab to access commentary in the style of traditional handsets.²⁷



Screenshots from the Chateau du Vincennes app developed with MyOrpheo.

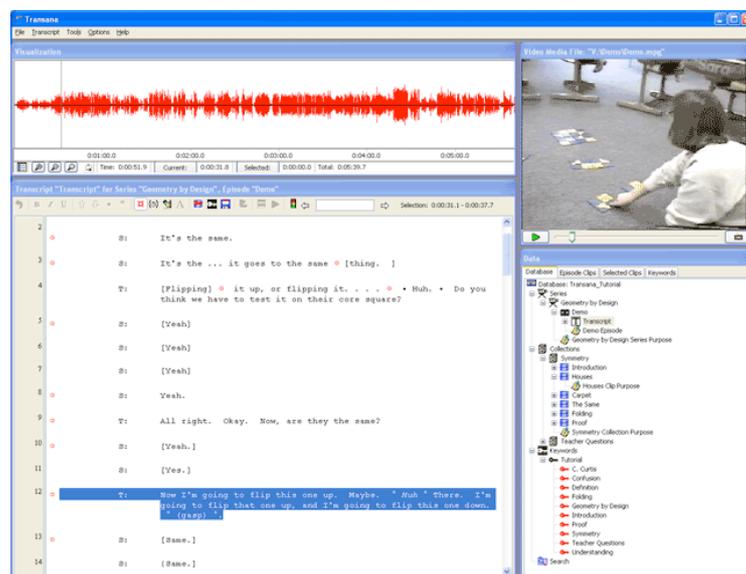
Apps built along similar lines to the MyOrpheo framework have been adopted by a number of organisations to provide interpretation for exhibitions, conferences, events and so on. These developments are indicative of the ubiquity the smartphone and have even led institutions such as the Cleveland Museum of Art and Bologna's Museum of Archaeology to experiment with replacing their standard audio-guides with QR codes. A QR code is a barcode-like image which can be 'scanned' by taking a photo with the phone's inbuilt camera. Once decoded the QR code usually contains a web-link which will take a visitor to the relevant content. Despite not being as technically complex as, for example, an audio-guide handset that is triggered by RFID tags, QR codes provide a simple and robust way to add new content, or revise existing content, quickly and cost effectively. However, to work well the implementation of the audio guide requires a significant investment not only in hardware, but potentially in infrastructure, which – although affordable to some institutions – is not necessarily accessible or appropriate in, for example, the grass-roots oral-historical context. While the paradigm of the audio-guide is useful, the next section will explore new, and potentially more accessible, technologies for oral history and geolocation.

²⁷ MyOrpheo. 2013. *Standard Applications*. Online at: <http://myorpheo.com/interactive-application/>. Visited 14/06/13.

L.iii. Technology Review II: New Tools for Oral History and Geolocate Technologies

“The Deep Dark Secret of oral history is that nobody spends much time listening to or watching recorded and collected interview documents. There has simply been little serious interest in the primary audio or video interviews that literally define the field and that the method is organized to produce. This is not really a secret, of course. On reflection, everyone recognizes that the core audio-video dimension of oral history is notoriously underutilized.” (Frisch, 2008)

The popularisation of Frisch's 'Deep Dark Secret' has led to a number of initiatives within oral history to redress the balance concerning the value of the primary interview materials. Such approaches have primarily focussed on database driven technologies. For example, the management/transcription system *Transana* goes some way to redress the historical precedence of textual transcription over audio by allowing researchers to compile databases of source material, as well as offering a flexible, time-coded transcription system and the ability to search, cross-index and otherwise 'data mine' materials within the database.



An image of Transana, showing audio waveform, video, transcription window and data browser.

Although it allows flexible data access and a centralised repository of information, *Transana* is very much a researcher's tool; there is a multi-user version to allow networked sharing of resources, and a 'presentation' mode, but access to the database via public interfaces is not strictly within the system's remit.

The *Stories Matter* system developed by Steven High and the Oral History department of Concordia University offers similar functionalities to *Transana*, and is also moving in its second stage of development to an online, collaborative environment.²⁸ Steven High and his associates have been involved with a number of projects with strong web-presences notably *Montreal Life Stories*, which contains video interviews, biographies, transcriptions and cross-referenced materials. The general impression one takes from *Stories Matter* is that of a powerful tool to facilitate the workflow from primary audio-visual interview material to web-presentation, as well as supporting academic needs.



Interface of the Montreal Life Stories website.

Web-based, multi-user developments such as *Transana* and *Stories Matter* indicate that the discipline of oral history is maturing in its relationship with 'database culture'. The next digital frontier with which the discipline could begin to engage is that of the mobile 'app'. By its nature, oral history is located outside the walls of the gallery or museum and in the environment of our daily lives. Making the use of GPS in the context of oral history presentation is therefore highly appropriate: interviews can be listened to in the context of the environments in which they were related or which they concern, and the physical geography of place and the journey through it becomes the skeletal framework for a narrative experience.

28 For a history and evaluation of the project, see Jessee, Erin; Zembrzycki, Stacey; High, Steven. 2011. 'Stories Matter: Conceptual Challenges in the Development of Oral History Database Building Software' in *Forum: Qualitative Social Research*, Vol.12, No. 1. January 2011.

Thus far the most notable experiments in applying 'oral history' in the context of geolocate apps have been *Hackney Hear: London Fields* (2012) and *Guardian Street Stories: Kings Cross* (2012).

The *Hackney Hear: London Fields* app is a derivative of the *Hackney Hear* podcast, by Hackney Productions – a community-based group that works with volunteers and community centres to collect the stories and field recordings that comprise their podcasts and app. Akin to Lynch's *Interview Project*, the podcast does not relate to any particular historical question, theme or methodology, although it does reflect stories and experience of a particular section of the London community. The opportunity to curate and selectively present material comes in the form of the app, which uses GPS to locate narratives in relation to the user.

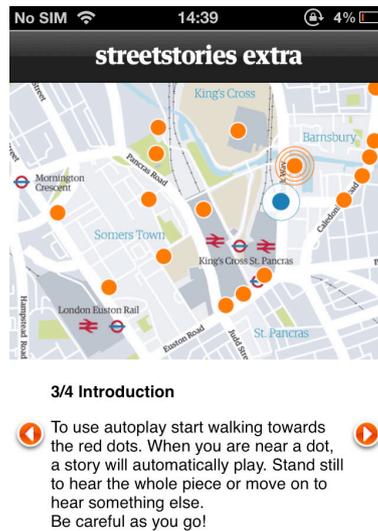


Hackney Hear app (2012, Amblr/Hackney Productions)

The app presents two modes of interaction – a non-linear mode in which the various narratives are represented on a map of the area, and a 'walk' mode that provides pre-defined routes through the area. The software has been developed by Amblr, a four-man team that describes themselves as “a developer, producer and publisher of location-based experiences.” Unfortunately it seems that Amblr have only produced two apps, both in 2012 and have been silent since Autumn 2013.

Guardian Street Stories: Kings Cross, also 2012, is the product of a collaboration between Francesca Panetta, special projects editor at The Guardian, and software developers Calvium.

This is a very similar concept to that of *Hackney Hear*, although without the pre-defined walks.



*Guardian Street Stories: Kings Cross (2012, The Guardian/Calvium)*²⁹

The *Street Stories* app was developed using Calvium's own Appfurnace platform, which specialises in delivering location-sensitive information via mobile devices. The team behind Calvium had previously worked on Hewlett Packard's *mescape*, an early mobile gaming and locative media platform that was discontinued in 2007. The Appfurnace platform itself presents a development environment for locative media, which is examined further in section II.iii.

Of peripheral interest to the area of new technologies and oral history are other locative platforms such as *Empedia* and *Roundware*. *Empedia* is not an oral history project, per se, but is a hosting platform that shares the documentary concerns of many such projects, being essentially a way to host data via an interactive map, based on Google maps technology.³⁰ The *Empedia* platform has a rather small sphere of influence, however, being dedicated to hosting materials specific to the East Midlands area.

29 Calvium. 2012. *The Guardian Street Stories App Development Story*. Online at: <http://appfurnace.com/client-case-study/guardian-street-stories/>. Visited 16/05/14

30 Cuttlefish. 2014. *Empedia*. Online at: <http://empedia.info/>. Visited 16/05/14.



empedia mobile player (2014, Cuttlefish)

Less geographically specific is *Roundware*, an open-source platform for delivering locative audio content developed by artist Halsey Burgund. The apps produced with Roundware approach the idea of locative audio from an entirely different standpoint. Whereas the apps discussed might be concerned with 'micro narratives' embedded as specific points around a location, Roundware apps emphasise a 'macro narrative', akin to a global sound installation in which the audio is not curatorially geotagged to place, but is part of an evolving sonic artwork that users can contribute to by recording their observations about the place in question, which will be dynamically mixed in with music heard by other users – what Burgund calls a 'contributory audio landscape.'³¹

Liv. Project Scope: Locative Audio for Oral Historians

As *Hackney Hear* and *Street Stories* demonstrate, aspects of oral history are finding expression in location-based media, although they are presently typified by community projects, rather than the kind of academically interpreted or artistically curated works typified by the productions of the Concordia group, or artist-academics like Toby Butler. The apps discussed above also present the narratives as linear texts, whereas the medium has significant potential for exploring the material as a non-linear, fragmented narrative via a post-documentary or sound arts aesthetic, akin to Butler's work.

³¹ Halsey Bergund. 2014. *Sound Sky*. Online at: <http://halseyburgund.com/2014/01/sound-sky/>. Visited 16/05/14.

The sections that follow will explore the development of a platform that can be used to present locative audio within these aesthetic concerns. The primary concern is an auditory one, and the awareness that many platforms for locative media do not offer a particularly flexible audio environment in which to realise more sophisticated modes of delivery than linear playback.

Oral historians have significant technical skills (such as recording and editing),³² yet a platform like Appfurnace requires a specific level of technical knowledge in order to engage with the scripting language necessary to realise more than a very basic series of interactions. Alongside developing a potential for a rich sonic environment, this work will also look at how to make a platform for locative oral history accessible to oral historians who, while proficient at handling audio, are perhaps not natural programmers or software developers.

32 Stephen Brier, 'Looking Backward, Looking Forward': A Life in Public History' in *Oral History*, Vol. 26, No. 2 Memory, Trauma and Ethics (Autumn, 1998), pp. 77.

II. Locative Audio: Proposals and Protoypes

II.i. LOAM: Proposals & Functional Specification

In the light of the foregoing discussion, it is proposed to develop a mobile application that will facilitate the delivery of oral history projects in the domain of geolocative audio, encompassing the concept of the 'fragmented narrative' and the considerations of aesthetics, sonic art and artistic curation which such an approach potentially involves. The system under discussion has been given the name *LOcative Audio Media*, or *LOAM*.

The use of dynamically delivered audio, based on a physical location may also bring the system into the domain of 'Augmented Reality' (AR). A broad term, in circulation since the early 1990s, augmented reality is usually used to refer to any addition to our experience of the world that is mediated via a layer of digital media.³³ Recent examples might be cited in the Google Glass, or software like ARToolkit, which uses a webcam or phone camera to overlay computer-generated imagery on printed 'anchors'.

