Animated Instruction Metaphor: A Study of Augmented Reality User Interface for Children

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Abstract—**This paper reports a study aimed at important of animation instruction metaphor on usability and ease of use user interfaces of augmented reality (AR) colouring application. Precisely, the study compares 2 interfaces developed for the wARna augmented reality coloring application: 3 color metaphor instruction and animation instruction metaphor. The main objectives of the comparative study were to: (1) determine which instruction metaphor is the most efficiency for users of wARna (e.g., children aged 6-8), and (2) identify the user able to complete the scanning task. To achieve users goals to complete their task within a reasonable amount of time an experiment consisting usability evaluation were measured. Sixty students age 6-8 participated in the study, thirty-two males and twenty-seven females. Results proved large significant improvement on user task performance (e.g. task completion time); nevertheless, animated instruction metaphor differences were seen in the rating of attraction, with the animation metaphor rated more 'likeable'.**

Keywords — Animation, metaphor, children computer interaction, user interface, user experience.

I. INTRODUCTION

Animation are visually appealing and essentially attractions user attention to the important parts or guide them through the product. It is broadly used in user interfaces and also a great way for connecting the user and great user experience practice to make the users feel easy using the product [1]. Children are now an influential user group for new software and technology, more attention besides focus are made precisely on how to design for children [2]. Animations as user guides often to inexperienced users, such as children often show a variety of facial expressions that symbolised confusion or surprise. From user experience perspective, this usually means that something in the flow is broken or not smooth enough, and therefore requires fixing. When these facial expressions become visible, it often implies that the user stops the original task for rethinking the situation and considering what to do next [3].

In many cases as such, animation can be a great intersection to connect different interaction, actions, events or just static objects, in order to avoid user confusion. Animations attract user's attention to an alert, tell our users that they might improve the way they approach their task or warn them about the next to come. Animation brings positive influences on user experience and it may change its purpose and animation style [4].

Animation act as an instruction to help explained complex or difficult instructions. These instructions are represented by familiar metaphor or frequently used by the user such as trashcan [5]. The question is whether instructions metaphor assist and facilitate the children? The issue is important because children await to see the outcomes of their actions directly, causing them lose interest and attention after five minutes on a tasks [2]. Therefore, this paper will describe the

early attempts by studying children's understanding of the instruction metaphor in order to design an engaging, useful, and usable instruction metaphor.

II. BACKGROUND

AR technology has been growing expeditiously, children now are able to experience 3D model floating the real world, after coloring augmented reality coloring books using mobile [6][7][8][9]. However, considering the age of the children who uses the coloring book the level of interaction methods specifically the task can't be complex or difficult [6].

In order to report this problem, three section should first be studied: the current practice specifically mobile augmented reality (AR) used in representing instruction metaphor on children's mobile devices, the literature on the usability of instruction metaphor, and the methods for user interface design guidelines for children.

2.1 Current Practice

The task analysis showed that several AR coloring application shows a few common trends. Generally, there are no instructions during the scanning task, therefore it is either represented by an icon or the metaphor is hard to understand by children such as the color metaphor even on products targeted at children as young as 6 years of age [2]. Table 1 shows the summary of the task analysis on four AR coloring application for children age 6-8 years.

Table 1. Summary of task analysis

Mobile Application	Instruction Metaphor	Main Menu	Layer
Quiver	Blue, Red and Green Metaphor	Pictorial Icon	4
Chrom Ville	Camera View Finder Icon	Text and Icon	5
AR Kids	Camera Icon	Text	4
Arevo Ocean 3D AR Coloring	Text and marker point	Text and Icon	4

During the pilot test with quiver coloring application we discover that most children were not familiar with the term scan, they had difficulty to understand the Blue, Red and Green Metaphor and was unable to complete the task. Most children were fed up holding the mobile pointed at the marker, due to this we discover that the scanning task was difficult and hard for the children [10]. Children rarely read text nor may not understand the word, it is possible that the function is helpful to children complete the scanning task with no instruction [2].

Furthermore, we design a paper prototype by placing the graphical metaphors of the marker with the cartoon pasted on top of the transparent paper and run the quiver application. We discover that the children understand the task by pointing the mobile straight at the marker and were able to complete the

scanning task within few second and happily interactive with the 3D model.

Figure 1.Graphical metaphors on transparent paper.

Graphical metaphors are easy for children's interfaces; it should be substantial visual, as less text as possible and cutting cognitive load. Instruction metaphor should be age-appropriate, easy to understand and remember, the icons should be visually meaningful and understood by children.

2.2 Usability of Instruction Metaphor

The metaphors' role in the user interface is to easy to learn, engaging, useful and results appear immediately. The simplest concepts to characterize instruction metaphor by utilising existing metaphors, considering children emotional value and the fact that children may not yet understand abstract concepts [6][7][2]. Consider which interaction methods connect and help children with the task (e.g. drag, touch, hold etc.) can be used for the metaphor(s).The instruction metaphor must be easy to recall and should prevent making use of concepts unfamiliar to children [6][5]. This explains the difficulty of using the suitable instruction metaphor, it is easy to come out with the design but hard to sustain the usability level.

