From paper prototyping to citizen participation: Co-designing geolocated cultural heritage applications that trigger personal reflection

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Context

In this paper we discuss our end-to-end process of co-design and evaluation for developing an urban discovery mobile app that elicits personal volunteered geo-located reflections. The app in question is a multicity game that fosters serendipitous exploration and user reflection on cultural heritage and public history. Based on a geo-enabled game framework and a technological ecosystem that supports the development of outdoor experiences and encourages in-place discussion, the app embraces the notion of *geographical citizen science*. In specific, it sets out to embrace the lived experience of the city, its residents and tourists, and combines this experience with a situated discovery of the city's past narratives (e.g. archival images) in order to stimulate geographically encoded personal reflections towards the creation of *a shared public history*. The city was chosen as the venue for this app because it provides an immersive environment in the form of the public realm. It offers multi-sensory clues that are encapsulated in an open space bounded by history, cultural heritage and social-spatial narratives of people past and present [1,3,13].

The app, currently known as pilot 4, places a particular emphasis on location tracking technology. Indeed, the user's location in the city and the direction in which they are moving drives the user experience, gameplay and content discovery. Content can only be discovered when the user enters a certain physical (geo-fenced) zone in the real world, demarcated through a radius around the user's GPS location. As the user wanders the city (which is predominantly unguided as our aim was not to design a tour guide), they discover Places-of-Interest (POIs) either through haptic feedback or by activating on-screen notifications (called navigational clues) in the form of a short text, a current photo of the place they need to find and distance to location. The navigational clues provide feedback to the user on where to go and act as further stimuli to draw the user's attention to content hidden at a specific location. Upon discovery of a POI the user can read a story linking the physical landmark and a topic (e.g. migration), accompanied by an appropriate resource (e.g. image from a digital archive).

Citizens contribute to the creation of their shared public history explicitly in four different ways. First, they can tag their thoughts on a story by selecting from a set of standardised keywords contained within a cultural heritage semantic knowledge base. Second, they can rate the POI where they story is located, indicating their interest in the physical landmark. Third, they can answer a reflective question based on the story (e.g. on a POI linked to the topic of immigration they are asked: "How might it feel moving to a different country where you know no-one?"). The fourth method of participative reflection allows users to author and publish their own personal geo-located story about the topic; these stories are added to the game for other users to discover and reflect upon. With each interaction users earn points and achievements as part of the gameplay.

Implicit volunteered geographic information is also gathered using the (user-agreed) tracking of the participant trajectories as they encounter the city and its stories. As part of our future work, we will use this data to create on online collective city map (a form of "lieux de memoires").
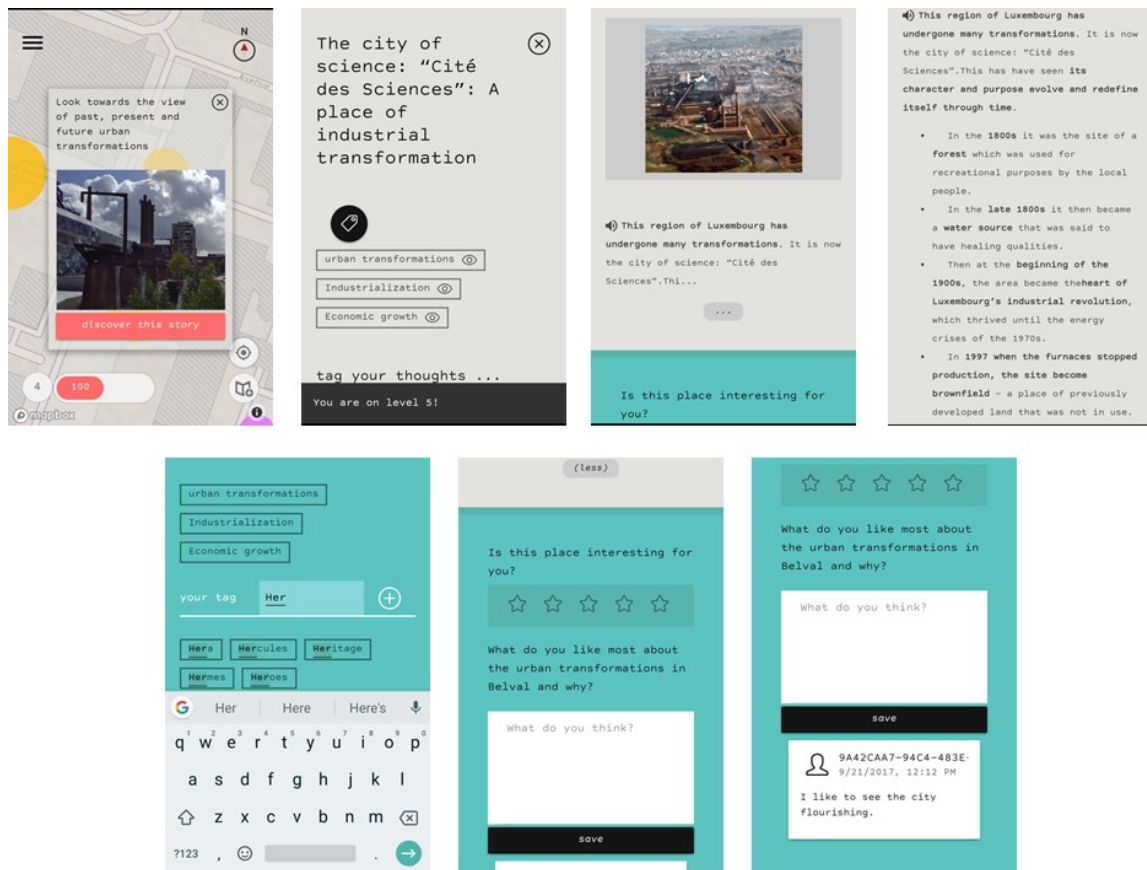
Figure 1: Pilot 4 app screenshots.