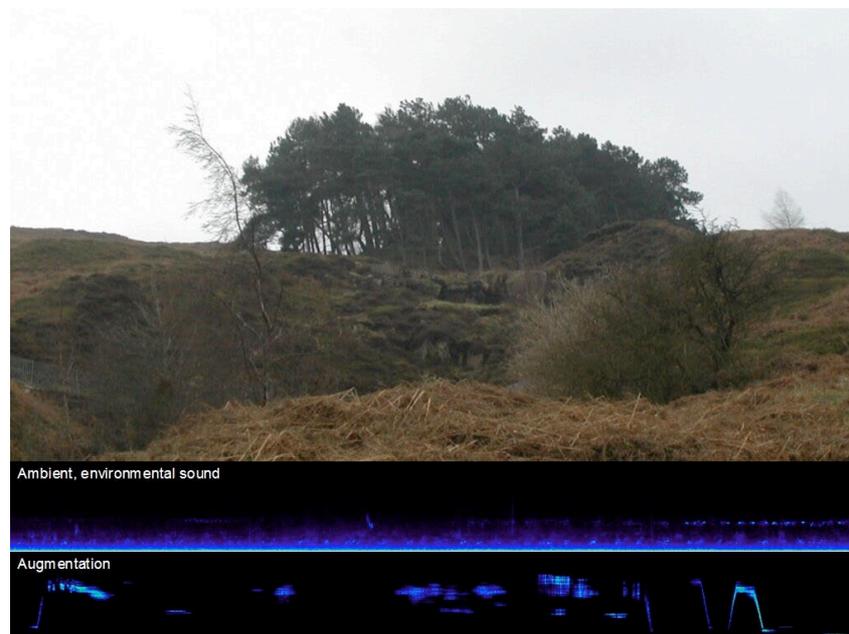


An physical AR anchor, and the augmented view of the anchor on a tablet computer.³⁴

33 The earliest use of the term is attributed to T.P. Caudell & D.W. Mizell. 1992. 'Augmented reality: an application of heads-up display technology to manual manufacturing processes' in *Proceedings of the Twenty-Fifth International Conference on System Sciences*.

34 Image courtesy of ARToolworks Inc.

Historically AR has been a visually-orientated medium: Caudell was himself a Boeing engineer, who adapted the idea of an aeroplane HUD to a pair of glasses. In the mobile context, with applications like ARToolkit this necessitates holding up a phone or tablet in front of your natural field of vision. Within the context of a locative history, however, it may be considered desirable to reduce the amount of 'screen time' an app necessitates in order for the actual environment to be viewed. The philosophy behind LOAM, therefore, is to develop an app that will not require much touch-screen interaction, but which will deliver an audio experience based primarily on GPS data.



Extending the audio domain by overlaying an 'augmentation' layer on the existing environmental ambience.

Functional Specification

A. Audio Components

The proposed prototype platform consists chiefly of components suitable for delivering audio within the context of GPS location and the possibility of the 'fragmented narrative'. They are summarised below, and borrow from a number of ideas in the sonic arts, among them the works of Michael Chion and Barry Truax.

The audio components inherent to LOAM can be broadly categorised using the diegetic/non-diegetic framework of Claudia Gorbman, popularised in the context of the sonic arts in the

work of Michael Chion.³⁵ To summarise, diegetic audio depends on time and space: in the context of film or video games, these are sound effects and speech. Non-diegetic sounds, such as music, are not strictly localised in time and space, but provide a unifying current.³⁶ Academic debate is ongoing about the value of the diegetic/non-diegetic framework, and, of course, these are only guidelines to usage, and open to subversion within the system.³⁷

A.i. Embedded Audio (Diegetic)

An 'embedded' sound is considered to be emanating from a given point. It will, therefore, increase in volume as the user approaches it. Such a sound may also be sensitive to the user's orientation (e.g. panning depending on their bearing), and may also have a number of different 'rolloff' curves that influence exactly how the volume of the sound alters depending on proximity.



*Example spatial rolloff curves from the Unity development environment.*³⁸

A.ii. Cloud Audio (Diegetic)

A subset of embedded audio is 'cloud audio'. An embedded sound will play in a linear manner, from start to finish, with the option of looping. 'Clouds', however, provide a way to randomly access waveform data. The concept of the 'cloud' is inspired by that of granular synthesis, which has become a mainstay of sonic arts and sound design. Granular synthesis involves dividing a sound-file into many small parts called 'grains' (often only a number of

35 Michael Chion. *Audio-Vision: Sound on Screen*. 1994, Columbia University Press, New York.

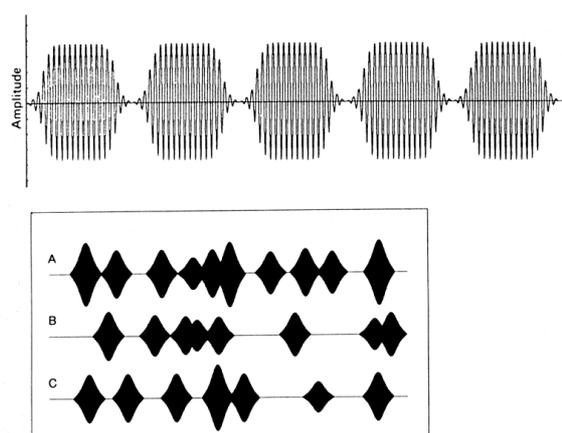
36 Chion, pp.67-93.

37 For a summary of the debate see Ben Winters. 'The Non-Diegetic Fallacy: Flm, Music, and Narrative Space' in *Music & Letters*, 91(2), 2010, pp. 224–244.

38 From Unity Technologies. 2013. *Audio Source*. Online at: <http://docs.unity3d.com/Documentation/Components/class-AudioSource.html>. Visited 19/06/13.

milliseconds long). These grains are then reassembled as 'streams', which are subjected to delays in playback, pitch/amplitude transformations and so on. A real-time digital approach to granular synthesis was realised in 1986 by Barry Truax, an electro-acoustic composer who has used the chaotic, naturalistic in his works, which often present themselves as responses to natural environments.

A single 'cloud' track could be a piece of music or soundscape divided into large grains which could then be played in a randomised order: the notion being that from a single source, a larger amount of material may be generated. At a more complex level, multiple clouds can be overlaid, with different sizes of grain to create something more akin to classic granular synthesis. This potentially presents a useful way to create non-linear soundscapes, for example, made up of recombinant ambient sounds.



Representation of a waveform divided into grains, and three streams of the resultant grains which would combine to create complex sounds.³⁹

A.iii. Narrative Audio (Non-diegetic)

The volume of both embedded and cloud audio is adjusted according to the distance of the user from the sound sources. Narrative audio, however, remains at a constant volume once it has been triggered. It can be thought of as akin to the narrative on a television programme, inhabiting a space 'external to the story world', as Chion puts it.⁴⁰

39 From Barry Truax. 2010. *Granular Synthesis in HTML Documentation DVD-ROM #1*. Online at: <http://www.sfu.ca/~truax/riverdvd.html>. Accessed 19/06/13

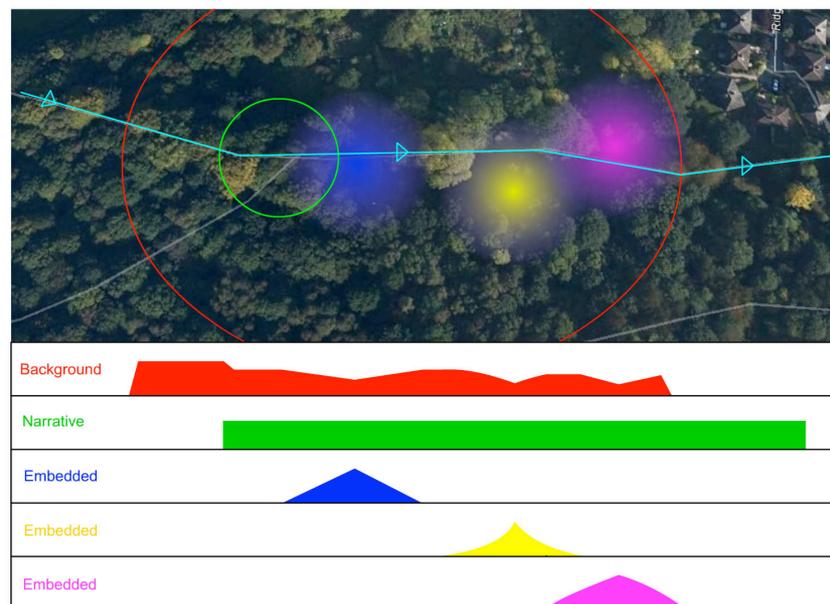
40 Chion, p.73.

A.iv. Background Audio (Non-diegetic)

Background audio provides an ambient layer which may apply to a large geographical area, but does not seem to emanate from, or is not otherwise associated with, a particular source. As ambient audio is what Chion might call 'territory sound', but it may also be music or any other type of sound which underlies or unites a narrative.⁴¹

B. Mixing: Interaction of Audio Components

As the user traverses a locale which is populated by the above components the software will mix them accordingly. The most obvious instance of mixing is the adjustment of the volumes for diegetic, embedded sounds according to the proximity of the user. However, this may also affect the volume of other audio components, particularly that of the background audio, which may be 'ducked' to provide additional headroom for the diegetic sounds to unfold. The below image demonstrates the proposed interaction of layers as a user follows a path (blue) through an environment. Two non-diegetic layers are triggered (background and narrative), alongside three diegetic layers (labelled 'embedded'), which fade in with differing roll-off curves as the user follows the path.



Interaction of layers based on user navigation (indicated by the teal path).

41 Ibid.,p .75.

C. Interface

As has been previously mentioned, the main mode of interaction with LOAM is locative: the app responds to the user's spatial position, and the focus is on the blending of audio with the user's immediate environment. With this in mind, the interface will initially be kept minimal – the app window divided in two, the upper half showing a map with the user's location, the lower half displaying contextual information. In some cases the user may also be able to tap specific areas for further information, but the focus should be on keeping the phone in the user's pocket and allowing them to experience their surroundings alongside the accompanying 'augmented aurality'.

D. Workflows and Third-Party Support

As has been outlined above, systems like *Stories Matter* help to facilitate the transition from the researcher's archive to web presentation and provide new ways of organising and transcribing material. Both *Stories Matter* and *Transana* rely on a database system to organise materials. With the addition of new 'fields' or tags to associate selected interviews or timecodes with geographical coordinates, there is potential to translate the material of such an oral history database directly to a mapping in geolocate audio. One of the intentions of LOAM, beyond the prototyping stage, would be to investigate ways in which researchers can make a straightforward transition from their own research databases to a locative realisation of their work, by essentially tagging their work with geocodes (complex numbers that translate into latitude/longitude coordinates).

One of the easiest ways to create sets of geocoded coordinates is via Google Earth, in which sets of coordinates can be defined and exported as a KML file.⁴² It is also suggested that developers using the software could use KML and an additional XML-style markup language to define exactly how each point defined in the KML behaves in terms of the audio components detailed above.

⁴² KML (Keyhole Markup Language) is an XML standard for geographic notation.

E. Context & Distribution

It is proposed that LOAM could ultimately be offered in three different 'flavours' depending on the context in which it will be employed:

LOAM Player

LOAM player would be a standalone app which could be directed to, or bundled with, a KML file and associated audio media. This would allow users to easily create LOAM applications by dragging and dropping files into the LOAM player and distributing them online.

LOAM Libs

A set of Open Source libraries for coders to use to develop their own apps or to extending the core functionalities of LOAM.

LOAM Bespoke

App development work carried out between developers and organisations to create unique apps based on the LOAM architecture. This would encompass all in one sound production, transcription, editing, programming and distribution solution.

II.ii. Development Environments

At present there are two dominant platforms for mobile computing: Google's Android OS and Apple's iOS. There are a number of methods of developing for these platforms, the dominant mode of development employing the Java or C# programming languages and using a coding environment like Eclipse (for Android applications) or XCode (for iOS applications).

A number of higher-level programming languages and development environments are also capable of exporting apps, such as the games development environment Unity and Processing (a programming language for graphics). A number of platforms were investigated prior to developmental work on LOAM-related materials commencing.

