Supporting the Mobile In-situ Authoring of Locative Media in Rural Places: Design and Expert Evaluation of the SMAT app

ABSTRACT

Providing users with carefully authored Locative media experiences (which can be consumed via a GPS equipped smartphones or tablets) has significant potential for fostering a strong engagement with their current surroundings. However, the availability of mobile tools to support the authoring of locative media experiences in-situ, and by non-technical users, remains scarce. In this article we present the design and 'in the wild' expert evaluation of a mobile app developed under the SHARC project (Investigating Technology Support for the Shared Curation of Local History in a Rural Community). The app is named SMAT (SHARC Mobile Authoring Tool) and supports the authoring of Locative Media experiences with a focus on the creation of POIs (Points Of Interest) and associated geo-fences which trigger the pushed delivery of media items such as photos, videos and audio clips. One important requirement of SMAT is the ability to support authoring in places where connectivity is intermittent or unavailable, e.g. many rural areas.

Keywords: Locative media, context-aware, geo-fence, authoring tools, frameworks, handheld devices, mobile app, push-based interaction, POI, field-trial, expert review.

INTRODUCTION

Locative media experiences have significant potential for enabling users to learn about the cultural heritage and local history of places that they visit or inhabit. One of the earliest examples of research relating to locative media experiences was the "34 North 118 West" project (http://34n118w.net/34N/) which ran in 2002 and provided users with an historic walking tour relating the early industrial era of Los Angeles. This project predated the advent of the common GPS-equipped smartphone and the device used to deliver the locative media experience comprised a touch-screen tablet PC device equipped with a GPS card and headphones. The tablet PC device displayed a historic map of Los Angeles and tracked the location of the user such that changes to their location would cause a "locative narrative" to unfold. More specifically, when the application sensed (via GPS) that a user entered a specified geo-fence representing a 'trigger zone' this would cause the audio voice-over of a dramatised history to be played through the headphones.

Despite the ever-increasing capability of handheld devices (in terms of storage, processing and position sensing) to support the playing of locative media experiences, the availability and associated study of tools to support the authoring of locative media experiences is very limited. In this paper we address this research gap by presenting the

design and expert evaluation of a mobile tool that has been developed to support the in-situ authoring of locative media experiences.

The need to support the in-situ authoring of locative media experiences was documented in research carried out under the Equator project (Weal, et al, 2006), this work explored requirements for in-situ authoring of location based experiences. This research utilised a co-design process and focussed on supporting the visitor experience to an historic country house, Chawton House, located in the South of England. This project had young children (in this case aged 10-11) as its target user group and also involved teachers and curators of Chawton House library in the co-design process. While the project did not result in the development of any tools as such it produced a number of key findings as a result of the co-design workshops carried out. One such finding, highly relevant to this article, was that: "curators felt unable to tell stories naturally while not in-situ" (Weal, et al, 2006). This signifies the importance of providing mobile tools as the location often provides a trigger for storytelling. Another notable requirement reported in (Weal, et al, 2006) and which informed the work presented in this article is that of supporting a 'two-phase authoring process' where media captured or authored in-situ in the field, e.g. textual notes or audio clips, can later be refined or expanded upon using a desktop based authoring tool.

One of the target user groups motivating the work presented in this article is the rural village community of Wray, situated in the North of England. Our past work with Wray has involved the longitudinal deployment and evaluation of a situated photo display system known as Wray PhotoDisplay (Taylor and Cheverst, 2009) that enabled residents to submit photos relating to their village. A recent analysis of the content (Do. et al 2015) revealed that a significant portion of the content was related to the Cultural Heritage and Local history of Wray. Building on this finding our current SHARC research project (Investigating Technology Support for the Shared Curation of Local History in a Rural Community) is exploring how the Cultural Heritage and Local history of Wray can be expressed as Locative Media, authored by residents of the village themselves. One of the key requirements that has emerged from our work is that developed mobile tools for supporting the mobile in-situ authoring of locative media experiences need to be able to operate in areas of poor or no internet connectivity.

The mobile tool that is described in this article is called SMAT (SHARC Mobile Authoring Tool). It forms a new component of the SHARC framework (Do and Cheverst, 2015) and an overview of how SMAT interacts with the framework is presented later in this article. Other components of the framework include a push-based mobile player app which enables residents of the village (or visitors) to consume locative media experiences. For example, when nearing Wray's 17th century school house the mobile player app will (on sensing the user's physical proximity to the school house) 'push' media relating to the history of this Point of Interest (POI). This media could include audio narratives from current residents of the village who attended the school as a child or historic photos (such as those submitted to the Wray PhotoDisplay system) showing how the school house used to appear before various historical building extension works were carried out.

