Star Catcher: a Mobile App Using Augmented Reality and Gamification to Engage Users in Art Exhibitions

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Introduction

Why would young people want to go to museums while they already have access to all the information they want online? Today's youth is growing among special effects and video games, and the traditional art industry struggles to attract them in its walls. For instance, the Palais des Beaux Arts museum located in Lille, France, recently proposed to its visitors a temporary exhibit called Open Museum Video Game, with pieces of the exhibit spread across its art galleries. Making things worse, the Covid-19 pandemic stroked, and museums had to limit their number of visitors, or worse, were forced to close their doors for a while.

Recent work highlighted the potential of augmented reality (AR) technology to increase user engagement, for instance in the retail industry [1]. According to them, interactivity, vividness and novelty are key elements to provide a great user experience. More recently, AR solutions were proposed to give users more engaging museum experiences, tending to increase both user engagement and learning [2]. We propose to combine AR and gamification approaches, a fairly new combination despite both showed benefits for user engagement and task completion time [3]. We aim to improve user experience and engagement toward art exhibitions without altering traditional art. Our solution deploys easily in any ongoing or future art exhibition without the need to alter the exhibition itself.

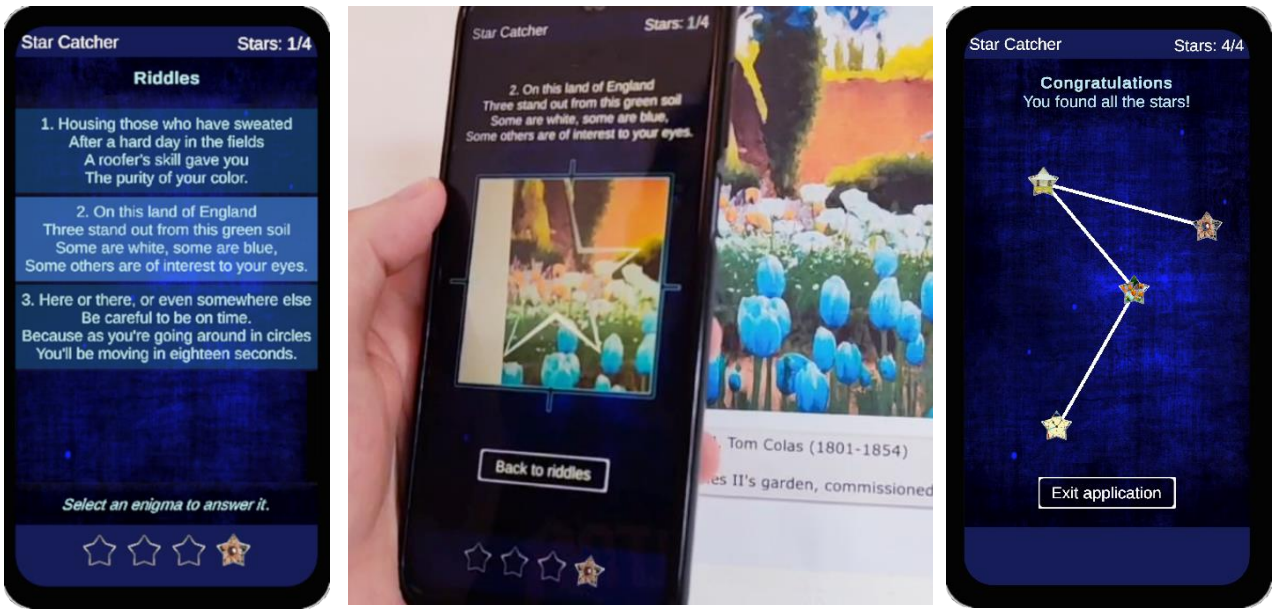
This work presents the development and evaluation of Star Catcher, a mobile app concept for increasing recall and user engagement toward art exhibitions. The app makes the exposed artworks pieces of a hunting game, where users have to solve riddles to find stars hidden in artwork details. This abstract introduces the concept and functioning of the app. It presents a user study evaluating the app in the context of a simulated art exhibition. Conclusion summarizes our concept, discusses our results and exposes in-depth planned future works.

Star Catcher

Star Catcher is a mobile app designed for art exhibitions. Its main objective is to improve public engagement toward them by allowing people to interact with exposed artworks. The app presents itself as a hunting game, where the player has to find and collect stars that are hidden in exhibited artworks. Riddles associate each star to find with a detail of one of the artworks. For instance, the answer to the riddle "*On this land of England, three stand out from this green soil. Some are white, some are blue, some others are of interest to your eyes*" would be the orange tulips in the background of the picture "Tulip field" (see Figure 1).

The application includes four main screens. The first screen corresponds to a tutorial explaining to the user the goal of the game and how the app works. The second screen displays the different riddles to solve (see Figure 1.a). When the user thinks he or she found the solution to one of the riddles, he or she tap on it to open a new screen displaying on their phone the image issued from the rear camera. The user then scans the detail of the image he or she thinks is the solution to the riddle. If the user is right, a star will be gradually drawn using AR on top of the target detail (see Figure 1.b).