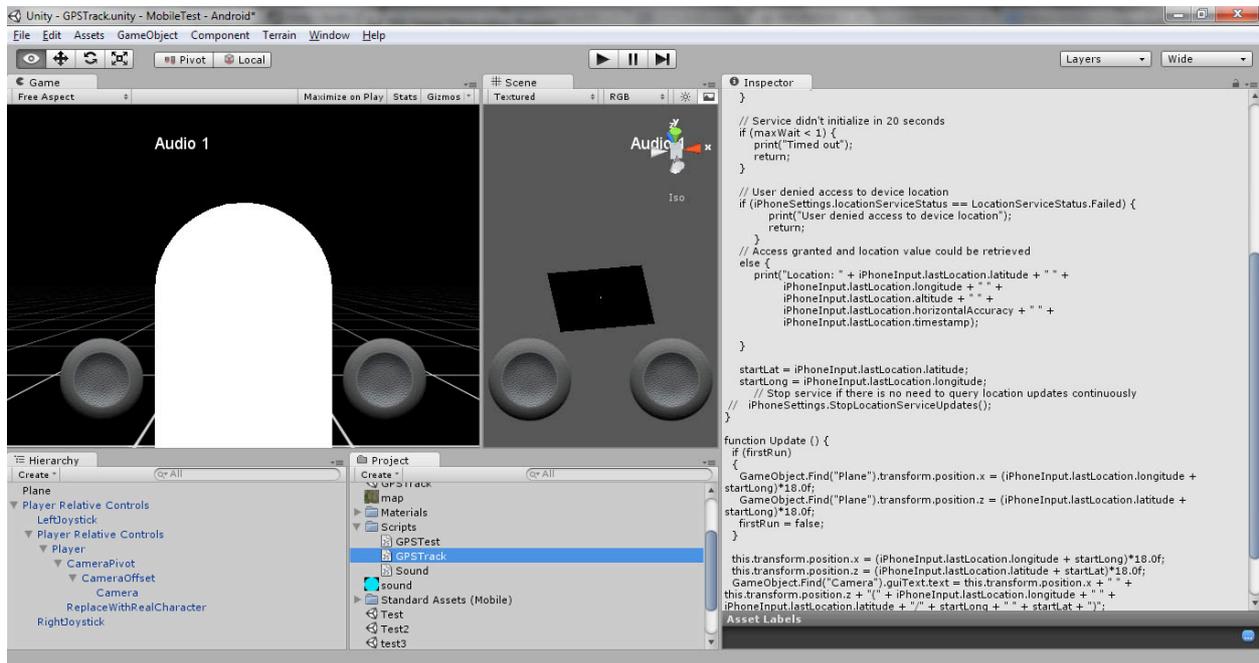
Unity

Unity is a cross-platform programming environment geared towards the production of games on desktop, console and mobile platforms. Part of the potential attraction for using Unity was access to a reasonably powerful, virtually spatialised sound environment, based on an abstraction of the FMod audio engine. The Unity environment also makes cross-compiling for iOS and Android platforms a straightforward task, without necessitating the writing of a large volume of additional low-level code.

A prototype application was developed with Unity to test the system in the context of GPS-driven locative audio. The system worked reasonably well: GPS data could be captured, translated to 3D coordinates into a Unity scene. The coordinates, and bearings between consecutive coordinates, could be also be mapped onto a virtual avatar within the environment – the result being that the volume of audio virtually embedded in the 3D environment changed in relation to the position of the avatar.

While GPS and other locative methods were very easy to implement in Unity, there was a fundamental flaw in the system which prohibited further development: mobile operating systems are designed to be as efficient and responsive as possible. This means that developers often make it a priority to pause particularly processor-intensive operations when they are not required. In the case of Unity, execution pauses every time the phone screen is switched off. With a demanding 3D game such as may commonly be implemented with Unity, this is understandable, however for a significantly less demanding application that also depends on 'persistence' (e.g. running as a background task while the phone is locked) this is not practical. It is unfortunate that this functionality is fixed at a low level in the Unity interpreter and cannot be overridden even by editing the AndroidManifest.xml file to try and force persistence. The only way to ensure the necessary functionality is to prevent the phone screen from turning its screen off and going into standby – obviously an unacceptable solution which would not only affect user experience, but which would also dramatically impact on the phone battery life – the use of fine-grained GPS itself already draws heavily on the phone's charge, and more use would lead to a frustratingly short experience. Unfortunately as

no suitable workaround was found Unity – originally the first choice - had to be abandoned as a development platform.



Prototyping a locative application in Unity.

Appfurnace

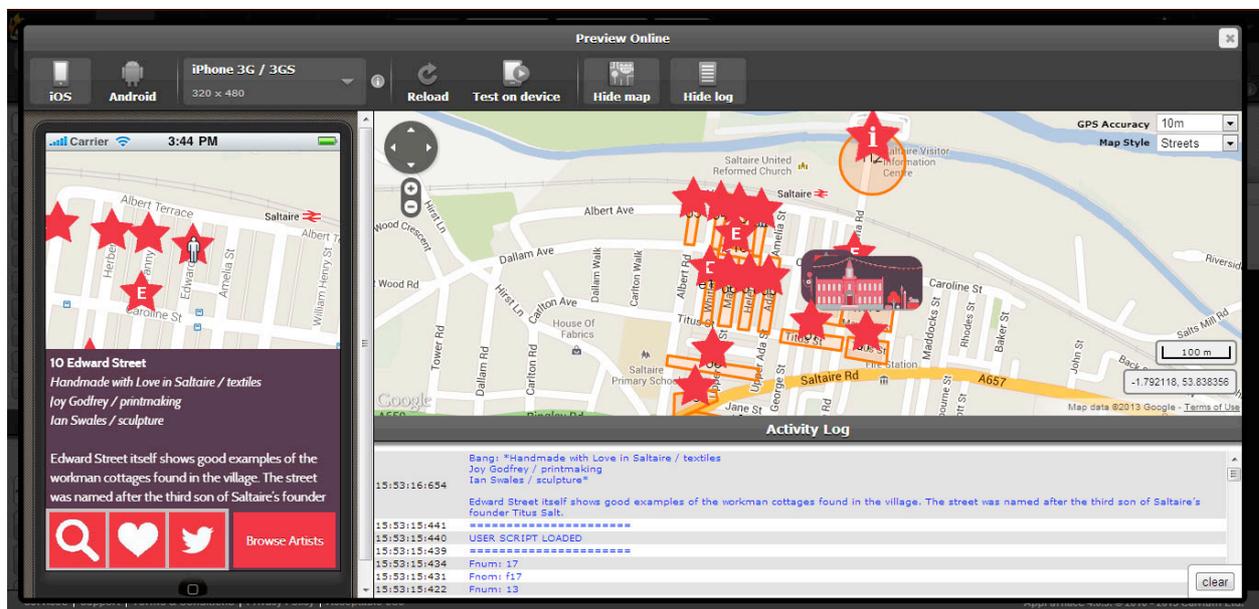
An alternate high-level development environment can be found in Appfurnace, previously mentioned in connection to the Guardian's *Street Stories* app. The development environment for Appfurnace is hosted online, with all files being hosted on Calvium's own servers.⁴³ Apps are written using a variant of Java-script, which is integrated into the Appfurnace API (application programming interface) to allow extended mobile functionality.

While Appfurnace has an attractive and robust environment, there were significant flaws which made it unsuitable for the type of augmented behaviour which LOAM envisions. Once again, there is the issue of the exported apps 'sleeping' when not in use: LOAM would demand a fully persistent app. Additionally the Appfurnace AudioChannel component does not allow random access, panning and so on, which are important to the aesthetics and philosophy underlying LOAM. The platform does not support remote streaming of audio either, which means that users have to download all the supporting files as part of the app

⁴³ See section I.iii, above, for a summary of Appfurnace and Calvium.

package, regardless of whether they will hear them or not. While this approach has the advantage of always having data accessible no matter what the wireless internet signal strength is, LOAM seeks to provide a more 'blended' use of online and offline media.

These shortcomings were something of a shame, since the environment is enjoyable to work in and makes the rapid prototyping of applications a very straightforward affair. There were also additional financial and political disincentives surrounding Appfurnace: publishing apps to both Android and iOS platforms costs £1000, and it would be also difficult to develop the LOAM Player element as an independent production if it heavily relied on Calvium's proprietary technology.



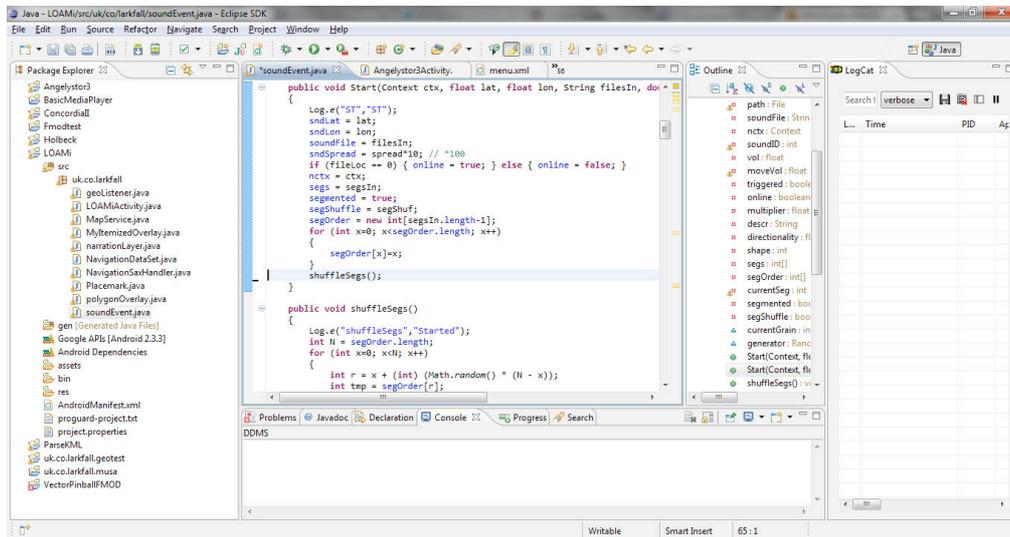
Developing an app in the Appfurnace environment.⁴⁴

Eclipse

Having surveyed the above development tools it became apparent that the app would have to be developed from scratch in a lower-level coding environment. Due to envisaged time constraints, it was decided to develop the prototype software on only one mobile operating system. Android was chosen due to the increasing popularity of the platform and significantly reduced development costs.

⁴⁴ Image from the authors' own work on an app for Saltire Arts Trail 2013.

When prototype development began (early 2012), the Eclipse SDK (Software Development Kit) was a popular choice for Android developers, with seamless support for Google's Android APIs and dedicated Android simulation and debugging. Writing in 2014, Eclipse remains a standard for Android developers, although new environments like IntelliJ's IDEA are gaining in popularity.



Coding in Eclipse Indigo.

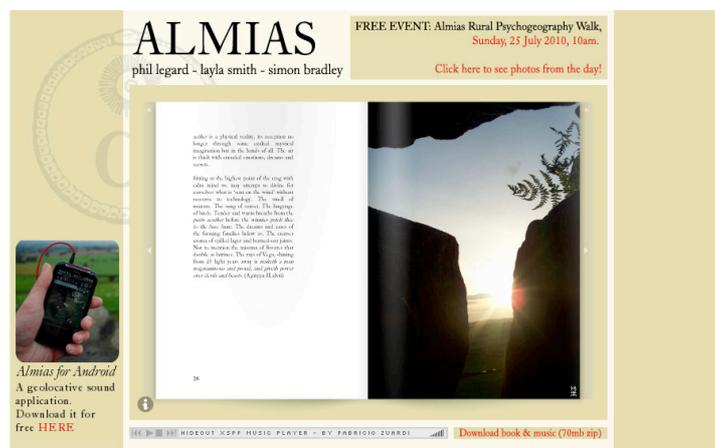
II.iii. Prototypes

The development of the LOAM application was supported by a series of prototypes, each implementing core areas of functionality, summarised below:

Protoype Name	Genre	Functionalities Developed
<i>Almias</i>	Sonic art/oral history	GPS/mapping, embedded audio, cloud audio, offline sound playback, pop-up text info
<i>Holbeck Audiowalk</i>	Sonic art/oral history	Graphic overlays, on-screen route information, narrative layer audio, online sound playback
<i>Concordia Displaced</i>	Sonic art/oral history	Background audio layer, online/offline hybrid delivery
<i>Angelystor</i>	Sonic art	User interface, dynamic audio location, rolloff curves, panning,
<i>KMLTest</i>	N/A	Import Google Earth KML data.