The remainder of this article is structured as follows: in the following section we present background and related work in the area of locative media and, in particular, focus on research tools and frameworks that support the mobile authoring of locative media experiences. Following this, we present the SMAT app and how it fits in as a new component of the SHARC framework. In the next section we describe our evaluation of SMAT which took the form of a field-trial evaluation involving two experts in mobile interaction design. This is followed by a section detailing the current

state of the project and our plans for future work. Finally, we present a summary and our concluding remarks.

BACKGROUND AND RELATED WORK

The Growth and Scope of Locative Media

The term "Locative media" was coined by Karlis Kalnins in 2003 (Galloway & Ward 2006; Bilandzic, M. & Foth, M., 2012; Wilken 2012) and while various definitions exist, the following definition provided by (Bleecker and Knowlton, 2006) is apt for this article:

> *"Locative media that is of most immediate concerns is that made by those who create experiences that take into account the geographic locale of interest, typically by elevating that geographic locale beyond its instrumentalized status as a 'latitude longitude coordinated point on earth' to the level of existential, inhabited, experienced and lived place. These locative media experiences may delve "into" the historical surface of a space to reveal past events or stories..."*

Furthermore, the social and community setting of locative media is also of importance given our work with the village community of Wray. The importance of this aspect of locative media is described by (Willis and Cheverst, 2011) as follows:

> *"The development of locative media applications is not simply about the physical location or social setting in which the interaction occurs, but rather about situating the media within the social setting of a community".*

To date, locative media has been exploited in various domains but most notably: storytelling (Procyk & Neustaedter 2014), literature (Løvlie, 2012), games (Procyk & Neustaedter 2014; Bell et al. 2009), city exploration relating to cultural heritage and history (Cheverst et al, 2002; Reid et al, 2005; Nisi et al 2006 and FitzGerald et al. 2012) and mobile learning (Heimonen et al. 2013).

Locative Media Authoring Tools

In this sub-section we describe the key related work in the area of frameworks that provide support for the authoring of Locative Media experiences. The earliest frameworks started to appear shortly after the millennium but did not provide mobile tools to support the authoring of experiences in-situ. However, more recently a small number of frameworks that support the in-situ authoring of locative media have been developed. However, they do not support the facility to work offline which, as discussed in the previous section, is a key requirement when working in rural areas.

One common feature of locative media authoring tools is the ability to associate geo-fences (which represent a given geographic area) with one or items of digital media. The geo-fence will then act as the 'trigger zone' to cause the playback of associated media items when the user's location enters the trigger zone. Typically, a geo-fence is specified using an appropriated annotation (e.g. circle or polygon) on a map-based interface. However, geo-fences can also be associated with Wi-Fi cells. For example, with the push-based Guide system (Cheverst et al., 2002) the area of coverage of a Wi-Fi-cell (e.g. the Wi-Fi cell associated with Lancaster's historic castle) would represent the trigger zone for pushing media to the user.

The seminal framework for supporting the rapid authoring and consumption of locative media experiences was MediaScape (Hull, et al, 2004). Indeed, MediaScape was used to author the 'Riot 1831' experience (Reid et al, 2005) which provided an engaging way for users to experience the Bristol riots of 1831. The locative media experience involved the use of pushed audio which would be triggered as users entered certain areas of a public square (known as Queens Square) in the English city of Bristol. The user trial involved over 700 users (comprising both residents and visitors to the city) who were required to wear headphones connected to GPS-equipped iPAQ PDAs in order to hear the pushed audio.

The MediaScape framework was developed by Hewlett Packard to enable non-technical users such as artists (as opposed to computer programmers) to develop locative media experiences and comprised four primary components: Mscape Maker, Mscape Library, Mscape Tester, and Mscape Player. Mscape Maker was a desktop application supporting the design of location-triggered media contents by importing a map, adding regions and associating geographic regions with media. Mscape Library was available to support the management of authored locative media experiences while the Mscape Tester desktop application provided a GPS simulator for testing authored experiences. Finally, the Mscape Player was the mobile application that allowed users to consume the experience and this ran on PDAs (notably the iPAQ) running the windows mobile operating system (which were common around the time of development and the only mobile devices supported by the framework). The MediaScape framework remains available for free download but is no longer supported by Hewlett Packard.

Developed at a similar time to MediaScape (and also utilising windows mobile PDAs equipped with GPS receivers as the mobile end system) M-studio was another system that allowed non-technical users to author location based experiences (Pan, et al, 2002). In the case of M-studio, the content supported was video and the client-server based system provided a graphical authoring tool featuring a map view and storyboard facilities in order to allow video content to be associated with a given location. In common with MediaScape, a mobile authoring tool was not provided.

A more recent system that provides a comprehensive framework for supporting the rapid prototyping of context-aware mobile applications by non-technical users is IVO (Integrated Virtual Operator) (Realinho, 2011). IVO has two mains components: IVO Builder and IVO Client. IVO Builder is a web application that has similar functionality to Mscape Maker. However, the shift from a desktop-based application to a web-based application has enabled greater portability and the outputs of IVO Builder are stored and shared on a web server. The IVO Client has been developed for both iOS and Android and loads the outputs of IVO Builder to operate as a context-aware push-based mobile application. While IVO has strong support for different context triggers no mobile authoring tool is yet provided.

