

BrainChain App: A Fully Crowdsourced Design Process For Museums

Lindsey van der Lans
Eindhoven University of
Technology
Eindhoven, The Netherlands
l.v.d.lans@tue.nl

Evy Ligia Ansems
Eindhoven University of
Technology
Eindhoven, The Netherlands
e.l.ansems@tue.nl

Vassilis-Javed Khan
Eindhoven University of
Technology
Eindhoven, The Netherlands
v.j.khan@tue.nl

ABSTRACT

Current design and development practices for technologies in museums are costly and difficult to scale. We present a study that shows paid crowdsourcing is a viable approach for the design of a museum app from concept to the development of a working prototype, and the creation of scalable content of over 80 museums worldwide.

Author Keywords

Crowdsourcing; Mobile Application; Museum; Co-Creation; Design; Public Engagement; Museum Visitors; Cultural Heritage

ACM Classification Keywords

H.5.3. Group and Organization Interfaces: Computer-supported cooperative work.

INTRODUCTION

Museums nowadays face several challenges. Among the most important is how to attract and sustain visitors and how to integrate modern technology. It should not come as a surprise that there might be a strong link between the two aforementioned challenges. Visitors are more technology savvy and thus expect an interactive experience within museums. To face the aforementioned challenges museums are shifting from being collection-centered to being community-centered. More specific questions that museums face are: How to keep the visitors engaged? How to let crowds contribute to content?

To tackle these issues, one approach is by using social media. Through social media, museums try to directly communicate with the visitors and try to engage them more. Museums tried to let the local community contribute with private stories and experiences to historical sites and objects. The community can contribute by social activities or categorizing objects. In this way, the community is a producer and consumer of the created content [14]. However, the application of social media has limited scope. Most of the times it is used for short-term objectives such as for voting or rating a post or to share images of events. Additionally, social media is used to motivate visitors to explore and to co-create.

Another approach is the use of modern technologies within the museum's premises for enhancing the visitor's experience. A common experiential issue is that people do not often know what to do when they are visiting a museum [2]. A popular solution to this within the premises of a museum is combining education and entertainment, called edutainment, to enhance one's learning experiences. Gaming elements can increase the visitor engagement [8] [7]. Examples of other technologies include mobile-device based walking tours or touch screens for requesting more information. A drawback for the visitors seems to be that they find it difficult dividing one's attention to the device and the environment [5]. Moreover, one study reports that another drawback of this approach is that although the target group was young people, designers needed to spend a lot of effort in explaining the task beforehand [15]. This kind of approach is museum-driven that in some ways excludes the crowd in co-designing or contributing content to it.

A third approach involves a local community in creating a sustainable relationship with the local heritage [6]. Part of the local community involvement was to show one's perceptions interpretations and expectations of the heritage. A salient practical implication of that involvement was content development for the museum [6]. Such an approach, although very useful, is obviously limited to local communities and is hard to scale beyond that community.

To our knowledge, there is not yet a research effort that tries paid crowdsourcing as an alternative approach to develop technology and content for museums. We contribute to the literature by presenting a study that evidently shows that paid crowdsourcing is a viable alternative for helping museums to: 1. ideation of technological concepts; 2. deciding which ideas are best; 3. design of visuals, and 4. development of content. In this paper we present our experiences with paid crowdsourcing in developing a mobile app from scratch and generating its content having the crowd on the steering wheel. In this way we present an alternative to current approaches and we reach out to a crowd beyond local communities for the design of novel learning experiences in the museum that are technically and financially feasible and sustainable.

- The author(s) retain full copyright of this work

METHOD

Although there are different definitions of what crowdsourcing is, for our work we adopt a broad, encompassing definition:

“Crowdsourcing is an umbrella term for a variety of approaches that harness the potential of large crowds of people by issuing open calls for contribution to particular tasks” [4].

It is evident that this definition includes paid crowdsourcing but does not restrict from other platforms such as social networking systems.

