DART: A Toolkit for Rapid Design Exploration of Augmented Reality Experiences

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Abstract

In this paper [MacIntyre et al 2004], we describe The Designer's Augmented Reality Toolkit (DART). DART is built on top of Macromedia Director, a widely used multimedia development environment. We summarize the most significant problems faced by designers working with AR in the real world, and discuss how DART addresses them. Most of DART is implemented in an interpreted scripting language, and can be modified by designers to suit their needs. Our work focuses on supporting early design activities, especially a rapid transition from storyboards to working experience, so that the experiential part of a design can be tested early and often. DART allows designers to specify complex relationships between the physical and virtual worlds, and supports 3D animatic actors (informal, sketch-based content) in addition to more polished content. Designers can capture and replay synchronized video and sensor data, allowing them to work off-site and to test specific parts of their experience more effectively.

Categories and Subject Descriptors: D.2.2 [**Design Tools and Techniques**]: Evolutionary prototyping, User interfaces; H.5.2 [**User Interfaces**]: Graphical User Interfaces (GUI), Prototyping; I.3.7 [**Three-Dimensional Graphics and Realism**]: Virtual reality; J.5 [**Arts and Humanities**]: Fine arts

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Introduction

Over the past few decades, augmented reality (AR) researchers (including ourselves) have explored a wide variety of task-focused domains, ranging from equipment maintenance and repair to medicine to battlefield awareness. Over the past four years, we have been collaborating with new-media designers, shifting our thinking from "AR as technology" to "AR as medium," and turning our attention toward more experiential AR domains such as in-situ educational historic dramas, art, and entertainment.

There are significant technical challenges to creating working AR systems, but these challenges can be overcome in specific situations through careful engineering and design. Designers exploring domains like AR are typically not novices in need of hand-holding and "easy to use" tools; rather, to be useful, design tools need to be predictable, understandable, well documented and powerful, and to support a work style that is appropriate for the medium.

DART (The *Designer's AR Toolkit*) is aimed at enabling designers to work *directly* and *effectively* with AR. The design of DART addresses a collection of problems that, together, make AR a difficult medium to work with. Rather than being a closed, "easy to use" tool, DART is implemented on top of Macromedia Director, the defacto standard for multimedia content creation (see Figure 1). Director was chosen because it is a full-featured, widely used tool that is relatively open and extensible, has a robust debugging and design environment, and is powerful enough for final content delivery.

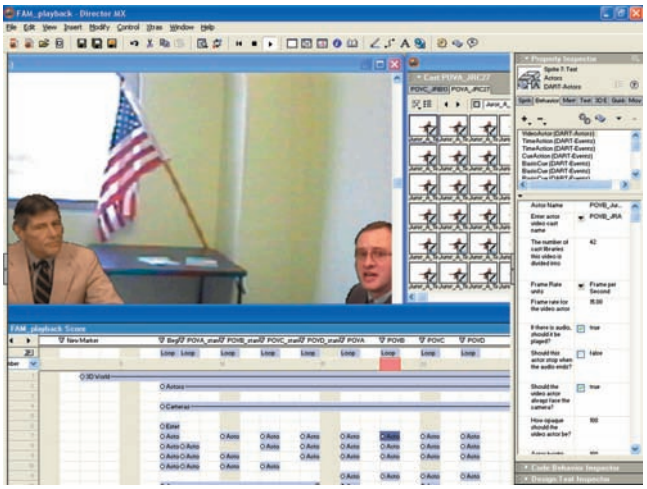

Figure 1: An example work session in DART (while debugging an AR experience called *Four Angry Men (FAM)*[1]). The entire score for FAM is visible, including the nine scenes and most of the actors (each scene is a column in the score). The stage (containing the running experience), part of the content for one video actor, and some of Director's editing windows are visible.

There are three main contributions of this paper. First, we identify a collection of problems that make AR a particularly difficult medium to work with, and suggest an approach to AR design (manifested in DART) that addresses many of these problems. This design process emphasizes rapid exploration and testing of AR experiences using informal content. Second, we argue for the importance of integrating research tools with existing commercial authoring software (Macromedia Director, in our case), and report on our experiences (especially the impact of the drag-and-drop timeline-based authoring model used by many such tools). Finally, we present a collection of novel features of DART that support our approach to AR design. These features include integrated support for physical and virtual content in the design environment, support for sketch-based animatic content, and capture/playback facilities that break the need for working in real-time in the target site.

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References

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[1] http://www.cc.gatech.edu/ael/projects/4am.html