Effortless Creation of Mobile Augmented Reality Experiences

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ABSTRACT
The advent of the mobile device has propelled awareness, adoption and implementation of Augmented Reality (AR) on a massive scale. The success and evolution of this event and the underlying technology over the last 5 years is nearly indisputable proof that the industry is progressing, though incredible examples of useful Augmented Reality applications are still to be explored. With present work we introduce a toolset for effortless creation of Augmented Reality experiences and artifacts tailored to mobile devices. Building on interoperable standards, we developed the Augmented Reality Experience Language (AREL) that brings a new level of interactivity to the final product. With present state-of-the-art instruments for creation of substantial interactive Augmented Reality scenarios we oversee wide adoption of novel forms of digital content creation and exploration in AR.

Author Keywords
Augmented Reality; Interaction; Authoring Tool; User Experience

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design; Experimentation.

INTRODUCTION
With the rapid penetration and evolution of mobile devices comes the ability to create new interactive experiences that enhance the way people communicate with each other and the environment around us. While there is rigorous investigation of the technological aspects of the Augmented Reality [2], there are few studies focused on the role of user experience and creative processes in such interactive settings. Liestøl introduced a genre of Situated Simulations, exploring a new abstraction named meaningware, a domain of digital discourse where individual content resides, framed by conventions [6]. Lee and colleagues have studied ethnographic methods and adapted AEIOU concept as a baseline for designers to incorporate user experience in handheld Augmented Reality applications [5]. We have considered mentioned abstracts, applied user-centric design principles and developed an authoring tool for effortless content creation, storage, maintenance and delivery of a final AR experience [8]. We have targeted media designers and artists as a primary user group in the early iterations of the tool. Now with extended functionalities we are reaching out wider audience including marketing professionals and developers.

DESIGNING MOBILE AUGMENTED REALITY
Effective design is a product of collaboration between stakeholders and specialists from different areas of expertise. To achieve design integrity, an interdisciplinary approach has to be taken into consideration, resulting in consensus on the current state of a design. Hence, we believe that all of the parties involved in a design process should easily participate and manifest their ideas, further contributing to the process of exploration.

Incorporating user experience into technology is not a novel idea and became a daily routine for human-computer interaction specialists. MacIntyre and colleagues introduced the DART system [7] which targeted skilled designers to support early design activities, especially the quick translation of storyboards into experimental prototypes in AR. A time-based approach was chosen in the DART implementation even though the timeline metaphor might not be the best choice for interactive scenarios. Fairly complex terminology and considerable expertise with specific a modeling environment put the bar too high for novice users to explore the full potential of the tool. Haringer and Regenbrecht got an inspiration from presentation software to develop a toolkit [3] for AR authoring. A standard workflow involves a number of tools to be used in conjunction and directs specific tasks in the automotive industry.

We focused on bringing Augmented Reality technology advancements such as 3D optical recognition and tracking systems [4] from the lab and into people’s lives, making them usable out-of-the box with popular mobile platforms. Designers, content creators and digital producers aren’t necessarily experts in Augmented Reality, so were driven by the idea of making it easy for consumers not only to launch an experience but also to be able to scale their content massively. We aimed to for user to be able to accomplish this goal in a simple and affordable fashion with just a few clicks.

In this paper we present a platform for creation and publishing AR scenarios and experiences within minutes. One can connect 3D content, video, audio and textual information to any form of printed medium or point cloud (3D map of an object or environment). Once the creation
process is finished, one can easily publish the AR experience immediately into an existing mobile consumer platform or create their own AR mobile application (Fig. 1).

Figure 1. A final Augmented Reality scene with a 3D model and a button attached to a printed trackable image pattern

PLATFORM HIGHLIGHTS
In this section we outline the main features of our platform, making the process of designing and delivering Augmented Reality experiences intuitive, natural and accessible.

Canvas
To facilitate creative production and to bring ideas into life, it is necessary to dedicate a significant portion of screen real estate for the scenario editing area. We have experimented with publishing, CAD and graphics software concluding the importance of the user’s primary focus on a main canvas, where pixel-perfect adjustments occur. Our authoring tool provides attention to details on every level of scene design – spatial position of artifacts, an object’s animations, support of touch interactions for a set of assets, etc. (Fig. 2).

Figure 2. A scenario editing screen

Resources
The described tool provides a number of resources to be included into Augmented Reality context. At your disposal are handles for 3D models, audio, video containers, hyperlinks, social connectivity triggers (e.g. Facebook, Google+ and Twitter), and system events such as calendar reminders. All of these resources can act as an interactive participant of a designed AR scenario, and therefore respond to assigned events, such as playing movie clip, submitting a new tweet, or playing a custom animation, etc. We leverage direct manipulation for handling resources and assets to allow the user to quickly learn the interface, work rapidly and immediately see the result of an action.