Since the backdrop of our research work was a two-week project on utilizing crowdsourcing platform for design research with one of the end results being an app that was requested to be developed. We began with a brainstorming session between the group members on topics for the app. A primary goal was to explore as much as possible crowdsourcing platforms. For that reason, we presented the topics that resulted from the brainstorming session to the crowd and let the crowd decide which one was most valuable for them. The topic chosen was to develop a museum app. We then went on to use crowdsourcing platforms for the crowd to decide what functionality the museum app should have. Next, we crowdsourced the app’s visual design. Then, we utilized crowdsourcing platforms to develop the app’s content. Afterwards, another crowdsourcing platform was used to test several aspects of our app. Finally, the programming of the app was crowdsourced as well. In the next section we detail the process and results.

PROCESS AND RESULTS

Need Finding

In the first step, our team of three researchers held a brainstorm session in which three topics were chosen by the team: 1. Museum: encouraging each other going to museums by unlocking riddles; 2. Recipes: creating new recipes with the crowd while playing a game; 3. Photos: getting photos by people one crossed paths with.

In the next phase, we asked the crowd to: 1) rank the ideas from one to three and 2) explain their reason for choosing the number 1. The results are shown in Figure 1. We distributed the survey link in several platforms: Facebook, Twitter, Google+, LinkedIn, WhatsApp and Skype. Eventually 77 responses were collected in 20 hours; 29 participants ranked the recipe app at the first place (Figure 1).

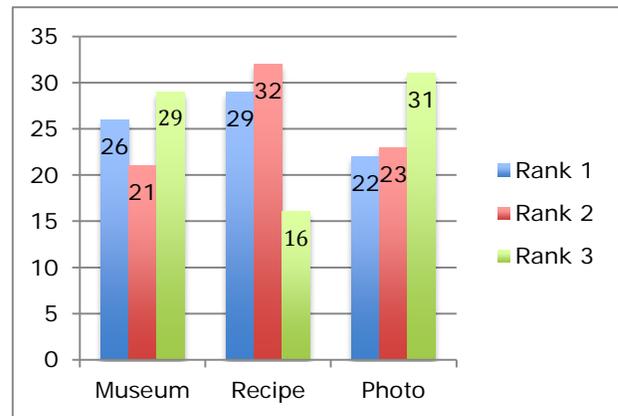


Figure 1. Utilizing paid-crowdsourcing to rank ideas that were themselves crowd-driven. The crowd ranked (29) the recipe-app idea as most interesting but when looking at the arguments it was clear that the museum-app idea was most favorable

However we decided to work on the museum app for which 26 participants ranked this on the first place. This is because participants elaborated on the reasons they would like to have a museum app. First, a simple word count showed that participants used on average 24 words (SD=29) to describe why they choose the museum app. In contrast this was only 13 words on average for the recipe app (SD=14). Examples of statements –for the museum app- are:

- *“I would like to go to a museum more often. Somehow I always fail to do this.”*
- *“Look at that, it's great for people to learn about art and history on a playful way! Think actually about simple museums and other touristy stuff in your own Neighborhood that we seem to forget because we live here and don't care anymore”*

Compared to the recipe app:

- *“I like to cook”*
- *“Love cooking”*

The museum app seemed to be more appealing and participants felt more passionate about it. This is why we continued with the Museum App concept.

Ideating

To specify the goal of the Museum app we decided to detail a design statement: *Design an App which educates people about art/museums by making use of wisdom of the crowd: collectively working on cultural heritage in a fun and engaging way.*

We identified two different aims of the game, 14 different functionalities, six different rewards and four different names for the app. We asked the crowd to show their preference for functionalities and rewards. The workers were

able to select multiple options. Moreover, they were asked to vote for the best name. Since it is made for them, we decided that it would be best to let the crowd have the final decision upon the functionalities to collect this data, we launched a survey on Crowdfunder. Crowdfunder is a platform where surveys can be set up and distributed to all workers subscribed in this platform. Workers earn a \$ 0,10 with every completed survey. In one hour we received 99 responses from 36 different nationalities. The workers were told that they could contribute to the design of a museum app.