Almias

Almias was a multi-media collaboration with Phil Legard, oral historian Simon Bradley and photographer Layla Smith for the Harrogate International Festival Fringe in 2010. The outputs included an e-book blending writing of the 'psychogeographic' genre with oral history and photography, alongside fifty minutes of music recorded by the collaborators on location and produced by Phil Legard. The publication was also supported by an event in the form of a semi-structured 'rural psychogeography' walk.



Almias website (www.almias.org.uk)

Having strong connections with 'place', oral history and experimental music, *Almias* was a rich project with which project to start exploring some of the fundamental functionalities for LOAM.

To create a 'locative' version of *Almias*, it was decided to embed the music tracks in areas of the crag itself. These areas would also overlap, so that while walking around the environment, the pieces fade in and out of one another. 'Cloud audio' was also created from the original oral history interview and embedded in relevant locations, such as the surrounding fields.



The distribution of virtually embedded audio (as purple circles) and cloud audio (as blue circles) around the environment of Almscliffe Crag.

The volume of the music or voice is dependent on the distance of the user from the centre. The sound propagates as a sphere, and the roll-off is linearly computed.

The musical tracks are instantiated using the first iteration of LOAM's soundEvent class. An example construction in Java being:

```
theSound[0] = new soundEvent();
theSound[0].Start(this, 53.936675f, -1.592439f, R.raw.almias01, 0.08);
```

soundEvent has no default constructor, initialisation being carried out in the Start(context, latitude, longitude, audio resource, sound spread) function. This is so that they can potentially be used analogously to a set series of sound-channels, being relocated around the user through repeated calls to the Start() function.

The cloud audio (see section II.i.A above) was further developed to support multiple modes of re-assembling the cloud material. Each 'cloud' consists of three individual channels, which can play back the narrative extract using one of eight modes:

Forward progression (move between grains sequentially: a, b, c, d)
 Reverse progression (move between grains sequentially, in reverse: d, c, b, a)
 Random selection (play one grain, then skip to another random grain: c, b, a, d)
 Forward Hop (play one grain, skip the next in series, play the one that follows: a, c, e, g)
 Reverse Hop (play one grain, skip the previous in series, play the one prior to that: g, e, c, a)
 Stutter (pick a grain, during playback randomly skip backward a small amount of time, up to 0.5 seconds)
 Brownian stutter (pick a grain, randomly skip backward and forward a small amount of time, up to 0.5 seconds)
 Explode (pick a grain, for a variable duration choose random short slices, up to 0.5 seconds in length and play back)

The above modes can also be switched between – after each grain there is a 10% chance of the cloud switching modes. Channels can also alter their panning for each grain they play, and either act independently of one another, or in imitation of one another. An example constructor for this element would be:

```
theGrain[0] = new grainEvent();
theGrain[0].Start(this, 53.936967f, -1.5936f, R.raw.almiasfarmertv,
                 farmerTVGrains, 0.04);
```

This is somewhat similar to the Start() function of soundEvent, but also requires an array that defines the position and length of each 'grain' in an audio resource in milliseconds:

```
private int[][] farmerTVGrains = { {0,3741},
                                   {3741,8961},
                                   {8961,14303},
                                   {14303,17923},
                                   [...] };
```

The *Almias* app was published on the Google Play website on the 21 July 2012.⁴⁵

45 Downloadable from www.almias.org.uk. See business plan appendix A for press release.



Still image from a video demonstration of the app.⁴⁶

Holbeck Audiowalk

The original *Holbeck Audiowalk* was created by Simon Bradley in 2010, using a collage of oral history interviews and field recordings. It had been distributed primarily as a series of MP3s with a printed map. The audiowalk had also been previously presented as a guided walk (in which attendees carried MP3 players) and a version for the *Layar* augmented reality system on iPhone was also implemented as part of Simon's initial exploration into the possibilities of augmented reality and mobile technology.

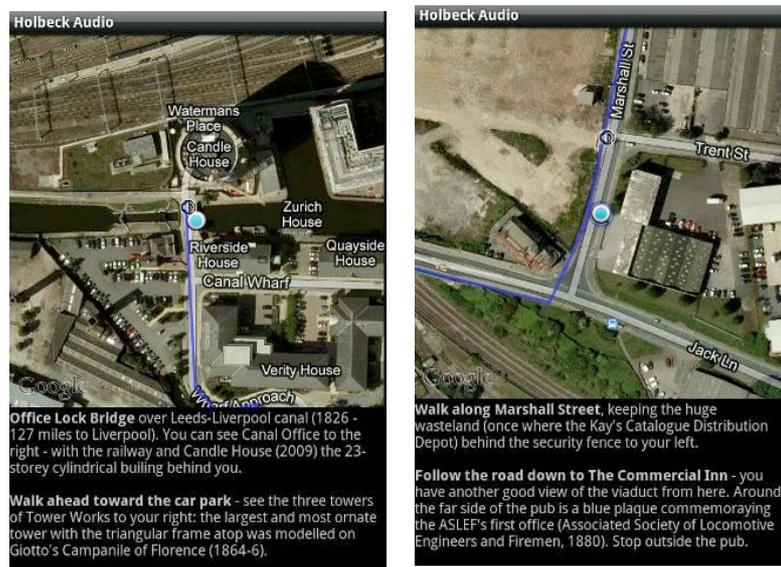
A new *Holbeck Audiowalk* app was developed as a prototype to test the implementation of a 'narrative' layer. The original audio files developed by Simon Bradley were taken and incorporated into an app using the developing LOAM libraries. As explained above, in the context of the LOAM environment a narrative conceptually floats 'above' any virtually embedded sounds. A narrative track begins when the user enters an area, and ends either when the associated audio has played through once, or when it is interrupted by another narrative zone being reached. The construction of the narrative layer looks like this:

46 Viewable at http://www.youtube.com/watch?v=yZBQ5_qyY6Y

```
narrationLayer narLayer = new narrationLayer();
narLayer.Start(this, narrationLocs, narrationRanges,
narrationSets,narrationFiles,STREAMING);
```

Where the various arguments given are arrays containing information about each narrative point: the longitude and latitude; the distance the user needs to be from them to 'trigger' them; a set of unique IDs for each element (used internally); and a list of either URLs or Android resource IDs for each sound used in the narrative layer. The narrative audio can also be set to STREAMING (e.g. online, accessed through the phone's wi-fi connection) or LOCAL (e.g. hosted on the phone itself).

The app also implemented a graphical overlay, showing the route of the walk, along with a text area at the bottom of the screen that contains directions and additional information about what is in the user's immediate location.



Images from the Holbeck Audiowalk app.

In *Almias*, all the associated audio files *were* bundled with the app itself, creating a package of around 50mb. For *Holbeck Audiowalk* the audio is delivered by streaming online soundfiles, hosted on the almias.org.uk server. As a result, the app size is only 43k. In *Holbeck Audio Walk* there is only ever one file playing at a time: it makes sense for the

narrative elements to be stored online, and any embedded elements to be stored offline. Sufficient bandwidth should be available on most mobile devices to facilitate uninterrupted streaming.

The development of both *Almias* and *Holbeck Audiowalk* also prompted some considerations about the limitations of locative technology in rural and urban contexts, as I wrote in my blog on June 12, 2013:

“It’s incredible how much perception of a place can be affected by variation in the positioning of the locative media (in this case audio files) and how the development of locative experiences needs to embrace a number of uncertainties largely associated with the accuracy of GPS. As I found when testing *Almias*, there is a tendency to underestimate the size that zones should occupy: while using digital maps to constructing the underlying data it is tempting to try and work as accurately as possible, blissfully unaware that either the GPS location may be a number of meters off from your finely chosen locus, or that things on the ground can be perceived very differently from how they appear on the map. The map is certainly not the territory and there is no substitute for working out in the field itself.”⁴⁷

Aside from the perceptual element, urban and rural environments also effect the technology in more practical ways. The performance of both wireless Internet and GPS was found to vary most in the urban environment. In an urban setting, the reflections of tall buildings can make it difficult for the GPS to locate the user in particularly built up areas. Similarly, wireless internet bandwidth can also be degraded when the system is under particularly heavy use – again, particularly in built-up office areas.

The *Holbeck Audiowalk* begins in a heavily redeveloped area, next to Candle House, home to many new 'professional' apartments and new media offices. The two aforementioned problems both seem to play a part in making the app often pause at the start, as it tries to both find the GPS and to buffer the audio from the web. A future revision of the app will therefore

47 Phil Legard. 'Known Unknowns' in *Larkfall* (blog), 06/12/12. Online at: <http://larkfall.wordpress.com/2012/06/12/known-unknowns/>. Visited 16/05/14.

see that the first audio file is hosted locally. Such a revision may also 'fake' the user's location until a true GPS connection has been made in order to create a smoother user experience.

Holbeck Audiowalk was published in January 2013.

Concordia Displaced

The *Concordia Displacement* was a small app made for Simon Bradley's residence at Concordia University. It employed several Holbeck-related sequences of embedded audio, along with the implementation of the 'background audio' layer, which fades in and out depending on the proximity of the user to other sounds. This background layer is hosted offline, while the sounds (of which no more than two layers ever overlap) are streamed from an online source. The basic constructor for the background audio is:

```
bgAudio = new backgroundAudio();  
bgAudio.Start(this, R.raw.bg, 0.7); // Context, resource ID, max volume
```

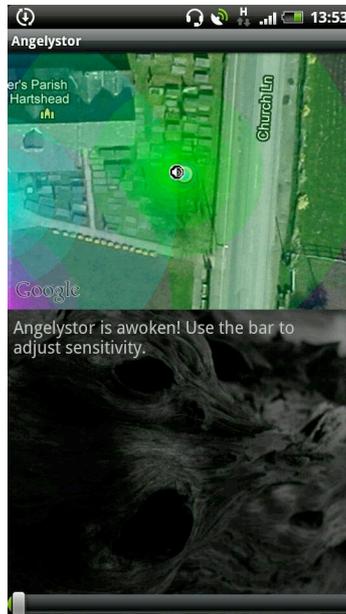
Angelystor

Given that a major thread in Simon Bradley's work relates to 'displacement' in all its forms, it was decided to experiment with the possibility of also creating a 'moveable' piece of locative work by re-mixing and virtually spatialising a 40-minute piece of music called *Angelystor*, composed by myself and inspired by a Welsh churchyard.⁴⁸ The motivation behind this prototype was not only to develop a new piece of locative artwork, but also to extend the user interface and implement the framework for initialising LOAM from a set of customisable variables (e.g. a user-defined map).

The user of *Angelystor* is directed to find any rural churchyard to run the app. A series of screens appear, directing the user to different places in the churchyard (a yew tree, gate, porch and a grave of interest). Each of these locations is tagged and become the 'sources' of the sounds that comprise the piece. The implementation of *Angelystor* also required the

⁴⁸ For the background to this piece, see Phil Legard. 'Composing with Yew Spectres' in Larkfall (blog), 07/12/12. Online at: <http://larkfall.wordpress.com/2012/12/07/composing-with-yew-spectres/> Visited 16/05/14.

additional coding of sound rolloff curves (which were linear only until this point) and panning, based on calculating the user's trajectory and then adjusting the left-right balance of the audio appropriately. *Angelystor* was published on the 4th of March 2013 for the *Uncanny Landscapes* conference at Royal Holloway University.



Testing the Angelystor app at St. Peter's Church, Hartshead.

ParseKML

The final prototype developed was not published, since it was purely a technical exercise in writing a parser to interpret the KML (Keyhole Markup Language) files generated by Google Earth. The prototype interprets geopoints (e.g. co-ordinates) and will also draw polygons and paths based on multiple geopoints. This implements several new classes such as navigationDataSet, an XML interpreter with KML extensions and a dynamic polygon overlay. This enables complex shapes to be constructed using Google Earth and then exporting to a KML file.



