'A Is for Art' – My Drawings, Your Paintings

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Abstract. The booming development of digital technologies has significant effects on the way that human see and feel this world. The digitalization of artworks raises a set of interesting topics with the aim of making the artworks accessible to anyone with an Internet connection. In this paper, an Android Mobile App '*A is for Art*' was developed to help the general public to find paintings using free-hand drawings, with the aim of involving more people with the Visual Art in an interesting way, particularly the paintings from the Tate Collection[1]. A focus group for usability evaluation was conducted, and several design principles were drawn from the phases of development and evaluation.

Keywords: Digital Engagement, Visual Art, Mobile App, Image Retrieval, Painting, Free-hand Drawing, Design.

1   Introduction

In recent years, the advanced development of digital technology has changed people's life a lot. With broadband speed increasing [4] and a wide variety of devices capable of supporting many different media and connecting to the network [5], the artistic paintings in museums and galleries are digitized by high-quality equipment, the public now have more opportunities to appreciate the artworks by visiting online art libraries or galleries. Moreover, several other factors, such as the widely disseminated digital camera and the popularity of the social network, make "*arts comes to you, you no longer need to go to it*" [1]. This offers the chance to touch the works of art, thus appreciate and get familiar with the authentic replica before they visit the real one in the art museum or gallery.

Arts can have a highly great positive impact on a person's life. Great art could help people to develop thinking and imagination [2]. As the writer Blake Morrison said, "*Art can do many things: entertain, instruct, console, inspire, enrage, transform.*

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[1] http://www.tate.org.uk/about/our-work/collection/
about-the-collection

It teaches us things we can't be taught in any other way and makes us see things we wouldn't otherwise see. It allows us the illusion of escaping our daily lives while simultaneously taking us deeper inside ourselves." [3]

However, arts do not make any impact on the world if few people see or hear what artists are trying to say. We did a survey on how often people went to art museums/galleries on average. From 134 survey responses, as shown by Fig. 1, around half (47.83%) of the subjects went to art museums/galleries less than once a year, 27.83% of them had never visited art museums/galleries.
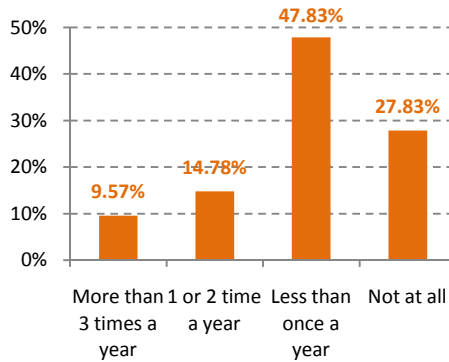

Fig. 1. 'How often, on average, you go to art museums to see paintings there?'

The motivation of our research is to explore some new and interesting ways to encourage more people to engage in the visual arts digitally.

The rest of this paper is structured as follows: section 2 introduces current related work, followed by section 3 which proposes a system overview of '*A is for Art*'. Section 4 describes the usability evaluation of the system, after analysing the study results, we propose several design principles for mobile app and plan for the following-up work in Section 5.

2   Related Work

Current digital museum participation includes visiting websites with aim of viewing the online museum/gallery collections, taking a virtual tour, searching for information about opening hours or buying tickets; on the other hand, the public use mobile device apps developed by museums or art organizations as a marketing tool, to enhance the participative arts experiences. For example, the '*Social Interpretation*' project [7] drew on the social media models to make museum visitors interact with other visitors via the Quick Response (QR) codes located near to Imperial War Museum (IWM) objects.

There are more and more museums and art institutes who digitize their art archives increasingly and provide free online access and other interactions. Google Art project[2] offers thousands of artwork pieces from 230 art collections or galleries, and the viewers can view the piece thematically and share the piece by posting onto social network sites or emailing to a friend. In December 2012, the Public Catalogue Foundation (PCF) and the British Broadcasting Corporation (BBC) launched *'Your Paintings*'[3] website which allows the public to access and tag 212,000 United Kingdom's oil paintings online. The Rijksmuseum[4] (Dutch) released more than 125,000 high resolution works to the public on April 2013, the visitors can touch and zoom the masterpieces to reveal the details and they are allowed to download or create (crop and edit the artworks)   and print out their favorite ones on postcards, shirts or other materials.