The workers could choose between two different aims: unlocking a letter/word for the crowd assignment or unlocking a part of a puzzle/riddle for the bigger assignment or both. They voted for the second one. This means there will be an individual question and the answer will contribute to the crowd assignment. After counting the votes for the functionalities (in total 557 votes) seven main functionalities were selected based upon the highest rating (> 40 votes). The same approach was taken for the rewards. In total 206 votes were received, and out of the six options three main rewards are selected (> 40 votes). 40 people choose the name BrainChain for the app. 94 people would play this game and 89 people said they would be motivated going to museums by this game. Tables 1 and 2 show the different kinds of rewards and functionalities the workers voted for. The main result from the crowd is that our app should be a game-like quiz app with questions relating to the museum.

This app is built upon the idea of combining the environment with technology [5] [13]. The game can be activated if someone is close to a certain object or is entering a museum. Another inspiration for further developing the app was: "... the major underdeveloped functions of museums is to provide opportunities for individually meaningful experiences that also connect with the experiences of others." [2].

Designing With Crowds

After identifying the functionality, it was time to come up with a design for the app. Our initial idea was to crowdsource some different designs and then let the crowd decide which design they liked the most. However, since there was only one Upwork worker (girl from Odessa, Ukraine) that offered to work for free, out of 15 offers that ranged approximately from 0 to 60 dollars, we decided to work with her. She wanted to improve design skills, so for her it was a learning experience. One of the team members was monitoring this process with the designer and in three days a complete design was received (see Figure 2). We developed a paper prototype and this was sent to the designer and during an iterative process with one of us the final design was created. The final design is shown in Figure 3.



Figure 2. First Graphic Design of the selected Upwork Worker. Landing page, login page, individual riddles, collective riddles and reward.

Developing Content With Crowds

Our app needed questions as content. Instead of coming up with these ourselves, we decided to crowdsource the questions by again using Crowdfunder. We described the workers that they became quizmasters and we asked the following questions: *What is your favorite museum?* And as a follow up: *What quiz question can you ask about the museum collection?* We also asked what their favorite art piece is in that museum and as a follow up: *What question could you ask about this art piece?* Out of 100 responses we could develop 115 qualitative good questions. See Table 3 for some examples. From this input we used only 25 questions for the first prototype, to make it work in the short amount of time we had for our project. Our results show that there is a plethora of diverse content that can be created in a short time and with a small budget with paid crowdsourcing for creating quiz questions. We would argue that this might hold true for similar museum apps.

Rewards	Votes
Free tickets to go to a proposed place to solve the next assignment	56
Coupons (can be spent anywhere)	47
Discounts on museums in general	46

Table 1. Chosen rewards for the museum application

Functionalities	Votes
Different Museum themes (architecture/sculptures/paintings etc.)	62
Receiving "points" by giving an individual correct answer	62
Difficulty levels	53
Extra reward for entering a certain level	46
Chat box to chat with other users	42
History of solved assignments	43
An overview of reviews of museums	40

Table 2. Chosen functionalities for the Museum App

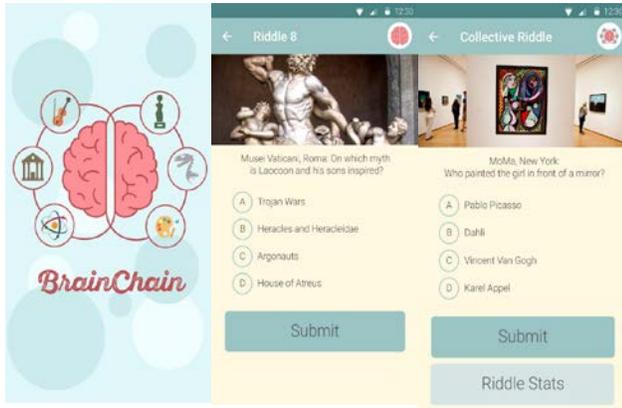


Figure 3. Final BrainChain design. Screenshot of landing page and the collective and individual riddles

Content-Crowdflower

Task: Imagine being a quiz master and create questions about your favorite museum.

Metrics

- Time: 4 hours
- Responses: 100, 95 useful
- Nationalities: 35
- Paid: 10 cents per participant
- Different museums: 80
- Questions: 115

Example questions

1. Philippine Museum, Manila
Who painted the Spoliarium?
2. Indian National Museum, New Delhi
How many art pieces does this museum have?
3. Passchendaele 1917, Zonnebeke, Belgium
What is the museum about?