A sample KML file interpreted by the prototype, showing a polygon (purple), two paths, and two geopoints (marked by icons).

It is necessary to be able to interpret KML to open up the possibility of LOAM being used by a less specialist user-group who are not programmers. This means that users will eventually be able to create entire LOAM experiences using Google Maps along with a supplementary 'markup' language for dictating exactly how each point behaves.

III. LOAM: A Platform for Locative Audio and Oral History

III.i. Technical Scope of the LOAM Prototype

LOAM integrates the various functionalities developed in the prototypical pieces of software, alongside the core functionalities detailed in the prior technical specification (section II.i, above).

The technical specification also mentions three projected distributions of LOAM: *Player*, *Libs* and *Bespoke*. However, within the constraints of this project, only the LOAM Player has been prototyped. The release of *LOAM Libs* could be made possible once the code has been standardised, but remains an area beyond the immediate scope of the proof-of-concept with which this project concerns itself. *LOAM Bespoke* embraces a business model and would be supported by LOAM Libs as a keystone technology. Again, such a development lies outside the scope of the immediate project, but is summarised in the accompanying business plan.

The technical scope prototypical LOAM player may be outlined thus:

- 1) It integrates all functionalities developed in prototype apps;
- 2) It allows a non-technical user to create a locative audio experience using Google Earth and LOAMXML.

The first of these areas has been covered in some detail in the preceding section. The second area relates to how non-technical developers may use the system to create locative application. As previously mentioned, the mechanic here relies on LOAM being able to interpret KML files.

The KML specification allows users to encode geospatial data within a text file. It is the standard of the Open Geospatial Consortium and most often edited using the Google Earth

software.⁴⁹ A KML file generally includes a series of <Placemark> tags with associated latitude and longitude co-ordinates and other descriptive data.

In order to create a meaningful locative experience, however, the KML language needs to be supplemented by a further set of tags (LOAMXML) that will enable a developer to specify what audio is associated with a given point, how it behaves and so on. An example of LOAMXML in the context of a KML file is shown below, although developers would primarily make use of Google Earth to provide a graphical approach to developing KML markup:

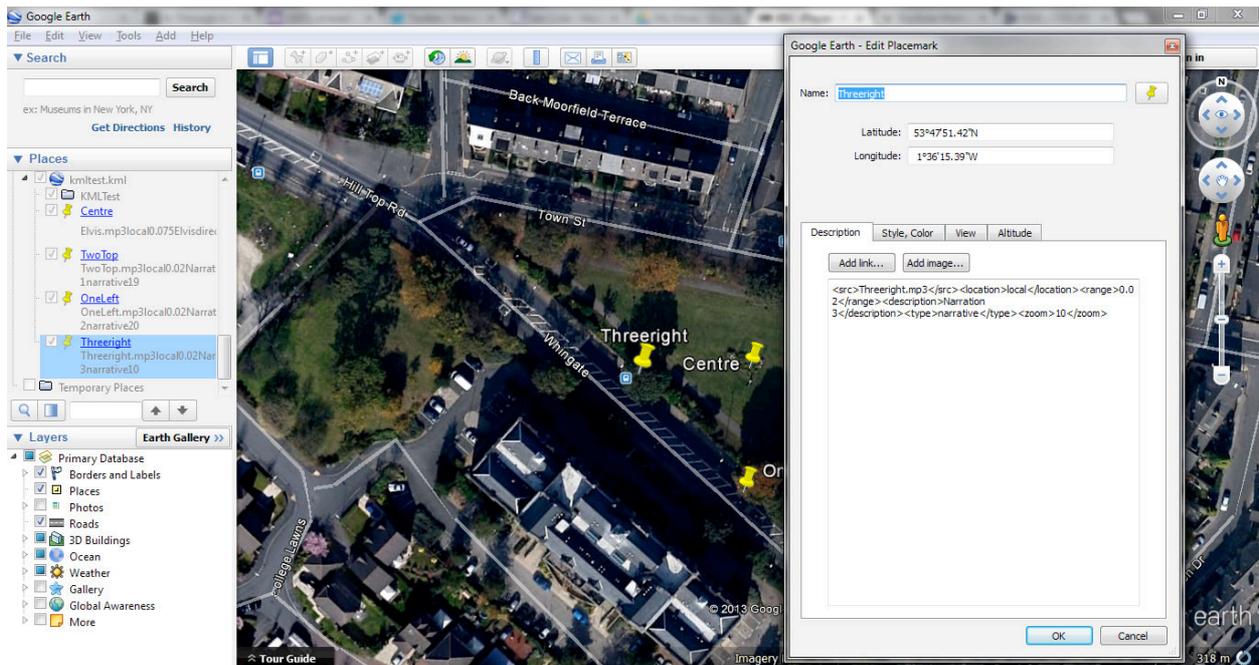
```
<Placemark>
  <name>Narrative 2</name>
  <description><![CDATA[<src>narr2.mp3</src><location>local
</location><range>0.025</range><description>Narration
  2</description><type>narrative</type><popup>Hello!
  </popup><zoom>19</zoom>]]>
</description>
<LookAt>
  <longitude>-1.546340252889989</longitude>
  <latitude>53.84241885458892</latitude>
  <altitude>0</altitude>
  <heading>-0.0005681642722206331</heading>
  <tilt>35.47532377945922</tilt>
  <range>174.8180864680167</range>

<gx:altitudeMode>relativeToSeaFloor</gx:altitudeMode>
  </LookAt>
  <styleUrl>#m_ylw-pushpin00</styleUrl>
  <Point>
    <coordinates>-1.547073004126607,
      53.84230669576879,0</coordinates>
  </Point>
</Placemark>
```

49 A technical overview of KML can be found on the OGC website:
<http://www.opengeospatial.org/standards/kml/> (Visited 16/05/14)

III.ii. The LOAMXML specification

As indicated above, LOAMXML can be embedded in the KML <description> tag to create associations between KML Placemarks and audio in the LOAM Player. This can be done easily in Google Earth as part of the process of creating a new Placemark:



Adding a LOAMXML specification to a Placemark description in Google Earth.

To work with the prototype LOAM Player, the finished KML file along with any audio media should be into a directory named 'loam' (lowercase) on the target phone's SD card.

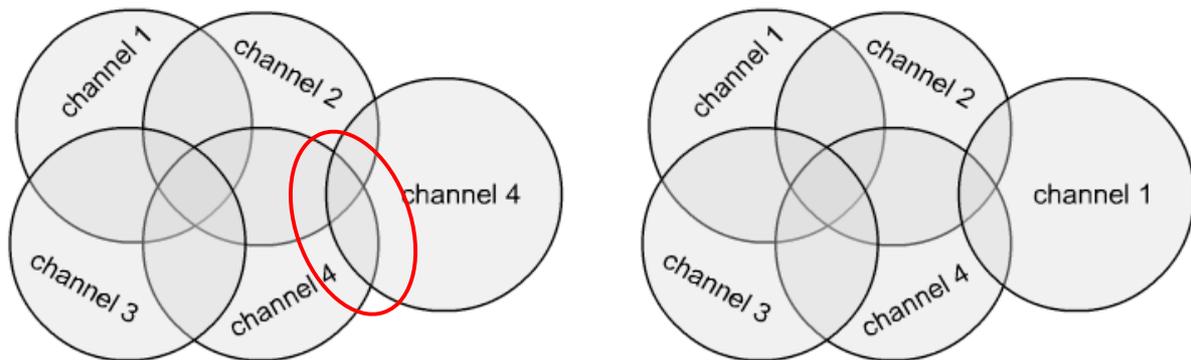
The preliminary specification of LOAMXML is tabulated below:

Tag	Description	Default Value
<src>	Audio source file (.mp3 or .ogg) Ex: <src>sound1.mp3</src>	null
<range>	Audible propagation range (kilometers) Ex: <range>0.025</range>	0.03
<location>	Source file location: remote (online), local (offline) Ex: <location>remote</location>	local
<type>	environment, narrative, background Ex: <type>narrative</type>	environment

<channel>	0-4 (environment), 5 (narrative), 6 (background) Ex: <channel>1</channel>	0
<spread>	Directionality of sound spread – from 0.0 (non-directional) to 1.0 (highly directional) Ex: <spread>0.75</spread>	1
<rolloff>	Rolloff factor: 1 – linear, 2 – square, 3 – cubic, and so on. Ex: <rolloff>2</rolloff>	3
<shape>	Sound propagation shape: sphere or 'henge'. A henge creates a 'band' of sound around a Placemark rather than a spherical propagation from the centre. Ex: <shape>henge</shape>	sphere
<description>	Contextual description to display in lower half of app window. Ex: <description>Welcome to the walk!</description>	null
<popup>	Message to display when the point is tapped on screen. Ex: <popup>Interview conducted 12/07/13</popup>	null
<zoom>	Map zoom level (larger number = closer zoom) Ex: <zoom>12</zoom>	17
<segs>	Create 'clouds' by dividing the audio up into millisecond segments (grains). Ex: <segs>0, 13000, 24000,32000</segs> This will randomly choose from the following segments: Segment 1 0 - 13 seconds Segment 2 13 - 24 seconds Segment 3 24 - 32 seconds	null
<seg-shuffle>	Where <segs> is invoked, the segments will be chosen randomly with the possibility of repetitions. By enabling seg-shuffle the segments will be 'shuffled' into a random order with no repeats, and then re-shuffled once they have all been played. Ex: <seg-shuffle>>true</seg-shuffle>	FALSE
<visible>	Each placemark in LOAM has a shaded area surrounding it. This can be disabled with the visible tag. Ex: <visible>>false</visible>	TRUE
<inqscribe-desc>	Time-coded transcriptions can be used with LOAM in a similar style to those used in Inqscribe and other transcription systems. This tag will transfer a time-coded transcription to a placemark's description. Ex: <inqscribe-desc>(00:00:00.00) this is number one \r\r(00:00:57.24) this is number 2\r\r(00:02:27.08) this is number 3\r\r (00:03:30.00)</inqscribe-desc>	null

<inqscribe-pop>	Similar to the inqscribe-desc tag, but this will transfer a time-coded transcription to a placemark's popup.	null
<inqscribe-segs>	Create a 'cloud' based on time-coded segments in a transcription.	null

To conserve system resources, LOAM Player assigns four audio channels for playing embedded sounds. When defining a locative experience using LOAMXML the developer



must ensure that propagation areas of the same channel do not overlap, for example:

Two proposed sets of Placemarks with overlapping audio zones.

The leftmost will cause a conflict on audio channel 4 in the highlighted area.

The rightmost will play as intended since there are no conflicts on channel 1.

There are two more channels, not accessible via LOAMXML:

Channel 5 - automatically assigned to any narrative sound.

Channel 6 - automatically assigned to any background audio.

With regard to the <description> tag, which forces contextual descriptions to appear at the bottom of the phone's screen: any description applied to the narration layer will always take precedence over environmental audio descriptions.