Along with the booming mobile Internet, more and more smartphone users access the Internet via their mobile devices rather than their computers[5]. According to the latest mobile usage statistics from GPMD[6], in 2012 there are more mobile phones in the UK than people, and 52% of UK mobile phone users own a smartphone; the smartphone sales overtook the PC sales and will continue to grow. From comScore[7], 82% of mobile time is consumed via mobile Apps until April 2013. Therefore, we decided to seize this opportunity to foster a new way of consuming the visual artworks during users' fragmented time by means of exploring and developing mobile Apps.

However, the current mobile Apps are built by specific art museums/institutes, with the same functionalities of their websites. In the case of people who have pictures in mind but cannot remember the title or artist of the pieces, they could not search the exact paintings they expect by keywords. We developed a free-hand drawing mobile App, '*A is for Art*', which allows people to find out the painting by drawing the sketch or rough colored objects in their memory.

A number of studies aimed to build the correspondence between sketches and the natural photographs [17], e.g., Sketch2Photo [6], Sketch-to-Image Matching [18], MindFinder [20]. Hu et al. [19] demonstrate a photo montage application based on sketches. To our best knowledge, we have not found any studies which are specifically focused on searching the paintings by free-hand drawn sketches.

3   '*A is for Art*' System Overview

With the consideration of fast response to user's query, our system adopted the Client-Server mode: users draw some sketches on the mobile phone (Client side), the

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searching procedure run on our Windows Azure server (Server side). We used the Jacobs et al.'s "Fast Multi-resolution image querying" algorithm [8] to do the image matching between the colour drawings and the paintings; the Inner-distance Shape Context [9-10] algorithm was implemented for searching the matched painting of the line drawings.

The current database for the painting searching engine was collected from the Tate website[8], which includes 748 abstract paintings, 91 portrait paintings and 95 others for line-drawing retrieval. We only show the matched paintings on the first version App, and the additional information of the paintings will be added in the later versions.

The interface of our Android App '*A is for Art*' allows users to use touch-based drawing to search the painting search:

1) The user draws a character/object, such as a sketch or a color drawing on the mobile phone App user interface;
2) After finishing the drawing, the user can press the '*search*' button and choose one of two options: '*Using line drawing*' or '*Using colour drawing*';
3) The system will retrieve the images through the search engine on the server and send the relevant paintings back to the mobile phone screen;
4) Then the user could select the most matched painting and zoom in/out to see more details by a double tap the image.

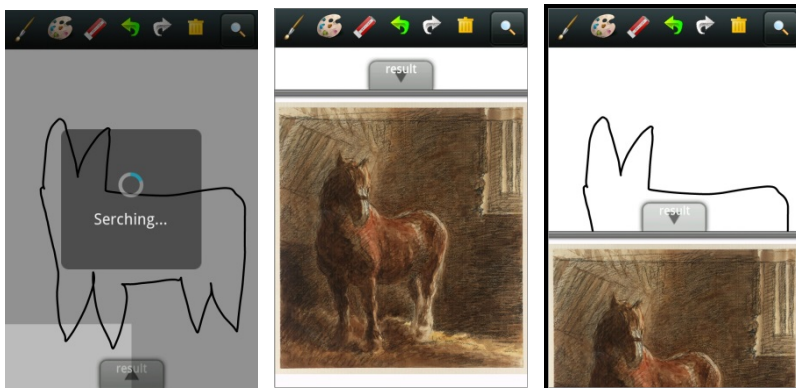The workflow of the system is shown as Fig. 2 and Fig. 3.