The LoMAK framework (Do et al. 2014) has taken a slightly different approach to the aforementioned frameworks in that it supports a web-based authoring tool that has the facility to produce geo-fences and associate media with these geo-fences by automatic extracting from suitable KML (Keyhole Markup Language) files. The framework also includes an Android-based 'player app' that can be used to play the locative media experiences produced by the authoring tool.

One of the first documented systems to support some form of mobile authoring tool was developed under the Urban Tapestries action research project (Lane et al 2003). The developed prototype required connectivity via GPRS and enabled non-technical

users to attach text, audio clips or photos to a specific address within a 3 kilometre square area of central London.

A more recent system that supports a mobile authoring tool is the CASTOR context-aware architecture (Pittarello and Bertani, 2012). Castor supports the creation of stories in-situ and has been designed for use in an education context to comply with the learning needs of young children and to help bridge the gap between the structured classroom learning and the outdoor experience. The UI of the mobile authoring tool enables specification of audio and image content but the tool appears to require constant connectivity to the CASTOR web and application server.

The TOTEM.Scout (Jurgelionis et al, 2013) is a mobile app that supports the authoring of location-based games in situ and does so using user-definable data-structures to provide a highly configurable system. The system supports the notion of Pebbles which can be assigned a name, description, and GPS location. Once created, users can then associate media items such as images, audios and videos to a given Pebble. The authors point out that one limitation of the system is that it requires an active online data connection and that removing this requirement "would be greatly beneficial to the tool's use in areas with patchy or expensive data-network coverage."

Finally, the Tidy city project (Wetzel, 2012) provides both in-situ mobile and web-based authoring tools to support the creation of location based games involving riddles designed to encourage users to explore their surroundings. Again, the tools are designed to support non-technical users. The mobile tool has been developed for Android based smartphones and tablets.

THE SMAT MOBILE AUTHORING TOOL

The SMAT app has been designed to provide non-technical users with a simple tool to author locative media in-situ in places where internet connectivity is poor or unavailable. In more detail, while internet connectivity is ultimately required in order to upload an authored experience, internet connectivity is not required during the actual authoring process and this is achieved through local storage of media items and the local caching of Google Maps tiles.

Following on from the recommendation presented in (Weal, et al, 2006) for supporting a 'two-phase authoring process' the SMAT app has been designed to provide authors with a relatively simple authoring facility such that more sophisticated editing can (optionally) be carried out using the web based authoring tool named SLAT (SHARC Locative media Authoring Tool). The author can also use SLAT to refine and edit any routes recorded using the SMAT app and this represents a novel feature amongst mobile authoring tools.

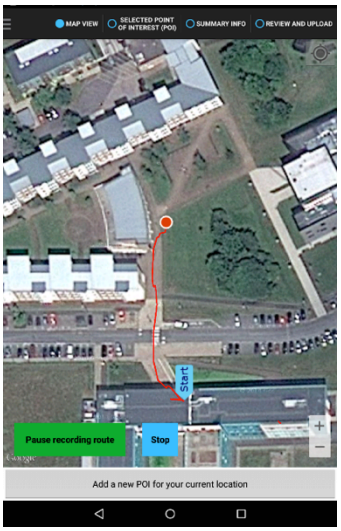
Both SMAT and SLAT are components of the SHARC framework (Do and Cheverst, 2015) and a brief overview of the framework is presented later in the article.

Overview of the SMAT Interface and Associated Functionality

The general approach for in-situ authoring locative media supported by SMAT is ostensibly a two-part process: firstly, the author creates a POI and when created the author can then associate one or more media items with that POI. Once in-situ authoring is complete the user can either publish their locative media experience directly from the SMAT app or further refine the experience using the SLAT authoring tool. An author can also choose to open an existing experience using SMAT if they wish to continue with in-situ authoring at a later date.

