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Course: MADE
Title of Research: **Augmented Pre-Vis: Re-imagining the on-set pre-visualisation process by virtual augmentation of the physical space.**
Presentation Method: Talk

Abstract:

My personal inquiry subject started off with the grander theme of virtual sets. I wanted to investigate how a VFX supervisor approaches the task of shooting in a void, the way they shot Avatar for example. A few of the things that kept coming up were: hardware based, physical restrictions, expensive. Since I wanted to step beyond just the research and make something, these were not motivating findings.

This made me approach this topic from an entirely different angle, and I also grabbed this chance as the last opportunity this year to bring in my previous experience as an interaction designer/developer.

I will be showing my development of a proof of concept application that potentially could be utilized as a new way to approach on-set pre-vis.

Augmented reality (AR) is a field of computer science that involves combining the physical world and an interactive, three-dimensional virtual world. Virtual reality (VR), AR's more familiar counterpart, is the replacement of the user's physical reality (particularly that which is experienced through sight and hearing) with a computer-generated reality.

From a consumer standpoint, it seems that AR advances have come out of nowhere to surpass VR advances. The acceleration in AR technology is due to two major factors: First, users are still experiencing reality, so believability is easier to achieve. Adding simple graphics (such as text or simple shapes) and color effects (such as night vision or thermal vision) to reality creates a better user experience. The user is still seeing a mostly familiar world. Second, this more subtle use of computer graphics is less expensive with today's technology, making it more feasible than VR.

The Personal Inquiry project is based around the principle that a camera (connected to the computer via USB or FireWire) will capture a marker image in an arbitrary position, and the application will augment the camera feed with a 3D model overlaid onto the marker's position.

With previous work experience as an 'Interaction Designer' I was familiar with the Adobe Flash toolset for rich application development. Another benefit of this platform is that Flash Player handles the heavy lifting such as video input and pixel-level image manipulation.

A great benefit of ActionScript 3's object-oriented programming model is the possibility to import existing libraries of code to save ramp-up time. My implementation of this AR technique for Augmented Pre-Vis takes advantage of three such libraries, each with a specific role in the project:

- Flex SDK code library.
- Spark Project's Flash Augmented Reality code library; Handles marker graphic detection.
- Papervision3D code library (PV3D): Handles the importing, positioning, and rendering of the 3D model.

Papervision3D - the 3D engine for Adobe Flash I'm using - needs a 3D model in the Collada format. An other possible 3D engine to explore is Away3D.

A cornerstone of this project is marker detection. The marker image is a graphic drawn, printed, and shown to the end application as it runs. The camera will detect this shape defined by the marker data file and parameters file. The detection scheme uses an ActionScript BitmapData object, which contains only the latest still-frame of video at any given time.

The markers are designed within a white square that is centered within a larger black square. An asymmetrical pattern is needed to help the application detect which way is up for the marker and enables its angle and rotation detection. As the marker graphic is detected via the camera, its position, rotation, and scale in the user's physical space are calculated.

References and resources:

Bolter, J. D., 2000. *Remediation: Understanding New Media*. The MIT Press.

> Media critics remain captivated by the modernist myth of the new: they assume that digital technologies such as the World Wide Web, virtual reality, and computer graphics must divorce themselves from earlier media for a new set of aesthetic and cultural principles. This text offers a theory of mediation for our digital age that challenges this assumption. In chapters devoted to individual media or genres (such as computer games, digital photography, virtual reality, film, and television), the authors illustrate the process of remediation and its two principal styles or strategies: transparent immediacy and hypermediacy.

Murray, J. H., 1998. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. The MIT Press.

> Technology changes storytelling. Janet H. Murray, director of the Laboratory for Advanced Technology in the Humanities at the Massachusetts Institute of Technology, investigates the changes emerging technologies may bring. Murray shows how the computer is reshaping the stories we live by and discusses the properties and pleasures of digital environments and connects them with the traditional satisfactions of narrative.

Klein, G., 2009. *Visual Tracking for Augmented Reality: Edge-based tracking techniques for AR applications*. VDM Verlag Dr. Müller.

> In Augmented Reality applications, the real environment is annotated or enhanced with computer-generated graphics. This book shows that visual tracking with inexpensive cameras (such as those now often built into mobile computing devices) can be sufficiently robust and accurate for AR applications. Georg Klein is currently a post-doctoral research assistant in Oxford's Active Vision Laboratory. His research interest is mainly the development and application of visual tracking techniques for Augmented Reality.

Lamb, P., *Human Interface Technology Lab: ARToolKit*. Available: http://www.hitl.washington.edu/artoolkit/. Last accessed May 2010.

> ARToolKit is a software library for building Augmented Reality (AR) applications. These are applications that involve the overlay of virtual imagery on the real world. Three-dimensional virtual objects can be seen by the user in the head set display they are wearing. When the user moves the card, the virtual character moves with it and appears attached to the real object. One of the key difficulties in developing Augmented Reality applications is the problem of tracking the users viewpoint. In order to know from what viewpoint to draw the virtual imagery, the application needs to know where the user is looking in the real world. ARToolKit uses computer vision algorithms to solve this problem. The ARToolKit video tracking libraries calculate the real camera position and orientation relative to physical markers in real time. This enables the easy development of a wide range of Augmented Reality applications

Tripathi, A., *Augmented Reality - An Application for Architecture*. Available: http://www.usc.edu/dept/architecture/mbs/thesis/anish/thesis_report.htm. Last accessed May 2010.

> Augmented reality (AR) works on the same principles as virtual reality. Yet, unlike VR where the user is immersed in a completely virtual environment, augmented reality overlays virtual objects and information over the real world. This is usually achieved by the use of see-through head mounted displays and tracking devices. Another area of computing that has seen substantial progress is wearable computing. Architecture is one of the many professions that can benefit and grow with the development of virtual reality technologies. This thesis develops a prototype augmented reality and mobile computing system for application to facilities management. It evaluates the system in a simple case study of the Master of Building Science laboratory.

Maes, P., 2009. *TED: Pattie Maes and Pranav Mistry demo SixthSense*. Available: http://www.ted.com/index.php/talks/pattie_maes_demos_the_sixth_sense.html. Last accessed May 2010.

> Demo of a wearable device with a projector that paves the way for profound interaction with our environment from Pattie Maes' MIT Media Lab's new Fluid Interfaces Group.

COLLADA. COLLADA - Digital Asset and FX Exchange Schema. Available: https://collada.org/mediawiki/index.php/COLLADA_-_Digital_Asset_and_FX_Exchange_Schema. Last accessed May 2010.

> COLLADA is a COLLAborative Design Activity for establishing an open standard digital asset schema for interactive 3D applications. COLLADA defines an XML database schema that enables 3-D authoring applications to freely exchange digital assets without loss of information. The COLLADA project was initiated by Sony Computer Entertainment to create a standard Digital Asset Exchange, in cooperation with major DCC tool companies, such as Alias, Discreet, and Softimage.

Papervision3D. Papervision3D. Available: http://blog.papervision3d.org/. Last accessed May 2010.

> Papervision3D is an open-source, MIT licensed 3D engine written in ActionScript 3.0 for Adobe Flash.