Application logic of an AR scenario is supported via visual programming with finite set of actions defined for a given AR resource. Complex relationships and the behavior of elements are also possible through altering the functional logic of a scenario via Augmented Reality Experience Language (AREL) scripting. AREL is a powerful mechanism to build interactive AR experiences based on common web technologies such as XML, HTML5 and JavaScript [1].

UI Designer
Static user interface design for your mobile application is a good supplement if one wants to white label a scene or provide navigation for a developed app (Fig. 3).

Figure 3. User Interface designer screen

Environment tracking
One of the advantages of the presented platform is to seamlessly deliver access to state-of-the-art tracking technologies, such as gravity aligned optical 3D tracking [4] with Simultaneous Localization and Mapping (SLAM) techniques. Our system reconstructs a sparse 3D map of the environment while tracking that opens a door to a variety of applications of use of an Augmented Reality authoring tool in such domains as architectural development, factory planning, product digitalization, etc. In order to explore such functionality, a point cloud of the object or environment is used as a trackable in a scene. 3D maps can be created using Toolbox [9] and then loaded into the authoring tool. 3D maps are visualized as point clouds with key frames or snapshots in the tool (Fig. 4).
KEY FINDINGS
Here we would like to summarize the motivation behind our design decisions in creating a tool and share some feedback collected from users. We also want to describe some challenges that we faced when building a design tool for combining physical and digital artifacts.

Design decisions made
The idea to redesign Metaio Creator was brought to our attention from publishing customers, an industry where media designers enjoy WYSIWYG functionality when developing layouts for a printed media. Earlier versions of the tool (Fig. 5) were very much workflow driven and required sequential selection of resources and tracking target patterns, then limited application logic design was possible in an instructive manner. That gave the end-user very little room for flexibility and interoperability of existing AR creations. One has to get through manipulation and encapsulation of many abstracted handles to get a desired result.

We employed the ethnographic AEIOU concept that helped us to frame the user scenario and make informed decisions on a micro-level. We have used constructs proposed for handheld Augmented Reality applications by Lee and colleagues [5]. Activities and Interactions are two building components that form actions upon AR resources to achieve the user’s goal. We have incorporated those primitives in such transactions as placing and adjusting virtual assets on the trackable, triggering animation for a model upon touching a screen, etc. The main canvas of an authoring tool embodies Environment, where activities happen. Mobile device performing AR scenario refers to an Object metaphor in the concept. We have put an emphasis on delivering AR experience in a simple and accessible fashion, which prompted us into new design decisions for the tool.

After analysis of a number of software solutions for 3D modeling and desktop publishing (DTP), taking into account interactive nature of the augmented reality we evolved the user interface of the authoring tool around the simple “drag-and-drop” interaction paradigm, where all the virtual resources can be simply placed on an embodiment of a physical object in design time. This mental model is familiar to DTP customers. Instantaneous real-time preview was also appreciated by end-users giving them immediate feedback of a designed AR experience.

Challenges explored
Good representation design aims to provide only relevant information for a given task to facilitate such activities as comparison, exploration and problem solving. We have encountered a few challenges in the representation of the point clouds (3D maps). It is essential for the user to understand context when designing AR scene in 3D. There are several possibilities: 3D reconstruction, highly dense point clouds, or 3D maps with key frames. The first two rely on the large amount of the features and suitable for a widely populated 3D maps. The goal of our point cloud capturing software [9] is to provide robust tracking therefore discarding unreliable feature points. We have chosen the latter approach – including key frames to a map, because it gives an unambiguous idea to user about a scene and most important, provide a perceivable reference to a ground plane, even for maps with fewer features. Still, sparseness of the features in a map is a fair challenge in visualizing point clouds and we are looking for new opportunities to address this problem accordingly.

Feedback collected
Initial feedback collected a year ago was extremely positive. Users highly appreciated new design scheme and interaction approach chosen for creation AR scenarios, simplicity of interface and proper visual guidance. The main feature requested was to incorporate the ability to export projects to IDE to build a mobile app for designed AR experience.

We are in the process of collecting feedback from our users, we expect 400-500 people to complete a survey. The goal of a questionnaire is to better understand challenges users faced when creating AR experiences with a tool. We asked users to provide insights about some tools offered and outline areas where opportunities for further enhancements can be created, e.g 3D map handling, application logic, representation of the 3D assets, etc. We aim to present results collected at the workshop itself.
CONCLUSION
We have presented a platform for the effortless creation of mobile AR experiences. The major component is an authoring tool that enables the design of complex interactive AR scenarios with virtually no development skills required. A utility tool for capturing a point cloud of an object or surroundings of the user allows one to work seamlessly with complex 3D environments. The platform runs AREL under the hood, and a web-bridge aimed to deliver created completed AR experiences to modern mobile platforms.

REFERENCES