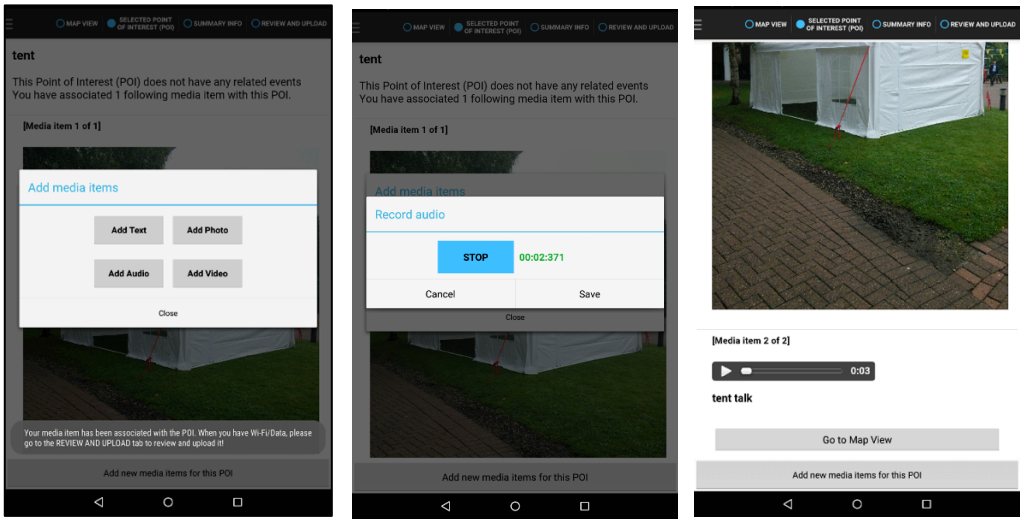
The SMAT app uses a tab interface with 4 tabs (see fig 1). The main tab view is 'Map View' where the author can view their current position on a Google Maps canvas. An illustration of this tab is shown in Fig 1 (note that all figures referred to in this section are associated with the field-trial evaluation by experts in mobile interaction design, which took place on the campus of Lancaster University).

Figure 1. Illustrative screen shot showing the four supported tab views (top of image) and the Google map canvas (with satellite view selected) presented in the 'MAP VIEW' tab with a red 'you-are-here' marker icon. In this screen the user has opted to record their route.



This map view contains buttons for adding a new POI based on the current location and also for recording the author's route (associating a route with a given locative media experience is entirely optional).

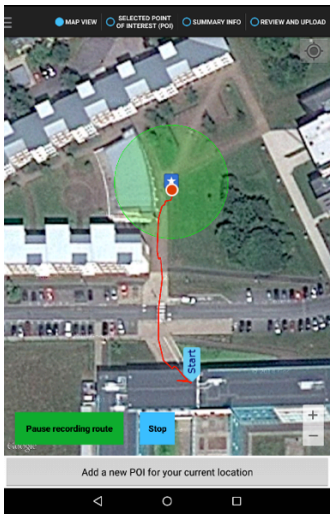
Figure 2. Illustrative screen shots showing the 'SELECTED POINT OF INTEREST' tab view. Image on left (figure 2a) shows screen when the author has just added a photo to the current POI and is being asked to add another media item. Image in centre (figure 2b) shows dialog for recording an audio clip. Image on right (figure 2c) shows resulting screen when the author of the experience has added a short audio clip in addition to the photo of the marquee tent.



Pressing the ‘Add a new POI for your current location’ button causes the app to display a dialog asking the user to enter the name of the POI and once this has been entered the app switches to the ‘SELECTED POINT OF INTEREST’ tab view (see figures 2a – 2c). This view contains an ‘Add new media items for this POI’ button (located towards the bottom of the screen) which enables the author to associate media items (text, photo, audio or video) with the POI. In the case of adding a photo or video the standard Android component is used but for text and audio media items (see figure 2b) we have developed new dialog components.

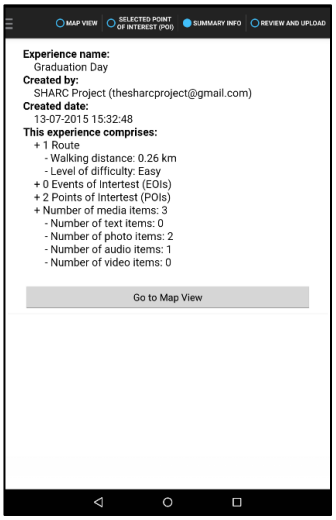
Once the author has finished adding media items she can return to map view where she can see the default trigger zone associated with the POI. By default the geo-fence representing the trigger zone is circular and has a radius of 20m. Note that the author can optionally adjust this geo-fence in a later editing phase using the SLAT authoring tool. An illustrative screen shot of this is shown in figure 3.

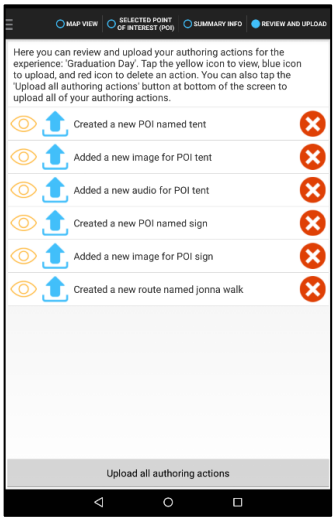
Figure 3. Illustrative Screenshot showing the presentation of a default geo-fence (in the ‘MAP VIEW’ tab) representing the trigger zone associated with a newly created POI.



The ‘SUMMARY INFO’ tab view (see figure 4a) enables the author to see a summary of the number of POI created, authored media items, distance travelled, etc.