Fig. 2. 'A *is for Art*' system workflow of searching '*Using line drawing*'

4   Usability Evaluation

Usability is defined as the "extent to which a product can be used with effectiveness, efficiency and satisfaction in a specified context of use" by ISO 9241-11 standard

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[8] http://www.tate.org.uk

[11]. The usability testing of the mobile App might be slightly different from the traditional usability evaluation [12-13], because of the unique feature of the mobile devices. Therefore we conducted a focus group mainly by means of observing behavior and partly encouraging 'think-aloud' [14].
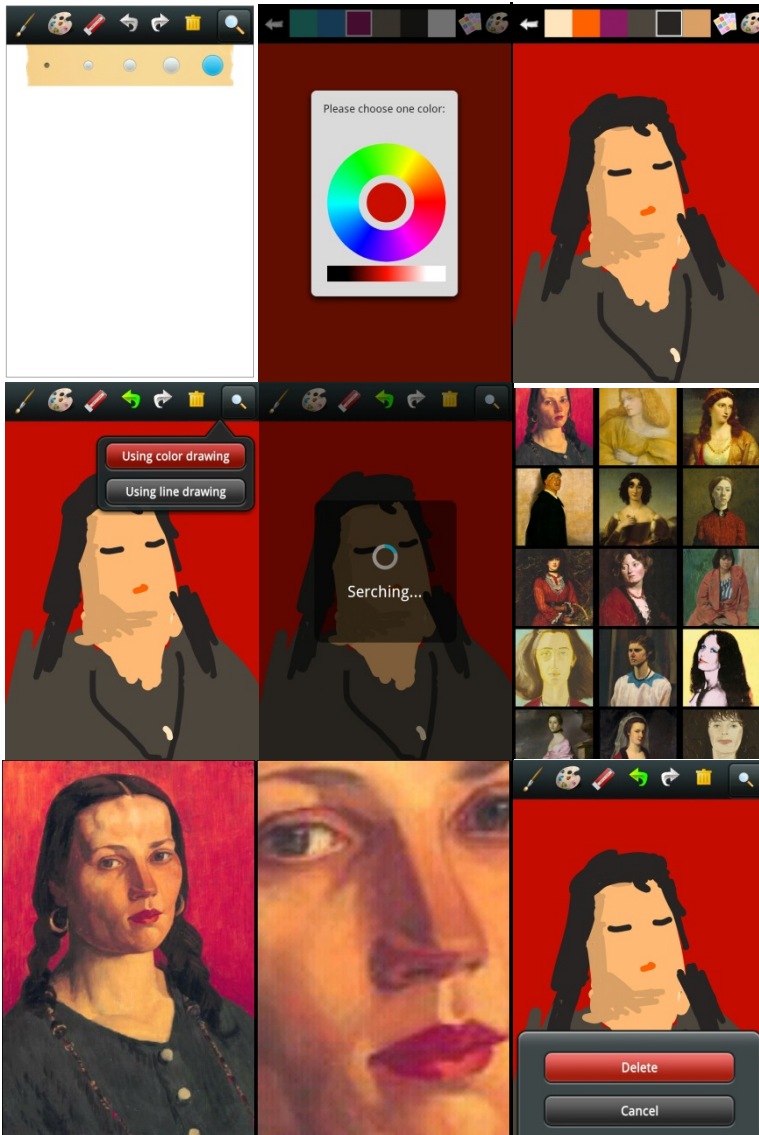

Fig. 3. 'A *is for Art*' system workflow of searching '*Using colour drawing*'

4.1   Participants

Four participants from the University of Nottingham Human Factors Research Group, volunteered to take part in the study. Levels of expertise were classified as expert in usability research.

4.2   Equipment

Four Nexus 4 phones were used with '*A is for Art*' installed. Google Nexus 4 phone offers relatively large displays (768×1280 pixels) and a high quality capacitive multi-touch touch screen, and built-in graphics processing unit (GPU), making it possible to create rich, visual interfaces such as zooming or touch-based manipulation.

The participants were recorded with one video camera (Canon Legria HF S21) and one webcam (Logitech C210) during the whole process of the focus group, with the purpose of later analysis.