To accompany the main app described above, the Pilot 4 ecosystem has two companion apps. The first is a Moderator app, which provides crowdsourced or expert moderation of the content generated by the users of the main app (comments, reflections and stories) to avoid the presence of hate speech and/or potentially offensive language. The second is the Web interface: a user-friendly authoring tool that enables non-technically savvy users (like city or museum curators) to add and edit geo-located content on the city map. Specifically, through this tool, users can effortlessly create POIs and attach narrative stories and historical material (e.g. archival photographs) to them. The POIs and stories that are added can be activated through this web interface and then they will appear directly in the main pilot 4 mobile app. Together the three tools (main mobile app, moderator app, and web authoring tool) provide a seamless new way of disseminating and interacting with digital objects in a manner that removes the bounds of the traditional constructed environment of the classroom or the museum and moves discovery and reflection embodied within lived experience of the city.

Design and development process

The success of designing any participatory geo-located game requires not simply a focus on the navigation aspects of the app (which has often been the case in the past [5]). Rather, it is necessary to strike a balance between content, use, usability and experience in order to encourage technology (in this case app) adoption driven and nurtured by a sense of perceived value. For the development of Pilot 4 we used a range of user design and development strategies to help ensure the best possible solution was developed.

Board game prototyping phase. Once the original idea for the App was conceptualised, we used a method of paper prototyping [4] that put the participant at the heart of the collaborative design and requirements gathering process [12] to increase the chances of the App being successful and usable

[8–11]. We started with a basic user scenario that outlined the app from the perspective of the user experience. With this initial scenario, we turned the experience into a board game that could be used as a co-design tool. The paper map-based board game simulated being in the city and used a throw of the die to reproduce movement. We used this method as a tool to explore: i) how players interacted with the content that would accompany the POIs, ii) if they were willing to contribute reflections and iii) if they would share their own stories (see figure 2). We made three play tests on the board game inviting a total of 16 volunteer players (14 of whom were unique and who were employed in the same institute as one of the authors). The final form of the game from the content design and localisation was described as a case study paper in CHI 2017 conference [6].

Figure 2:From left to right: (1) Board game play test (2) Welcome day field test (3) controlled experiment with students

Overall, the use of the board game to co-design requirements enabled us to identify and describe the core game design concepts (game goals, loops and rewards), as well as to evaluate content and refine reflective questions. Feedback from debriefing sessions, analysis of questionnaires and observations made during the play sessions provided us with a set of co-designed requirements from which we could build paper-based wireframes.

Iterative mobile app development phase. With the wireframes designed we moved on to the development of a technology prototype prioritising the development of a minimum set of bare bone features that would give us a viable mobile app product. For the process of technology prototyping we worked in two week cycles where the core pilot 4 team to bug hunt and iteratively feed-back on the development of the App and its review its content. Within this process we periodically worked with individual volunteers who were not directly part of the project but loosely connected to the team; this provided a pragmatic solution to refine the app based on their feedback.

Experimental phase with beta mobile app version. Once we had a more refined beta version of the App we began field experiments followed by three controlled experiments with volunteer participants.

- *Field experiments.* The first field experiment took place at the university Welcome, where we invited new students to come and experience the app. This playtest highlighted a serious usability issue. Only two volunteers were found to interact with more than one story, as users found it too difficult to activate content. Thus, users never ever made it to the point where they could use the app to reflect. Following this result, we undertook a significant redesign of the navigation and discovery of content screens. The second field test took place during an after work social event. From this test we observed the need to provide access to content for different types of learning preferences, as some people just did not want to read while walking in the city.

- *Controlled experiments.* The three controlled experiments were conducted using the same improved version of the app with different groups of volunteers (cultural heritage stakeholders, students and participants in a winter school on the topic of geo-located mobile experiences). Their results, leading the way to new research questions are detailed next.

Lessons learnt and what next?

By qualitatively examining the results of the controlled experiments from the post-test questionnaires, as well as by exploring the contributions shared by the volunteers we were able gain more understanding across a number of themes which we believe will aid the design of future apps that are interested in place-based exploration or situated historical reflection. We gathered insights about (1) the user response and their attitudes towards the app (2) the perceived value the user placed in the App and (3) the likelihood of a user adopt the technology in the future. All of these observations can be used to identify a typology of the mobile city-app user, ranging from the cynic to the enthusiast which provides a more ground understanding of the user and help progress the development design and best practice of tools. Another remark which could spark interesting new research was the inherent bias that we witnessed in user comments, stemming from the sentimental distance between the subject (i.e. the volunteer app user) and the pilot team, as well as from the motivations for volunteering. We observed different user responses according on distance of the social connections which might indicate a degree of reciprocity to the responses. We foresee running future experiments that will allow us to delve more deeply into these aspects of use, user and usability to better understand the nature of the user response, the expectations and viewpoint on the perceived value and social reciprocity that underpin the design processes.

Acknowledgments

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