Figure 4. Illustrative screen shots showing examples of the ‘SUMMARY INFO’ (figure 4a) and ‘REVIEW AND UPLOAD’ (figure 4b) tab views.





When the author has finished her in-situ authoring then she can review and upload her authoring actions and an illustrative screen shot of this tab view is shown in fig 4b. Note that the uploading process may occur some time later when the author has internet connectivity.

Logging User Interaction with SMAT

In order to support analysis of user interaction (e.g. by supporting triangulation with qualitative data such as audio transcripts following evaluations using the think-aloud protocol), an interaction log is produced by the SMAT app. An example of the interaction log (showing the log produced from the expert review) is shown in fig 5.

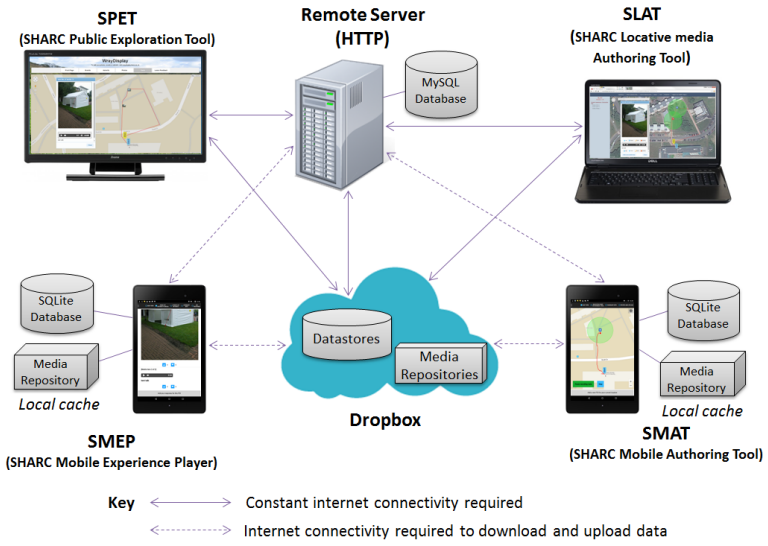
Figure 5. Example of an interaction log produced by the SMAT app (based on app usage captured during the field-trial by experts in mobile interaction design).

	A	B	C	D	E	F	
1	Date and Time	Location (LatLng)	DeviceID	UserID	ActionCode	ActionName	Data
2	Mon Jul 13 15:05:34 BST 2015	undefined	079274b2	387643271	0	START_APP	V1.04
3	Mon Jul 13 15:06:32 BST 2015	54.00559896 -2.78486441	079274b2	387643271	2	SELECT_YAH	SmallRed
4	Mon Jul 13 15:07:43 BST 2015	54.00559896 -2.78486441	079274b2	387643271	37	CREATE_EXPERIENCE	Graduation Day
5	Mon Jul 13 15:07:59 BST 2015	54.00559691 -2.784869	079274b2	387643271	38	START_ROUTE	
6	Mon Jul 13 15:10:37 BST 2015	54.006396 -2.7851051	079274b2	387643271	43	CREATE_POI	tent
7	Mon Jul 13 15:10:39 BST 2015	54.006396 -2.7851051	079274b2	387643271	23	SELECT_POI_TAB	FROM_LOCATION_SERVICE#tent
8	Mon Jul 13 15:11:10 BST 2015	54.00618431 -2.78497612	079274b2	387643271	27	OPEN_RESPONSE_DIALOG	
9	Mon Jul 13 15:12:06 BST 2015	54.0064893 -2.784959	079274b2	387643271	29	ADD_RESPONSE_IMAGE	POI#1436796638107
10	Mon Jul 13 15:12:21 BST 2015	54.00620902 -2.78496942	079274b2	387643271	23	SELECT_POI_TAB	3#tent
11	Mon Jul 13 15:15:06 BST 2015	54.00631538 -2.78495756	079274b2	387643271	22	SELECT_MAP_TAB	54.005989116563526 -2.784836031496525#18.686243
12	Mon Jul 13 15:15:18 BST 2015	54.00632042 -2.78495784	079274b2	387643271	23	SELECT_POI_TAB	FROM_MAP_PULL#tent
13	Mon Jul 13 15:15:28 BST 2015	54.00632067 -2.78495762	079274b2	387643271	36	SELECT_BACK_BUTTON	from tab 1
14	Mon Jul 13 15:15:28 BST 2015	54.00632067 -2.78495762	079274b2	387643271	22	SELECT_MAP_TAB	54.006171577063554 -2.7849818766117096#18.686243
15	Mon Jul 13 15:16:21 BST 2015	54.00632792 -2.78493166	079274b2	387643271	23	SELECT_POI_TAB	FROM_MAP_PULL#tent
16	Mon Jul 13 15:16:34 BST 2015	54.00633166 -2.7849276	079274b2	387643271	27	OPEN_RESPONSE_DIALOG	
17	Mon Jul 13 15:16:44 BST 2015	54.00633595 -2.78492381	079274b2	387643271	30	ADD_RESPONSE_AUDIO	POI#1436796638107
18	Mon Jul 13 15:16:54 BST 2015	54.0065085 -2.7848861	079274b2	387643271	32	ADD_RESPONSE_DESC	tent talk
19	Mon Jul 13 15:17:04 BST 2015	54.0065085 -2.7848861	079274b2	387643271	23	SELECT_POI_TAB	3#tent
20	Mon Jul 13 15:17:32 BST 2015	54.00636612 -2.78491666	079274b2	387643271	22	SELECT_MAP_TAB	54.006171577063554 -2.7849818766117096#18.686243