The following snippets demonstrate the use of LOAMXML within a Placemark description:

An online environmental sound

```
<src>http://www.almias.org.uk/Angelystor/sine1.mp3</src><location>remote</location>
<range>0.025</range><description>Sine wave 1</description><channel>0</channel>
```

A locally hosted environmental sound

```
<src>sounds/sine2.mp3</src><location>local</location><range>0.025</range><description>Sine wave 2</description><channel>1</channel>
```

An online narrative sound

```
<src>http://www.almias.org.uk/Angelystor/sine3.mp3</src><type>narrative</type><range>0.05</range><description>Sine wave 3</description>
```

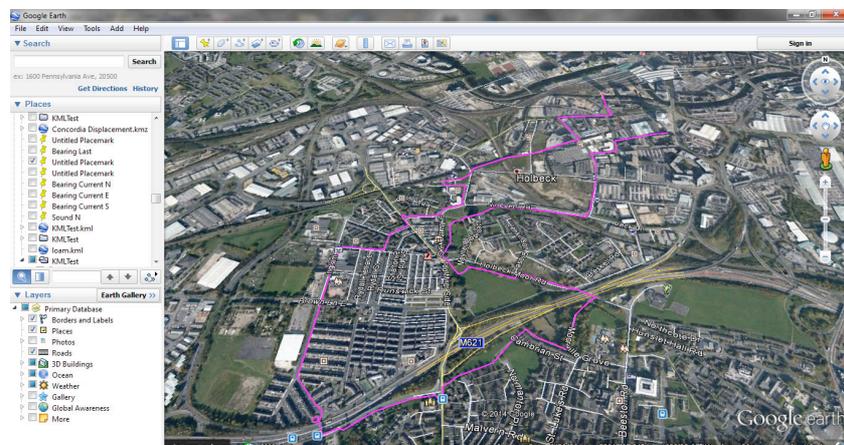
A local file used as background audio

```
<src>sounds/background.mp3</src><location>local</location><type>background</type><range>0.5</range>
```

III.iii. Example Use Case

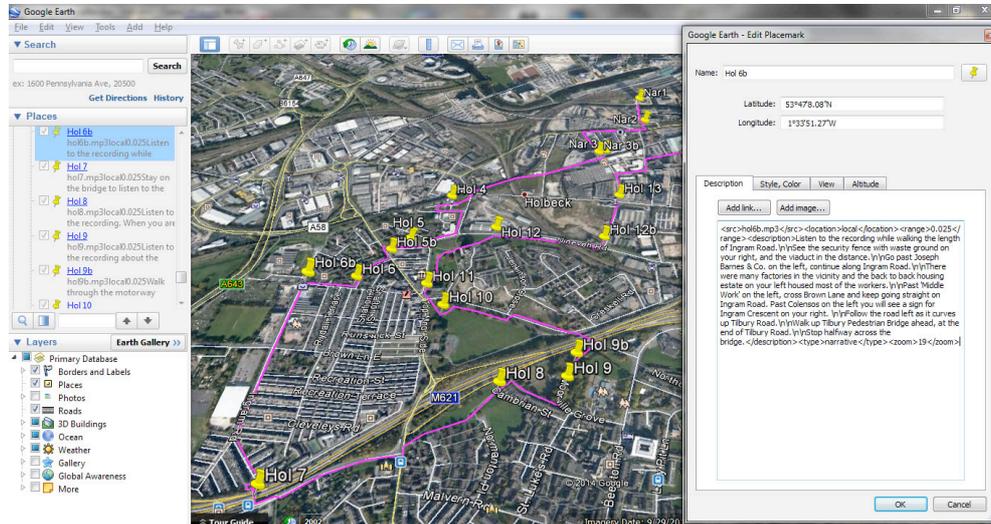
With the prototype LOAM player it should be possible to realise any existing audio walk as a locative audio experience. An example use case is given here, outlining the process of creating a new LOAM-based version of the Holbeck Audio Walk, which extends Simon Bradley's original work by complimenting his fragmented narrative-style approach with a series of embedded ambient soundtracks drawn out of his original work.

Having assembled a series of MP3 files containing both narratives and ambient sound, the process of developing them into a LOAM app was straightforward. Using Simon Bradley's original map of the walk, a route could be plotted using Google Earth's Path tool.



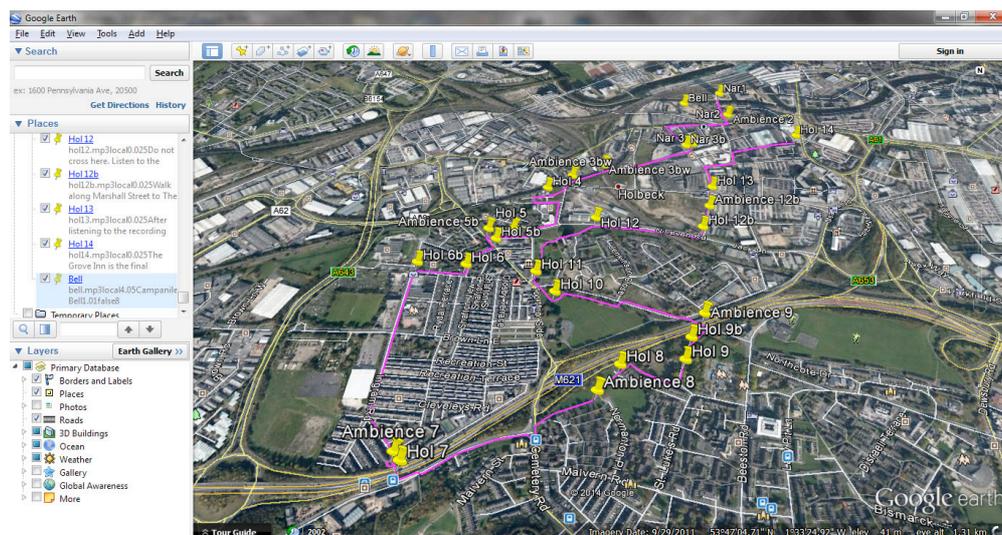
Plotting the path of Holbeck Audio Walk within Google Earth.

This route can then be populated by narratives, using Google Earth's Placemark feature. LOAM XML could be appended to each placemark to reference the appropriate audio files, declare their 'range' and provide descriptions (adapted from Bradley's original map):



Populating the path with narratives geopoins, referenced via LOAMXML.

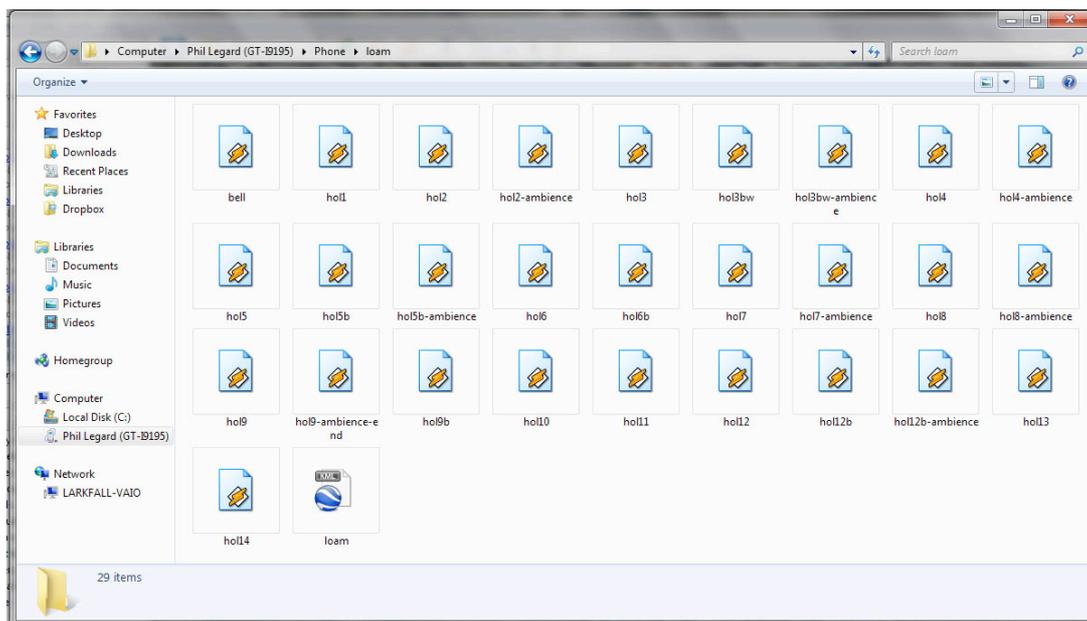
At this stage, the implementation is comparable to the original *Holbeck Audio Walk* app, which solely relied on LOAM's narrative layer. However, for this implementation a series of additional ambiances were developed from sections of Bradley's work, which take advantage of the non-linear or fragmented idea by occurring asynchronously, or independently, of the narrative, as well as using features such as LOAM's `<segs>` for random access playback.



Augmenting the narratives with additional ambient sound areas.

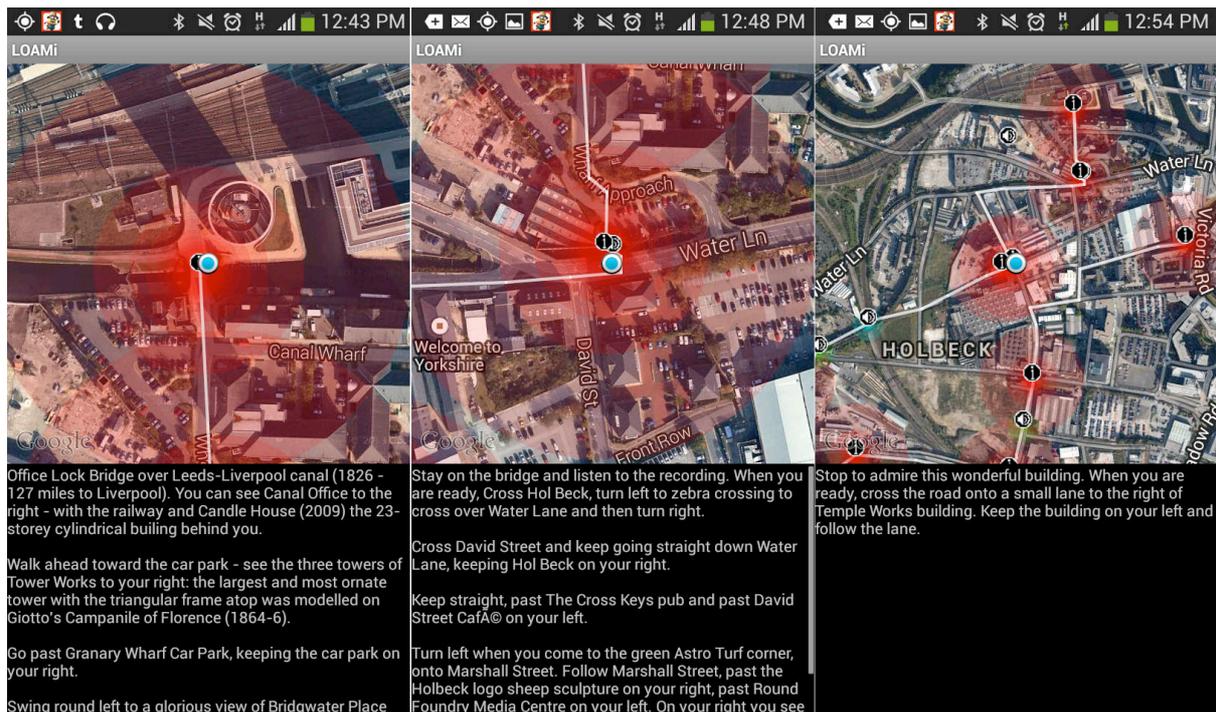
Following a discussion with Simon Bradley about his plans for future locative work in the Holbeck area, he articulated a desire that the 'Campanile' bell, a motif throughout the original work, should be audible throughout the experience, its location and loudness varying depending on the user's relation to it. This was realised by embedding a sound with a 2.5km range and a cubic rolloff curve.

The final step is to save the KML data from Google Earth and bring the MP3 and KML files together in the *loam* directory on the mobile phone's internal storage:



The audio and KML files used for the LOAM realisation of Holbeck Audio Walk.

Having brought all the files together, the development is complete. The final stage is to visit the location and run the LOAM player app. Once the GPS has managed to locate the phone, the app will begin to deliver any audio tagged to nearby placemarks, as well as present the descriptions associated with each narrative in the lower half of the screen:



The walk in progress in the LOAM app.

As can probably be inferred, once the basics of LOAM XML are grasped, the development of an application for LOAM player is fairly straightforward. It should be stressed that, while LOAM has been developed with ideas like 'fragmented narrative' in mind, such an approach is up to the individual oral historian, composer or artist, depending on their aesthetic. LOAM XML tags like <segs> and the ambient layers enable potentially rich auditory scenes to be developed, but would necessitate planning from the early stages of the work. In this respect, while the LOAM implementation of Holbeck Audio Walk demonstrates the fundamentals of the system, it should be taken as a 'proof of concept' only, given that the scope of this project precludes the development of a bespoke locative audio oral-historical composition solely to demonstrate the LOAM player.