4.3   Procedure

Participants were first welcomed to the room, the purpose of the study was explained clearly and the consent forms were signed before undertaking the tasks. Participants were asked to complete the following three tasks (shown as Fig. 4), and they were encouraged not to worry about the experiment or their performance, they could ask the observer for help if they got into difficulties. No instruction about how to use our system was provided. The participants could write notes about their experience during the action to make sure they could remember the details for the group discussion afterwards. The experiment lasted about one hour.
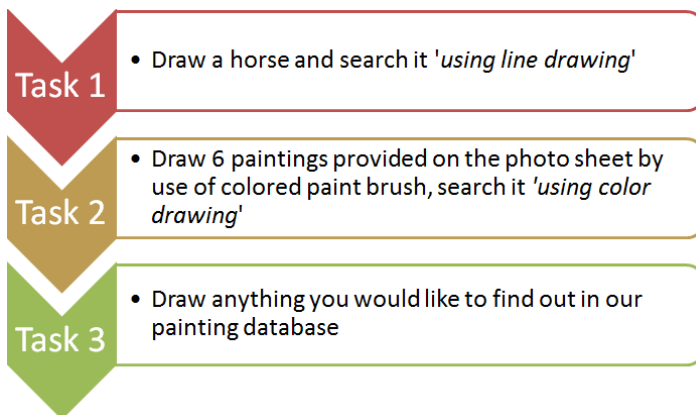
Task 1
- Draw a horse and search it '*using line drawing*'

Task 2
- Draw 6 paintings provided on the photo sheet by use of colored paint brush, search it '*using color drawing*'

Task 3
- Draw anything you would like to find out in our painting database

Fig. 4. Focus group tasks

4.4   Results and Discussions

There were no significant problems with accessing to the device, but most participants were confused about how to go back, because the Nexus 4 phone does not have any physical back button, home key and soft menu key, and some participants were not Android phone users. The participants' drawings are shown as Fig. 5 and Fig. 6.
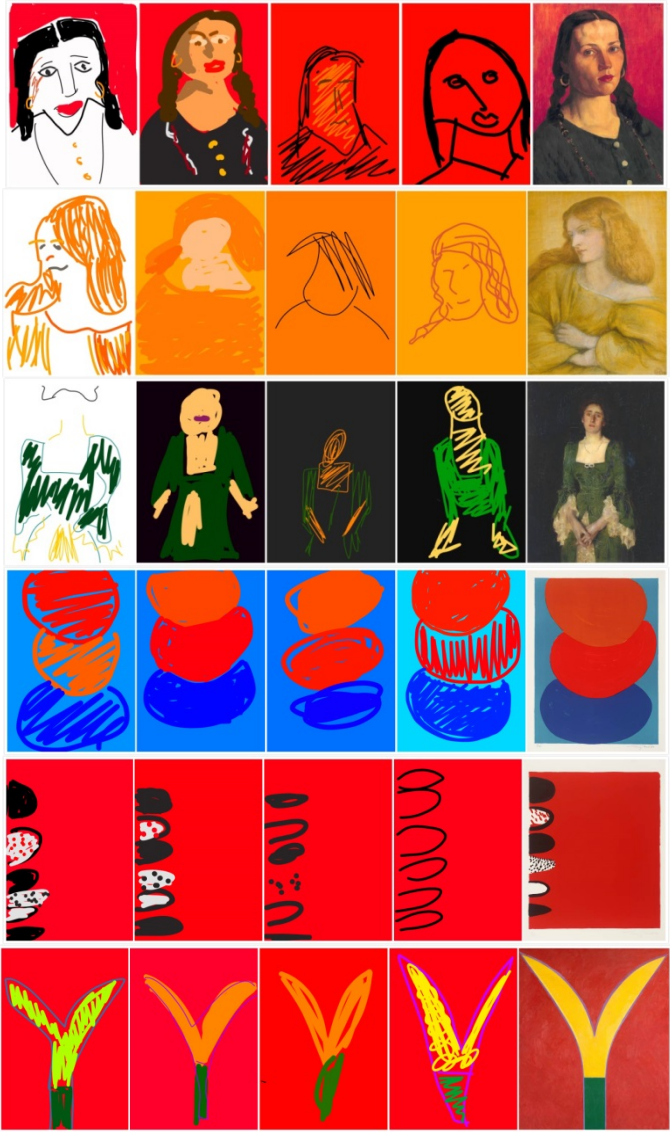