The SHARC Framework

The components comprising the current SHARC framework are illustrated below in figure 6.

Figure 6. System architecture of the SHARC framework.



As discussed in (Do and Cheverst, 2015) (and illustrated in Figure 6) the SHARC framework utilises personal Dropbox storage accounts. Consequently, an author using

SMAT is required to log-in using their Dropbox credentials prior to publishing their locative media experience.

The SMAT app represents a new component of the framework. Other components of the framework include the web-based SLAT which provides more sophisticated functionality to support the authoring of locative media experiences such as the ability to change the order in which media items associated with a POI are displayed. An emulator facility is also available through SLAT. Another component is SPET (SHARC Public Exploration Tool) which is a web-based app for browsing locative media experiences authored and published through the SHARC framework. The final component of the framework is SMEP (SHARC Mobile Experience Player), an Android app that supports the playing of locative media experiences.

FIELD-TRIAL OF SMAT BY EXPERTS IN INTERACTION DESIGN

Overview

In order to evaluate the quality of the interaction design aspects of the SMAT app, we invited two experts in mobile interaction design to use and review the application 'in the field' (Rowley, 1994) rather than carrying out a lab-based usability study. Within the MobileHCI literature there has been much discussion on the merits of carrying out studies in the field vs. in the lab (Kjeldskov, et al. 2004) (Kjeldskov and Skov, 2014). It is important to note that the field-trial based evaluation carried out and presented in this paper had significantly more controls than would be the case with a longitudinal 'in-the-wild' study (Crabtree, 2013) and as discussed in the 'CURRENT STATE AND FUTURE WORK' section, such a study is planned for the future. However, at this stage it is important to ensure that the app is of sufficient quality (in terms of appropriate interaction design and robustness) for longitudinal use (and associated evaluation) 'in-the-wild'. While the use of a field-trial is likely to produce findings with greater ecological validity than would be the case with a lab-based study (Carter et al., 2008) the greatest ecological validity arises from an appropriately designed 'in the wild' study (Crabtree, et al., 2013).

In this case, the field-testing involved the experts in mobile interaction design using the app on Lancaster university campus, in an area outside the main computing building, on July 13th 2015. On this particular day, a graduation ceremony was taking place on campus which involved many additional temporary POIs around campus, such as marquee tents.

The first expert (UX1) is a female full professor at a Finnish university with approximately 15 years experience in the area of mobile interaction design. The second expert (UX2) is a male senior researcher (again based in Finland) with significant technical coding experience and with over 10 years experience in mobile interaction design. Figure 7 shows expert UX1 using the app with one of the marquee tents visible towards the right hand end of the photo.

Figure 7. Expert UX1 using the app with one of the marquee tents visible towards the right hand end of the photo (UX2 is out of shot).

Procedure for the Field Trial by Experts in Mobile Interaction Design

During a brief debriefing session, the experts were asked to use the SMAT tool to create POIs and to associate media items to these relating to the area directly outside the main computing building (for later consumption by a visitor). They were also asked to use the SMAT app together, our intention being that the group situation would enhance the dynamic for providing feedback. This appeared to be the case. They were also instructed to follow a 'think-aloud' protocol during the trial and were provided with a Nexus 7 Android tablet running SMAT (v1.04) and version 5.1.1 of the OS. In order to test that the app functioned correctly without internet connected the Wi-Fi on the device was disabled for the duration of the outside field-trial.

Two researchers (both being authors of this article) accompanied the experts. One of the researchers recorded audio using a Dictaphone which left the other free to pay more attention to the actions of the experts and provide prompting where necessary.

Use of the System During the Field Trial

The evaluation of SMAT by the experts lasted approximately 35 minutes and this time period was deemed to start once the experts exited the main computing building (where the short debriefing took place).