III.iv. Evaluation

The decision to approach development of LOAM through a series of prototypes enabled me to share the developing work in both academic and public forums. *Almias* and *Holbeck Audio Walk* were promoted, alongside discussions of the proposed LOAM system, in several

conference sessions throughout 2012-13.⁵⁰ Generally response from the academic community has been positive and enthusiastic, yielding lively discussions and valuable contacts. Historians and sonic artists could both see the relevance to, and across, their respective fields, as well as applications beyond the two disciplines that Simon Bradley and I traditionally focus upon. Following the paper at the Sonic Arts Forum, Ian Cole (York University) independently tested out the *Almias* app and later commented positively on both the sound and technology involved.⁵¹

In the public sphere, the *Almias* app was launched as part of the 2012 Harrogate International Festival Fringe, while the *Holbeck Audio Walk* was covered in a half-page feature in the *Yorkshire Evening Post*.⁵² Following this coverage, expressions of interest in similar projects have been received from the Friends of Roundhay Park, Temple Works, NTI and Harewood House.⁵³ Most of these expressions of interest relate to public heritage concerns, although the Harewood House inquiry also reflects the interest the Harewood Estate obviously has with regard to new technologies for artistic and historical interpretation, which can be seen, for example, in their commission of Susan Collins' *Excavation*: an animated film composed from still-photographs, which can be viewed via mobile phone as part of the experience of 'medieval Harewood'.⁵⁴

50 Simon Bradley & Phil Legard. 2012. 'Located Memory and the Realisation of Place' presented at *Spaces of (dis)Location*, Glasgow University, Glasgow, 23-24 May 2012; Bradley & Legard. 'An Archaeology of the Voice: Location and Audition' presented at *Sonic Arts Forum*, Leeds University, Leeds, 7 July 2012; Phil Legard. 2013. 'Stop, Look, Listen & Think: Embodied Sound and Our Environment' presented at *Network Music Festival*, Birmingham. 23-25 February 2013.

51 Personal communication, 2013.

52 Bellamy, Alison. 2013. 'Rich history of Leeds suburb can be heard on latest app for gadgets', in *Yorkshire Evening Post*, 10 January 2013.

53 Personal communications with John Ferguson, Reinhold Behringer, Andrew Raby and David Lascelles respectively.

54 Harewood Estate. 2012. Harewood's new exhibition season launches with a Private View and Summer Party in Harewood Church, House and Grounds. Online at: <http://harewood.org/about/blog/news/harewoods-new-exhibition-season-launches-with-a-private-view-and-summer-party-in-harewood-church-house-and-grounds/>. Visited 16/05/14.



Phil Legard & Simon Bradley, from the Yorkshire Evening Post article.

The present prototype of LOAM Player enables a user to create a locative audio experience with little more than an Android phone, some sound-editing software and Google Earth. The basic functionality for creating virtually-embedded presentation of oral history and audio material can be said to be present. However, several areas present themselves for development in order to improve the performance of the app itself and as well as its usefulness to prospective developers.

Most pressing from an oral history perspective is to develop methodologies to support existing oral history databases, such as the aforementioned *Transana* and *Stories Matter*. This will involve setting up a mechanism to tag either interview records, or transcripts themselves with geospatial data. An XML file tagged in such a way, along with the original interview files, suggests many ways in which the original recordings could then be interpreted as part of a creative presentation of oral history material (ethical concerns permitting).

From the audio perspective, it is apparent that LOAM is lacking in some respects, relying as it currently does on the Android API's basic media player as the fundamental audio playback technology. To make the software more streamlined and appealing to the wider mobile audio community it is suggested that a future version strip out Android media player in favour of an audio component implemented with LibPD, an Android and iOS embeddable version of the PureData audio processing and synthesis software.⁵⁵ This would also make the implementation of further 'immersive' approaches to audio, such as realtime pseudo-HRTF

⁵⁵ Online at <https://github.com/libpd> (Visited 16/05/14)

(Head-related transfer function) a possibility. HRTF simulates the way that spatialised sounds arrive in the ears at different times (milliseconds apart) depending on the orientation of the listener.⁵⁶

Such a shift from the specifics of Android to a portable audio component in LibPD would also be an important step towards developing for both Android and iOS, as it could be integrated into a cross-platform development project using an SDK like PhoneGap which now includes a cross-platform 'cloud compiler', making it possible to create iOS apps without using a Mac.⁵⁷

At present the LOAM Player requires the user copies all media files (or at least the KML file if audio is remotely hosted) to their phone's SD Card. With further development I suggest that the basic architecture could be integrated with a 'web community' aspect in which users could upload and share their locative audio works. A user could then run an app, see what LOAM experiences had been created in their immediate area and download the necessary files over a wireless connection. This means that a user would not necessarily have to know in advance that a specific place has an associated locative audio project, but can discover them through an app and online community. This would also behave as a centralised repository for all projects developed with LOAM, and could possibly be streamed or even 'monetised' in some way.⁵⁸

While Google Earth provides a fairly straightforward way to create KML files, users still need to have some knowledge of the LOAMXML specification to create their own projects. It would be helpful to the non-technical target audience of LOAM, and fairly straightforward also, to create a more intuitive interface for developing hybrid KML-LOAMXML files through the use of the Google Maps API. This means that a programmer can integrate data from Google Maps into a new application (for example a web interface) into a web-based interface and therefore extend the functionality to include not just the creation of Placemarks,

56 For an overview and references, see Richard Duda. 2000. *3-D Audio for HCI*. Online at: <http://interface.idav.ucdavis.edu/sound/tutorial/>. Accessed 12/07/13.

57 See <http://phonegap.com/> (Visited 16/05/14)

58 See the associated business plan for an elaboration on these ideas in terms of a startup enterprise.

Paths and Polygons but also provide a graphical interface that would automatically generate LOAMXML based on a series of tick boxes, text input fields or drop-down menus.

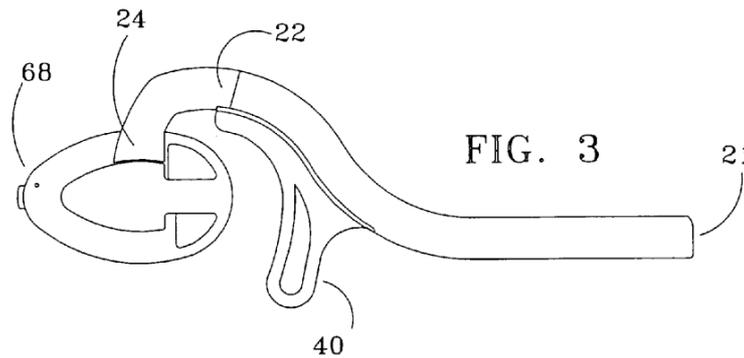
Additional future developments should also be able to address changes in the environment: planning alternative routes or allowing users to 'grab' Placemarks that may have become inaccessible due to environmental changes. Developments in headphone technology should also be carefully monitored to advance the quality of aural augmentation and the illusion that augmented audio events share the same space as 'actual', ambient sounds. Binaural recording techniques have been used for some time (pioneered for example by Janet Cardiff), but new technologies such as DTS Headphone:X are allowing surround sound mixes to be encoded to virtual 11.1 audio deliverable on regular headphones.⁵⁹ This potentially broadens the creative possibilities for the use of sound in locative contexts.

A fundamental problem with delivery over headphones is that they filter out much of the higher frequency content of the environment which a locative audio project seeks to augment. The most simple workaround would be to create binaural field recordings of the environments to use as background ambience, but this has problems: more audio data to store, and the potential for wearying repetition if small recordings are looped. A hardware solution may take two forms. First, a low-tech solution: use as poorly insulated headphones as possible (although the knock-on effect is that poorly insulated headphones are poor quality, and thus usually have poor sound reproduction), or alternatively use collapsible headphones with ear-pads that can be rotated to let in more of the external environment, such as Sennheiser HD 218s.

A high-tech solution would involve the development of specialised headphones. A US patent document submitted by Glen T. Poss outlines schematics for a pair of headphones that allow ambient noise to enter the ear canal alongside sound generated by headset speakers.⁶⁰

59 For an overview see: DTS Inc. 2014. *DTS Headphone:X*. Online at: <http://www.dts.com/professionals/sound-technologies/headphonex.aspx>. Visited 16/15/14. An audio demonstration of Headphone:X can be found here: <http://www.youtube.com/watch?v=m7IaEu-maCw> (Visited 16/05/14)

60 Glen T. Poss. 2008. *Head Set Speaker and Stereo Playing Device*. Patent No. US 7,426,282 B1. Online at: <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahhtml%2FPTO%2Fsearch->



A figure from Goss' patent, showing a headphone speaker enclosure and band, with aperture to allow ambient sound.

Another high-tech approach that allows ambient sounds to fuse with augmented audio could be proposed through the use of the bone-conduction transducer technology recently employed to relay sound with Google Glass.⁶¹

However, considering the inclusiveness traditionally upheld by oral historians and also vital to the philosophy underlying this project, it may be advisable to keep the technology as accessible and democratic as possible. While new hardware may be embraced, backwards-compatibility with our dependable earbud, earpad and over-ear headphones should always be ensured.

As an exploratory academic project at masters level, it is acknowledged that the prototyping of LOAM and associated applications has only been able to go *so far*. Yet, the positive reception that these experiments have garnered from academic and public communities indicates that there is potential in these ideas that would justify further research, funding or business development. Halsey Burgund, developer of Roundware, mentioned that his own software often fires the enthusiasm of artists, educators and institutions, but, embracing the

<http://www.androidcentral.com/google-details-glass-specifications-bone-conduction-audio-12gb-usable-storage-full-day-typical-use-b> (Visited 16/05/14)

61 For Google Glass specifications, see Jerry Hildenbrand. 2013. 'Google Details Glass Specifications' in AndroidCentral (16/04/13). Online at: <http://www.androidcentral.com/google-details-glass-specifications-bone-conduction-audio-12gb-usable-storage-full-day-typical-use-b>. Visited 16/05/14. Further technical information can be found in Bruce N. Walker. 2007. 'High Fidelity Modelling and Experimental Evaluation of Binaural Bone Conduction Communication Devices', paper from *Proceedings of the 19th International Congress on Acoustics*, Madrid, 2-7 September 2007.

Open Source philosophy as he does means he encounters the problems of developing on a very tight budget. In his case, development is largely supported by commissions for artworks using his system.⁶² Therefore, even without attendant funding for an enterprise, any expressions of interest from potential collaborators may be considered as opportunities to fund platform development and extend LOAM beyond the basic prototype.

The prototype meets the specifications laid out in part II of this report, and as such supports the construction of locative experiences that are sympathetic to an emergent 'fragmented' or 'database' approach to narrative. However, this is largely down to the aesthetic sense of the individual producer, researcher or curator. LOAM is flexible enough to allow the construction of a very traditional audio walk (for example in the vein of *Holbeck Audio Walk*, but without the collage-approach to each audio file), as well as more experimental experiences (as in the *Almias* app, with large washes of sound and stochastic delivery of fragmented oral testimony). It is hoped that the sample use-case illustrating the extension of the original Holbeck Audio Walk resources serves to illustrate the potentials of both approaches and encourages any future experimenters with either LOAM or the broader area of locative audio to seriously consider way in which different forms of 'diegetic' augmented audio may be able to augment or accent the presentations of their narratives.

62 Halsey Burgund, interviewed by Eliot Van Buskirk. 2012. *Why the Roundware Open-Source Audio Location Platform Rules*. Online at: <http://evolver.fm/2012/10/17/interview-why-the-roundware-open-source-audio-location-platform-rules/>. (Visited 16/05/14)

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Appendix A: LOAM Info Sheet⁶³



LOAM
Locative Oral/Audio Media

Contact: Phil Legard

Email: phil@larkfall.co.uk

Web: larkfall.wordpress.com/codings/loam

What is Loam?