2.3 User Interface Design Guidelines for Children

From the study and observation, children voice need be acknowledge and children need to participate in the design process. By assuming bright colors and icon based on adult preference won't work for children because children have their own preference, like and dislike in order to increase the usability level [8][2][9][10]. Researcher from the field of Children Computer Interaction has many results on working with children which prove many guidelines that reflect helpful principles to be followed [8][2][9]. Design instructions need to be easy to easy to remember. Onscreen character interventions should be helpful rather than confusing. Acknowledge children to control access to instructional information. Design icons to be visually meaningful to children. Reduce scaffolding sub-menu and avoid hidden button. Last avoid complex, abstract and difficult instruction as children will be frustrated with the task [8][2][9].

III. DESCRIPTION OF THE STUDY

Instruction Metaphor

The two metaphor used in the experiment are the conventional metaphor, which use in Quiver AR coloring application and animated instructional metaphor use in wARna AR coloring application [12]. wARna instruments marker-based detection to augments the 3D content onto the colouring book. Consuming 'frame marker' in Qualcomm AR library, the colouring outline will implanted inside the frame marker.[13].

Metaphor 1(colored instruction metaphor): The colored instruction with text appears when the user aims out of the AR marker, the transition are not smooth and does not appear constantly. There is no sound or visual reaction and the colored changes as the user aim at the marker, red means error or out of the marker, blue means close or loading and green means completed.

Metaphor 2 (animated instruction metaphor): The animation instruction metaphor began with an icon of the marker followed by the transition of a phone aiming at the marker and end with at tick mark. There is no sound and it loops until the user press the ok button.

Fig. 2 Left coloured instruction on Quiver, right animated metaphor instruction on wARna.

B. Participants

30 children age 6 years; 32 males and 27 females.

C. Procedure

The experiment consists Cognitive walk-through by scanning the marker.

Cognitive walk-through: Each interface was displayed on a Oppo Find 5 Mini,1 Gigabyte of Ram, 8 Megapixels, CPU Quad-Core 1.3 GHZ with resolution of 540x960 pixels. The mobile was held by the children as the marker was positioned on a desk and subjects stand at a distance of about 0.5 meters from the mobile phone. All participants were showed how to operate the scanning task and later the participants performed the test individually and interacted with the interface. Each subject was presented with two interfaces three times, beginning with the colored instruction metaphor followed by the animated instruction metaphor. The order in which the participants performed the activities was the same for all interfaces and all subjects.

The participants were asked to perform a cognitive walkthrough which included one tasks: (1) scanning the marker while holding the mobile phones.

IV. RESULTS

Results show that while there are differences in the mean task completion times of the scanning tasks using the 2 interfaces (all completion times are lower for the animated interface metaphor), the mean for colored is .4253 and animated mean is .1690.
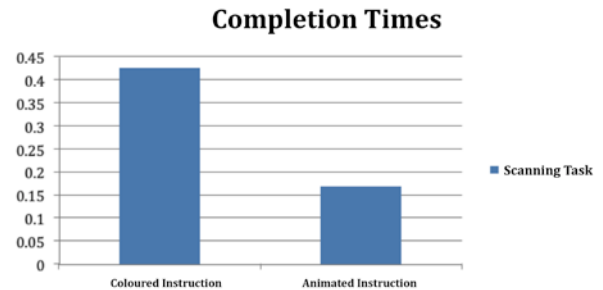
Fig. 3 illustrates the means completion times for each task using the 2 interfaces.

Task (1) required the user to; hold the mobile phone and aim straight at the marker which was place on the desk. The children's hand gesture was recorded using SONY Handycam and another Photo Booth camera to record their facial expression. Each participant was given a maximum time of 10 minutes to complete the tasks. For this activity, the recorded (in writing) completion/non-completion of actions and time of completion.

In addition, children reaction with the animated instruction metaphor shows significant result throughout the experiment and gain usability level and user experience. We asked the children which task do they like the most, either scanning the marker or interacting with the 3D model.

V. CONCLUSION

This paper describes two animation instruction metaphor (colored instruction metaphor and animated instruction metaphor) developed for the wARna AR coloring application, and reports the results of a study aimed at comparing children's use of the two interfaces. Specifically, the study investigated the effects of animation instruction metaphor on user task performance and appeal, with the main goal of determining whether an animated instruction metaphor seemed most appropriate for the target users.

Results of the study proved the significant effect of animation instruction metaphor on user task performance (measured by activity completion times and a number of errors while performing the activities). Nonetheless, task completion times using the animation instruction metaphor was consistently lower compared to completion times using the colored instruction metaphor. Interface differences were seen in the rating of appeal, with the animated instruction

metaphor rated more 'likeable' than the colored metaphor because of the animation.

All sixty children prefer interacting the 3D model rather than scanning the marker, this proved that the interaction design needs further development. The comparison of the two interfaces has provided critical data that will inform the final decision on which interface design to adopt in wARna AR coloring application. Further studies need to be done with a larger sample in order to develop and improve the usability of children experience using AR application.

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