The tablet device was held by UX1 throughout the trial and the first action carried out by her was starting the recording of her walking route. Having walked for approximately 50 metres both experts noticed a highly visible marquee tent and decided that this would make an appropriate first POI on the route. When standing a few meters from the tent (see figure 7), UX1 pressed the 'Add a new POI for your current location' button visible under the 'MAP VIEW' tab (see Figure 1 for an illustrative screen shot at this point) and chose to name the POI 'tent'. UX1 then commented on how she felt confident that the app had added the POI:

> "ah it has added my Point of Interest I think"

UX1 then decided to author two media items for this POI. The two media items (a photo and a short audio clip description) were successfully added (see figure 2c) but an

interesting interaction design issue was revealed. In more detail, UX1 expressed concern over the salience of the 'Add new media items for this POI' button and the fact that the system did not automatically pop-up the dialog box for adding a new media item (this dialog box is shown in figure 2a) once the POI had been created (instead the the app required her to press the 'Add new media items for this POI' button in order to cause the pop-up dialog box to appear. In particular, UX1 commented:

> *"but it didn't like ask me to take a photo or anything"*

and then, once directed to look at the bottom of the screen by one of the researchers, she commented:

> *"ah add a new media item [brief pause] ok I wouldn't look down there at the screen at all"*

UX1 was also concerned about the use of the term "Media Item" in the interface, suggesting it may be too technical a term for many users.

Regarding the confirmation message displayed once UX1 added a photo media item (see bottom of figure 2a), she was positive, stating:

> *"So I like the confirmation; submitted…"*

The next POI encountered a short distance north of the tent was a sign relating to 'seasonal harvesting'. When UX1 added the sign as a new POI the 'MAP VIEW' tab appeared as shown in figure 8a, i.e. with overlapping trigger zones (resulting from the proximity of the two POIs to one another. On seeing the overlapping trigger zones, UX1 commented:

> *"What happens if I get two triggers at one time?" [pause] "Is there a conflict?"*

on hearing this (and without prompting by the researchers) UX2 replied:

> *"No, it depends which way you go first".*

The two experts then discussed the approach being used with UX2 commenting on the trade-off between a highly complex way of presenting trigger zones versus a more simplified approach and the need to consider:

> "…how complicated you want to make it"

to which UX1 responded:

> *"But I think it is nice generally yes".*

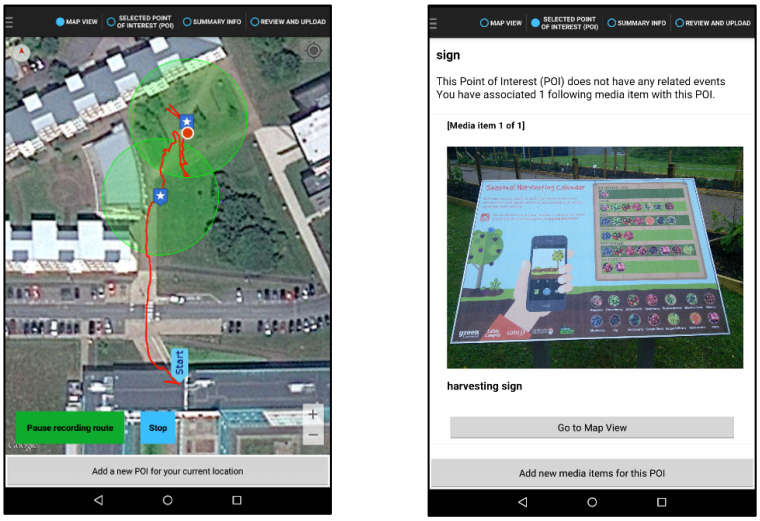
UX1 then wanted to take and then add a photo of the sign but, again, struggled to see the necessary button (at the bottom of the screen) for achieving this and commented:

> *"And again so how do I take the photo…?" [researcher points to the bottom of the screen] "this for me is hard to see".*

UX1 then pressed the required 'Add new media items for this POI' button and proceeded to add a photo of the sign resulting in the 'SELECTED POINT OF

INTEREST' tab view shown in figure 8b. Having associated photo images with both of her POIs UX1 suggested that it would be helpful and reassuring if the blue POI icons shown in the 'SELECTED POINT OF INTEREST' tab view were changes to thumbnail images of the photos that she had taken.

Figure 8. Illustrative screen shots showing the two trigger zones (represented as geofences) that resulted when the 'Sign' POI was added (figure 8a) and the resulting screen in 'SELECTED POINT OF INTEREST' tab view when UX1 associated a photo of the sign (figure 8b).



Having created the two new POIs the two experts and two researchers returned to the computing department building. On reaching the building UX1 pressed the 'Stop' button in order to signal that the route was now finished. The experts then chose to view the *'SUMMARY INFO'* tab view (see figure 4a) and then the *'REVIEW AND UPLOAD'* tab view (see figure 4b). The researchers then suggested going back to the lab in order to upload the experience and to view and possibly refine the trigger zones associated with the experience on the web-based authoring tool (SLAT).