Table 1. Results of Content Creation, The task description, metrics and examples of questions

Testing With Crowds

Having the design and the content, the next step was to test this with the crowd. UsabilityHub is another crowdsourcing platform that offers a different kind of design tests. At this platform we earned ‘karma points’ by being workers for others. With these points we could ‘pay’ our own workers.

The first test we conducted was a short questionnaire about the design of our app. In total 10 workers were asked. The purpose of this test was to find out what people would expect after tapping on a UI element. The following questions were asked about Figure 4.

Imagine you are going to the museum, at the museum you see advertisements with this picture of a mobile app.

1. What do you think the app is about?
2. What would you expect to happen when you click on submit?
3. What would you expect to happen when you click on see others?
4. What would you expect to happen if you click on the brain image in the upper right corner?
5. Do you have any design recommendations?

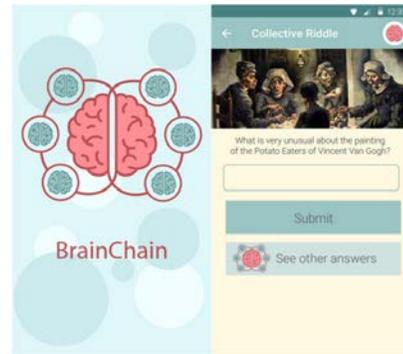


Figure 4. Screens which were questioned about the functionality and the intention of the application.

Most workers thought the app was a brain game (5 out of 10) or museum quiz (3 out of 10). Other responses were that it was to boost imagination or to share specialist knowledge. We also asked what they would expect after clicking on the submit button. We found out that they expected to see the right answer after submitting it, they wanted feedback. This is something we did not think about at that stage. Our own thought before was that they would just go to home screen instead of seeing the right answer. The brain icon was considered as going to the home screen or settings. The workers were also asked to give suggestions about the design. The only feedback we received was that the readability of the text in the buttons should be increased.

The second test was a flow-test. Ten workers had to complete the following tasks: you are going to (1) play an individual game, (2) choose game 4, (3) submit the answer, (4) go back to the main screen, (5) check discount and (6) go back to the main screen. The first task was not completed well, this is probably due to the confusing task description. We could have asked them to click on an individual game. For task three to submit the answer, they might have thought that they should write an answer which was not necessary to continue with the test. The lesson we learned from this, is that it is very important to be clear about what you want from the crowd.

The last test on UsabilityHub conducted was a preference test for the logo (11 workers). This test was conducted to test

which logo would better convey the purpose of the app. We provided a short description of the app and then workers had to choose between the two alternatives of the logo, which can be seen in Figure 3 and 5. Ten out of the eleven people choose the current design (Figure 3). The overall time of receiving answers from UsabilityHub was very fast: between 10 and 15 minutes per test.

Prototyping

As aforementioned, our aim with this project was exploring how much we could crowdsource for the development of a museum app. After designing an interactive prototype in Axure, we uploaded that again in Upwork together with a detailed task description. After one hour there was a response from a Ukrainian developer who was willing to program a working prototype. Due to our limited time schedule, the programmer had only one day left for programming the app and therefore he only coded part of the app. However, in our experience, it was easy to find a good programmer for a reasonable amount of money. The programmer was paid €8 for about 24 hours of work.

DISCUSSION

Creative implementation of digital technology can be a means to support active learning in a museum context and can add extra meaning to the physical museum exhibits [16]. Although museum research focuses on implementation of digital technology to involve the visitors, no intervention has yet been tested which merges digital technologies and crowdsourcing within the field of participatory museum experiences [9].

The BrainChain app we presented has elements of Gamification, which also used crowdsourcing as a method in the realm of content creation, communication and evaluation (e.g. curatorial thinking). Instead of giving the control to the curator solely, crowdsourcing enables involvement of the connected museum visitors. The visitors create, share and evaluate digital museum content via crowdsourcing platforms. Thereby, the visitors leave their digital traces and trigger others to search for the traces in the museum context. We believe that digital crowdsourcing media are likely to motivate users in visiting museums through fostering public engagement. That is of course left to be validated for future research.