Two bars located at the top and bottom of the screen remains on each screen (see Figure 1). The top one displays the number of stars already caught and stars to catch in total. The bottom one displays the collected stars, i.e., the details of artworks related to the riddles they already solved. When a user has collected all the stars, he or she is rewarded with an animation of the stars on the bottom, moving across the phone's screen to draw a constellation (see Figure 1.c).



a. Riddle 2 selection b. Scan of the solution (orange tulips) c. End screen

Figure 1. Applications screenshots of riddles and end screen used for our user study (translated from French), and display of a star drawn using AR over the detail of the picture corresponding to riddle 2.

User Study

This user study aimed to evaluate how Star Catcher improves user experience, and influences memorization of the presented pictures and their description.

Apparatus

This experiment required to simulate an art exhibition to evaluate our app. We used Dall-E 2[1], an AI system able to create original pictures from a textual description, to create six artworks. Each artwork was associated to a fictive title, artist's name and description. This ensures participants could not have seen them prior to the experiment as we aim to evaluate recall.

Participants

30 french-speaking volunteers (14 females, aged from 21 to 56, M=32.3, SD=10.2) were involved in this study. They were randomly assigned to either the experimental or control. Thus, half of the participants used Star Catcher during the tour visit (Application condition, C_A). The app was loaded with riddles related to the exposed artworks. The other half made the tour without Star Catcher, as if they were visiting a classical art exhibition (Control condition, C_C).

Materials

We used the User Experience Questionnaire (UEQ) to evaluate visit experience [4]. The UEQ consists of 26 items evaluated on bipolar 7-items Likert scales. It evaluates various dimensions of experience, as perceived attractiveness and novelty. We also designed a short questionnaire to collect participants' opinions on the visit through 7-items Likert scales (e.g "*Would you recommend this visit?*"). Participants' memorization of eighteen items was evaluated through MCQ, 6 artworks × 3 questions for each one: a picture detail related to a riddle of the app (e.g. "*What color is the barn's roof?*"), a detail not related to a riddle (e.g. "*How many farmers are represented*?") and an element from picture description (e.g. "*What century is described?*").

Procedure

Firstly, participants were informed we were conducting an experiment to simulate and analyze a museum visit experience. We neither asked them to memorize pictures, nor told them they would have to pass a MCQ after the visit.

Then, participants were left alone in the experiment. No time limit was set for the visit. Six artworks with their description were exposed. The participants were told neither about the real aim of the experiment nor that we used AI-generated pictures until the end of the experiment.

After participants finished the visit, they were seated in another room to ensure they could no longer see the artworks. They first fulfilled a questionnaire concerning their visit experience. They next fulfilled a MCQ evaluating how much information they memorized about artworks and descriptions. At this step we explained to them that we were not aiming to evaluate their personal memory but more globally what people tend to remember to avoid stressing them.

[1] AI-based image generator: https://openai.com/dall-e-2

Results

Visit experience. Mann-Whitney test displayed significantly higher scores for items of UEQ in C_A than in C_C (p-value≪0.01). The application made the visit experience feel more original and innovative, but also enjoyable, attractive and appealing. Participants in C_A reported they would be more likely to come back in the next six months for a similar visit than those in C_N (6.4 VS 4.0, p-value≪0.01) or to recommend the exhibition to others (6.87 VS 4.0, p-value≪0.01). Furthermore, participants reported they found the application visually pleasing and easy to use.

Memorization performance. Results displayed benefits of the app when the users were asked on details of artworks related to riddles (48% VS 17%, p-value<0.01). We found no differences when details were not related to riddles (41% VS 33%, p-value=0.19). Concerning description, we observed a hindrance tendency when using the app (62% VS 79%, p-value=0.052).

Conclusion & Future works

We proposed and evaluated Star Catcher, a mobile app aiming to improve user engagement for art exhibitions. A user study highlighted that the application was really appreciated by our participants. They reported a high intention to come back and recommend the tour to others, showing a great interest of the app for museums willing to improve visitors number compared to participants in control group. Most participants also told us they would have like to have more information on details of the artworks related to riddles. This is encouraging feedback since it suggests that our participants were truly engaged with the art exhibition.

Our results also showed the application enhances memorization of artworks, but lessen memorization of descriptions. We suggest two possible explanations for this result. A first explanation could be that the application focused the attention of participants more on the artworks than their description. A second explanation could be that our participants were not used to art exhibitions, as they reported on average usually going to museums less than once a semester. They would then naturally focus less on learning about artworks than real visitors. Our next step is to deploy Star Catcher in a real art exhibition, with real visitors. This will allow us to study how the application influences memorization when people actually come for the art exhibition, using riddles related to meaningful details of exposed artworks.

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