On hearing that trigger zones could only be adjusted using SLAT, UX1 stated:

> *"I would have probably like if I could have done it when I was creating it – like on the phone"*

On walking back to the lab, UX1 commented:

> *"I was really excited – I can do a new one?"*

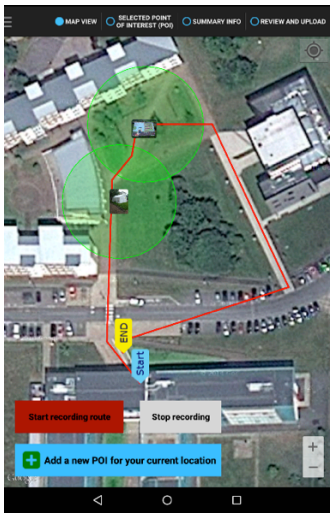
In summary, the experts were successfully able to use SMAT in order to create a route, POIs and to associate media items with these POIs. Furthermore, they found the different tab views straightforward to navigate. However, UX1 did highlight a usability issue with regard to the saliency of the 'Add new media items for this POI' button and felt that the dialog for adding a media item should appear automatically once a new POI had been created. With regard to the visualisation of trigger zones, UX1 did have some concern over what was implied by overlapping trigger zones although (without prompting from researchers) UX2 was able to explain that for the consumer of the locative media experience whichever trigger zone was entered first would cause the appropriate media items to be pushed. The ability to adjust trigger zones using the

SMAT application itself (rather than requiring the use of SLAT) was also suggested by UX1.

CURRENT STATE AND FUTURE WORK

Following the expert feedback obtained from the field trial we have modified the UI design of SMAT in order to address the point made regarding the need to make the appearance of certain buttons more salient. We have consequently adopted a consistent 'floating button' style for adding new POIs and adding new media items (a suitable 'plus' icon has also been added for these buttons). We have also included a thumbnail image of the first image media item as suggested by UX1. Figure 9 shows an illustrative screenshot of the new design.

Figure 9. Illustrative screenshot of the new design for the 'MAP VIEW' tab following feedback from the field-trial (in this image the route has been refined using SLAT).



In addition, we have also modified the interface such that the "Add media items" modal dialog (see figure 2a) now automatically appears once the author has added a new POI (rather than requiring her to first press the "Add new media items for this POI" button).

Our next step is to invite members of the Wray community to use the system in order to author an experience based around Wray village. We have been in contact with one of the residents who is particularly interested in accessibility issues associated with documented walks and she will be the first to test the system within Wray. Ultimately, we plan for the mobile authoring tool to be available to the entire Wray community and for it to be used over a longitudinal period of time in order to function effectively as a technology probe (Hutchinson, 2003). Based on our past experience, we are confident that such as 'in the wild' study will provide valuable feedback regarding the app's usefulness within the community as well as (hopefully) providing new insights for design.

In addition to Wray village we also plan to hold a user trial of SMAT in the rural English Lake District National Park. This follows on from an interview (carried out in May 2015 by one of the authors) with a Woodland Ranger who works for the National Trust (www.nationaltrust.org.uk). The aim of the interview was to discuss the potential of locative media for enhancing the visitor experience within the Borrowdale valley, one of the most beautiful and frequently visited areas of the Lake District. Early in the interview the ranger commented that he did not think mobile devices would be much

use in the valley because of the lack of cellular data coverage. He was certainly encouraged when informed of the potential of SHARC to support off-line use (for both the authoring and playback of experiences) and we subsequently discussed potential scenarios involving locative media such as walks that would take visitors to some of the oldest trees within the valley and present media explaining their history and significance.

SUMMARY AND CONCLUDING REMARKS

Providing users with carefully authored locative media experiences (which can be consumed via their GPS equipped smartphones or tablets) has significant potential for fostering engagement with their current surroundings. In order to support the authoring of locative media experiences, mobile tools that enable the in-situ authoring of an experience can be very useful. However, in rural areas, levels of connectivity can be very poor and this can be problematical because current mobile authoring tools tend to assume strong internet connectivity.

In this article, we have presented the design and field-trial evaluation (by two experts in mobile interaction design) of the Android-based SMAT mobile authoring tool which has been designed to support the authoring process by non-technical users in places where internet connectivity is not available. The tool supports the authoring of locative media experiences with a focus on the creation of POIs (Points Of Interest) and enables media items (such as photos, audio clips, etc.) to be associated with so-called trigger zones represented by geo-fences surrounding POIs. A user may choose to publish their locative media experience directly from the mobile authoring tool or they can optionally refine the experience using a web-based authoring tool.

The feedback from the evaluation provided some interesting ideas for future functionality for SMAT (e.g. the ability for authors to adjust the size of trigger zones in-situ) and also revealed the need to correct a small number of user interface issues. However, overall the positive feedback highlighted the overall suitability of the interaction design and provides us with confidence that the app is in a suitable state for use in forthcoming ‘in the wild’ studies.

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