Fig. 5. Colour Drawings from Participants A, B, C, D (individually each column) and the original paintings provided on a sheet as reference (last column)
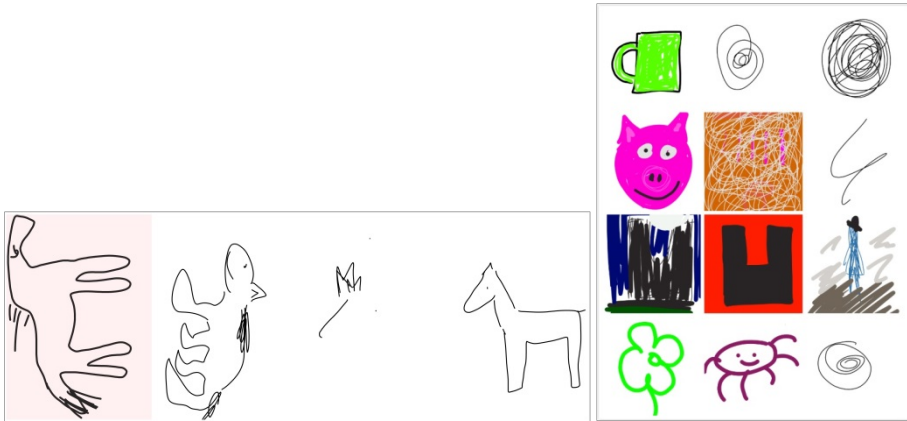
Fig. 6. Horse line drawings from Participants A, B, C, D individually each column (Left) and the free-drawings from Participants A, B, C, D individually each row (Right)

92.8% of the tasks were completed (finding the paintings on the task sheet by free-hand drawings). One participant did not find the horse in Task 1; one participant failed to find the second paintings in Task 2.

Users were observed when using the mobile App in unexpected ways. From Task 1 (Fig. 6, left), two participants drew the horse in landscape orientation, which was not expected by our searching algorithm.

From undertaking task 2 (Fig. 5), several interface issues were reported:

- No instruction about what icons can do;
- No indication of the size & colour of the brush chosen;
- The size and colour of brush are set to a default size after clearing the canvas;
- The size of both the brush and eraser are not wide enough, and users can not choose the size continuously;
- No tutorial about how to choose colour on the colour picker;
- Top menu of App can be confused with the Android Notification because of the full-screen mode;
- Undo icon doesn't always highlight when only one point dropped;
- No 'save' function;
- Inconsistent interface for displaying the matching result of line-drawing and colour-drawing;
- No intuitive colour saving mode (e.g. saving the used colour in the way of first-used-first-saved).
- Need more pre-set colour.

Although there was a learning curve for the new user to explore the features of the system, the participants reported that they enjoyed using the system. One participant preferred the drawer-like way of displaying the result, so she could pull up and down to compare the matched painting and her own drawing.

During the discussion, some participants reported that they would like to find the particular painting by both free-hand drawing and text information, e.g., the year the painting was made or the name of the artist. Some participants thought taking photos of the painting or selecting one photo from the phone gallery to do the retrieval would be their preferred choice.

5   Conclusion

According to Flurry[9], the future is an App world. We predict that the digital participation will keep increasing.

Participants in the focus group informed the refinement of the design. Nickerson's Overimputation theory [15] indicates that it is difficult for the designer to put themselves in the position of a real user who has none of their specialist knowledge. So it is important to involve real users during the product development. There are several design principles learned from the usability study:

— Keep the user interface as simple and intuitive as possible;
— Always keep users informed about what they are doing and where they are;
— Provide the option to recover from mistakes;
— Increase the consistency between the mobile devices and application features, and keeping internal consistency [16] will make users to use the same way of thinking throughout the interaction;
— Applying the existing icons to make the functions easy to understand, so the metaphors could be transferred from other products and experiences;
— Making good use of users' prior knowledge.

The next stage of work will be refining and improving the system '*A is for Art*', followed by field-work evaluation. Meanwhile, we plan to increasingly develop our painting database, and to build the new database of relevant text information about the paintings.

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[9] http://blog.flurry.com/bid/95723/Flurry-Five-Year-Report-It-s-an-App-World-The-Just-Web-Lives-in-It

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