A free platform for oral historians and sonic artists to develop locative audio experiences on mobile devices. Loam can be used to create multi-layered, immersive audiowalks and sonic environments from a wide range of data sources.

Loam will launch publicly in three 'flavours':

Loam Player – Easily create Loam applications by dragging and dropping files into the Loam player and distributing them online.

Loam Code – Open Source libraries for developing your own apps or extending Loam functionality.

Loam Bespoke – An all in one sound production, transcription, editing, programming and distribution solution.

What can I use to make Loam apps?

You will need files containing geo-coded data alongside well as any text, transcriptions and narrative elements that you wish to include. Loam will eventually support:

XML
KMZ / KML (Google Earth)
Transana Databases *
Stories Matter Databases *

** To use these databases you will need to add to keys to each transcription record containing the decimal latitude and longitude associated with the narrative.*

Loam is primarily a sonic experience, therefore sound files are also necessary: MP3 or FLAC formats are recommended. Files can be hosted virtually, or packaged locally with your Loam app. Sound files can be delivered across four layers depending on their context:

Guide – This layer retains a consistent volume and can be used for voice overs and directions to guide the user.

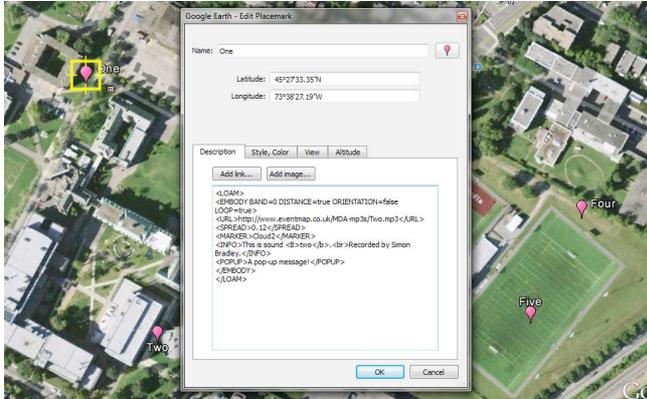
Embedded – Embedded sounds increase and decrease in volume and spatialisation depending on the user's proximity and orientation to them.

Cloud – A 'cloud' is a particular type of embodied sound, which also loops upon and replicates itself into new sonic textures. Clouds can be used to create more experimental interpretations of source audio, or even to create aleatoric soundscapes.

63 Originally distributed to colleagues at Concordia Oral History and Digital Storytelling Centre during Simon Bradley's residency, autumn 2012.

Background – The background layer might contain music or ambient sound – it 'fills in the gaps' and can be made to rise and drop in volume in relation to the other sounds the user is experiencing.

Loam supports its own flexible XML-style definitions, which can be included in descriptors (such as the 'Description' tag of a KML file) in order to construct behaviours:



In this example an 'embodied' sound is created on the Concordia campus. Loam media can be divided into multiple 'bands' reflecting categorical or historical grouping – users can select bands akin to tuning a radio.

Embodied sounds can also be sensitive to distance and orientation. Here 0.12 km area of propagation is here defined for a remotely hosted file. Files may also be held in local (SD card) storage, or even connect to live streams.

Prototypes

As a part of the development of Loam there are currently three prototype applications for Android phones:

Almias – An experimental soundscape sited at Almscliffe Crag, North Yorkshire. Implements Embodied and Cloud layers. See www.almias.org.uk

Holbeck Audio Walk – A new version of Simon Bradley's 2010 tour of urban Leeds. Implementing the Guidance layer and KML support. See www.holbeckaudiowalk.org

Concordia Displaced – A short and sweet audio test, implementing Embodied and Background layers.



Getting Involved

We encourage all interested parties to get in touch. We would be particularly interested in making contact with:

- collaborating on specifications to support existing or additional database/transcription formats;
- suggestions or wish-lists for the functionality of the system;
- scholars / artists who wish to test pre-release versions of the platform with their own projects;
- programmers interested in developing the platform for iOS.

Appendix B: LOAM User Guide

LOAM Beta presents a fairly rudimentary stage of the LOAM project, but it should be serviceable at this point for creating experiences with narrative layers and multiple environmental sounds.

Contact: Phil Legard, p.p.legard@leedsmet.ac.uk

Installation

Go to the Google Play store and install a file manager such as ASTRO:

<https://play.google.com/store/apps/details?id=com.metago.astro>

Use a USB cable to copy the LOAMi.apk file to your phone's internal memory or SD Card.

In your phone **Settings**, go to **More > Security**.

Tick "**Unknown Sources: Allow installation of apps from sources other than the Play Store**".

Open ASTRO and browse to the location that you copied LOAMi.apk to.

Touch the icon for LOAMi.apk - you should be asked if you wish to install it.

Install the app - it should now appear with your other apps.

Running LOAM Beta

In order for LOAM to run, you need a folder on your phone's internal storage called 'loam' (lowercase).

Create this folder using Astro or by connecting to a computer with a USB cable.

Inside this folder you will need a Google Earth kml file, called **loam.kml**

This contains your placemarks, polygons and LOAMXML tags.

This folder should also contain all the resources for your audio walk, as MP3 files.

If all the files are in the right place, you should see the message "LOAM Beta is looking for your GPS coordinates..."

Creating LOAM media

Explore the example LOAM folder to see how to set up tags and reference media using LOAMXML.

LOAMXML is a series of tags that are embedded in the 'Description' tag of a KML placemark.

Open the example loam.kml file using Google Earth. Right click a placemark and select "Properties"

LOAMXML 0.4 Summary

Embed LOAMXML in KML placemark descriptors using Google Earth. Save as a kml (not kmz) file in the loam directory of your phone's SD card. At present the file MUST be called kmltest.kml. Put audio files in the loam directory.

Currently audio triggers only work with spheres around placemarks - polygons to come.

TAG	DESCRIPTION	DEFAULT
<src>	Audio source file	null
<range>	Audible Range (kilometers)	0.025
<location>	file hosting location: remote, local	local
<type>	environment, narrative, background	environment
<channel>	0-4 (environment), 5 (narrative), 6 (background)	0
<spread>	Stereo spread/directionality - 0.0 non directional to 1.0 - highly directional	1.0
<rolloff>	Rolloff factor - 1 = linear, 2 = square, 3 = cubic, 4 = quadratic and so on.	3
<description>	Description to display in window	""
<popup>	Popup message on placemark touch	""
<shape>	Sound propagation shape: sphere or henge	sphere
<zoom>	Map zoom - narration audio only	17
<segs>	Millisecond segments in piece. First seg is the start, last seg is end. E.g. <segs>0, 13000, 24000,32000</segs> will randomly choose from the following: <div style="margin-left: 40px;"> Segment 1 0 - 13 seconds Segment 2 13 - 24 seconds Segment 3 24 - 32 seconds </div>	null
<seg-shuffle>	Shuffle segs (no repeats until all played) or pick randomly each time (repeats may occur)	false
<visible>	Show range on map	true
<inqscribe-desc>	Process an Inqscribe text to the description	null
<inqscribe-pop>	Process an Inqscribe text to the popup	null
<inqscribe-segs>	Process an Inqscribe text into segments	null

Note on Inqscribe Transcriptions

You can copy timecoded text from Inqscribe. However, you need to find-and-replace square brackets - [and] - with regular brackets - (and). At present a square bracket will terminate the XML handler for the placemark description, leaving you with an incomplete Inqscribe snippet (and crashing the system). You should also timecode the end of your transcription so that LOAM can successfully create the final segment when <inqscribe-segs> is invoked:

So:

[00:00:00.00] this is number one \r\r[00:00:57.24] this is number 2\r\r[00:02:27.08] this is number 3\r\r [00:03:30.00]

Becomes:

(00:00:00.00) this is number one \r\r(00:00:57.24) this is number 2\r\r(00:02:27.08) this is number 3\r\r (00:03:30.00)

Rolloffs & Spread

Use 1 or 2 rolloff and low spread (e.g. 0.2) for general ambient zones.

Use 3 or 4 rolloff and high spread (e.g. 1.0) for sources embedded at specific points.

Use larger values for wide-range diffuse sounds with or without spread depending on sound type

(general ambience or point source).

Note on channels

LOAM will ultimately implement four channels for playing environmental sounds.

Accommodate this thinking in your designs by making sure that zones that will be on the same channel do not overlap.

Channel 5 will automatically be assigned to any narrative sound.

Channel 6 will automatically be assigned to any background audio.

Narration

Narrative descriptions always take precedence over environmental audio descriptions.

Example use of <segs>

```
<src>example.mp3</src><location>local</location><range>0.05</range><description>Sine  
wave 1 – directional</description> <spread>1.0</spread> <channel>0</channel>  
<segs>0,2159,4107,5851,10579,14785,16771</segs><seg-shuffle>true</seg-  
shuffle><channel>2</channel>
```

Appendix C: Technical Appendix on LOAM Classes & Functions

This technical appendix provides an overview of the key classes written in Java as part of the LOAM application. Eventually the classes discussed below would form the basis of the *LOAM Libs* package, to be made available to other (non-commercial) developers.

The documentation below lists only public methods, used in the deployment of LOAM as a library to support larger tasks. Refer to the source code to view the private methods, used internally by the LOAM classes.

I. NarrationLayer

```
public class NarrationLayer
```

NarrationLayer handles playback of audio on LOAM's narration channel.

Public Methods

Start (Context ctxIn, float[][] locsIn, double[] rangesIn, int[] setsIn, String[] filesIn, String[] infosIn, int[] zoomsIn, int modeIn)

locsIn[][] - Array of latitude and longitudes relating to narrative placemarks.

rangesIn[] - Range in which a narrative will be triggered, per placemark.

filesIn[] - Filenames/locations for narratives associated with placemarks.

infosIn[] - Information associated with placemark (will be displayed on screen).

zoomsIn[] - Zoom levels for each placemark.

modeIn – Execution mode, use static types LOCAL or STREAMING.

CheckNarration(double latIn, double lonIn)

Pass latitude/longitude from a geolister to CheckNarration to check whether the user has entered the range of a narrative placemark.

String **GetDesc**()

Get the description of the current narrative track.

int GetTrack()

Return current narrative track playing.

int GetZoom()

Return zoom level of current narrative track.

Silence()

Silence narrative layer.

Unsilence()

Resume narrative playback.

II. SoundEvent

public class SoundEvent

SoundEvent handles all embedded sounds – including segmented audio which may be built up into granular clouds.

Public Methods

public void **Start**(Context ctx, double lat, double lon, String filesIn, double spread, int fileLoc)

Use this method to create unsegmented embedded audio.

lat, lon – Audio placemark location.

filesIn – Audio filename.

spread – Audible propagation range.

fileLoc – Location of file, use static types LOCAL or STREAMING.

public void **Start**(Context ctx, float lat, float lon, String filesIn, double spread, int fileLoc, int[] segsIn, boolean segShuf)

Use this method to create segmented audio.

segsIn[] - Array of segment boundaries (in milliseconds).

segShuf – If TRUE then shuffle segments and play through as a series, then re-shuffle, otherwise play segments randomly, allowing for repeats.

setVolume(double distance, double bearing)

Calculate whether the embedded audio is audible based on the user's distance and bearing.

III. GeoListener

public class GeoListener

Public Methods

Start(Context ctx)

Begin polling location updates with LocationManager.

double **GetBearing**(double lat2, double lon2)

Interpolate between the bearing of the current location and the last location (lat2/lon2). This begins a process of interpolation between the two bearings – as if the user is rotating in space. NB: Rotates in the direction of the least distance, which may not necessarily be the way the user has themselves turned to begin the bearing.

double **GetSoundBearing**(double lat2, double lon2)

Return the bearing between the current location and a sound at lat2/lon2.

double **GetBear**()

Return the current bearing.

double **GetLat**()

Return current latitude.

double **GetLon**()

Return current longitude.

moveToward()

Deprecated.

IV. Placemark / NavigationSaxHandler / NavigationDataSet / PolygonOverlay

Private classes, referenced internally by foregoing classes only.