Although museums are willing to incorporate digital technology to enrich the museum experience, it is hard for museum professionals to establish this [12] [13]. However, as we have shown in our study, crowdsourcing museum content creates opportunities for museums by involving visitors in the design for museum experiences. This emerging crowdsourcing approach addresses the evolving museum trend of being community-centered instead of collection-centered [18]. The two-week development of the BrainChain application shows that concept development and content creation can be established by making use of existing crowdsourcing platforms.

The right type of crowdsourcing platforms needed to be found during the process, because the many existing crowdsourcing platforms differ in their focus (crowd creation, crowd voting, crowd wisdom or crowd funding [4] [11]), their expenses, quality control and immediacy. Mainly, crowd creation platforms were used for the design and content creation of the mobile application. Unfortunately, crowd creation platforms related to design contests (e.g. DesignCrowd) often asked for starting fees which was not feasible for the €100 budget. However, these platforms offer quality control because the initiator has the privilege to choose the best design from the crowd. Another benefit is that these platforms often require a self-initiated design deadline for the crowd.

Nevertheless, low-cost, bid-oriented and yet immediate crowdsourcing platforms exist as well. These platforms allow crowdsourced workers to improve their skills. For example, multiple potential workers responded to the design proposal of BrainChain which was posted on the crowdsourcing platform of Upwork. Subsequently, one of the Upwork workers offered to work for free in order to learn and extend her online portfolio. Since the graphic design deliverables of the mobile application were as expected and beyond, money was given as an extra reward for the good collaboration and deliverables. The latter reward felt more justified due to the notion of exploitation otherwise. Still, positive online reviews or recommendations could also be a reward option due to the value of reputation.

The two-week development of the BrainChain application demonstrated the validity of crowdsourcing content creation. Nonetheless, it matters how the crowd is involved by the initiator. It needs to be clear for the crowd what is expected from them and it needs to be appealing to generate productive outcomes. Text and visuals functioned as a way to communicate ideas during the content creation and concept development including the design of the mobile application. The text was made appealing by letting the crowd truly become part of the app development. For example, the crowd knew what the app was about, why their participation was important, how their input was going to be used and were triggered by playful storytelling.

During the design of the app, a pro-active attitude of the initiator was required. Hereby, giving immediate and online feedback on visuals of the currently developed graphic design was essential to establishing common ground. Moreover, when the initiator was not able to give feedback on the multiple design outcomes of the Upwork worker, the crowd was asked to make a design decision through crowd voting. The approach of coaching and involving the crowd fostered an immediate and fruitful design process.

The BrainChain application is a location-based game that provides the opportunity for content creation and is regarded as being adaptable to renewed exhibitions due to the content evaluation of the crowd [10]. This flexibility in modification will benefit the act of quickly and cost-effectively

responding to new requirements for the app in order to comply with end-users that act as content consumers and content suppliers [3]. This subject of flexibility in modification was suggested for future research by Fidas et al. [3]. However, research is still needed to find out how the content can be managed accurately by the crowd without the help of cultural heritage experts. For example, gamers are able to evaluate potential quiz questions of others in the Question Factory of Trivia Crack¹, which allows checking the questions for accuracy [1]. Therefore, it is possible to let the crowd actively co-create and evaluate digital museum content as an attempt to enrich the user experience in museums by providing flexibility in modification.

CONCLUSION

Although crowdsourcing is relatively unknown as being an effective and efficient approach for participatory museum experiences, the development of the BrainChain application mainly shows that crowdsourcing can be a valid method not just for ideation, designing, software development and testing, but also for content creation. Furthermore, providing emerging digital technologies for crowdsourced museum content is likely to create opportunities for visitor museum engagement as well as participatory museum experiences and addresses the trend of connected museum ecosystems. While crowdsourcing platforms differ in their expenses, quality control and immediacy, decent content creation is mainly dependent on how the crowd is involved. Future research will cover the subjects of incorporating accurate adaptability in crowdsourced content creation, further (software) development of the app itself and the evaluation of the app in the context of use.

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¹ <http://www.triviacrack.com/>