Bom dia!

A Multivariant Design Tool based on affordable VAM-Technologies

Interactive Design and Flexible Immersion

Architecture in the age of the 4th Industrial Revolution

XXIII SIGraDi/37th eCAADe Conference in Porto, PT 2019

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... remixed for CocoaHeads Aachen

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Virtual Reality
As early as the development of perspective drawings, or the invention of photography.

Augmented Reality
Thomas Caudell and David Mizell coined the phrase in 1992 at Boeing.

Mixed Reality
Similar of age, early 90’ies
also: Intereality, Hybrids
Different concepts

• Virtual realities handle only virtual models

• The technique of augmentation is to augment a layer from reality with a virtual created layer

• Mixed Realities may combine several layers and feedback from both the reality and the virtual modes
Perception of those realities

<table>
<thead>
<tr>
<th>Reality</th>
<th>Perception Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>The real world</td>
<td>$P = R$</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>$P = V$</td>
</tr>
<tr>
<td>Augmented Reality</td>
<td>$P = R + V$</td>
</tr>
<tr>
<td>Mixed Reality</td>
<td>$P = n \times (R + V)$</td>
</tr>
</tbody>
</table>

$P$ is always 1; or 100%
Technique

In essence, all technologies are compositions.

From them, “AR” is the most widely accepted and understood technical term.
Historical AR

Mid 1990’s

AmbiViewer 2002 - 07

ACADIA ’09
Historical Concept

camera feed

composing

tracking

modeling

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Camera: SouthernReel

SouthernReel

Downloads are disabled. This site remains only for documentation purposes.

Introduction

Please note that this software was written for Mac OS X 10.7 with 10.3.3 and does not support Mac with Intel processors.

SouthernReel is a program for displaying and recording videos provided by almost every video camera or computer running Mac OS X and is powered by QuickTime. It is just another program for watching the image from an AVI file or a DV camera and a Lightroom/Adobe camera, or one of those expensive video cameras. Connect a camera to the program and watch the video on screen. One of the most distinctive features between these programs is the design of the start/stop button.

Here is a suggestion:

Camera 1

Camera 1

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Introduction

SimpleGPS is, as its name stated, a small utility to display information produced by some GPS receivers on for computers running Mac OS X. It is mainly designed to be a tool for viewing all kind of informations while traveling or hanging around. SimpleGPS has no mapping, tracking or storing functions whatsoever of its own.

The program supports only the NMEA 0183 protocol (inofficial sources are [here](#) or [here](#)), which uses exact specified ASCII-strings and requires a transfer-rate set to 4800 baud. Because only serial receivers are available, only those are supported. Meanwhile there are some bluetooth GPS-receivers available, but those are still very expensive, and they have no other advantages. This keeps in mind, that GPS is a 20+ year old technology, based on even older standards.
**Modern AR: ARKit and similar**

- Introduced in 2017
- Integrated hard- and software
- VIO (visual inertial odometry)

- Liberated the concept from the technology no more
  - tracking
  - camera feed
  - composition (mostly)
The virtual experiences

The augmented lie:

Presentations on the internet are always looking good.

But where is the gear?
Physical gear

Gear are all devices, markers and other installations to permit the desired experience.
Perception of realities with gear

<table>
<thead>
<tr>
<th>Reality</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>The real world</td>
<td>( P = R )</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>( P = V + G )</td>
</tr>
<tr>
<td>Augmented Reality</td>
<td>( P = R + V + G )</td>
</tr>
<tr>
<td>Mixed Reality</td>
<td>( P = n \times (R + V) + G )</td>
</tr>
</tbody>
</table>

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Multi-variant toolset

different scales

flexible immersion

tools

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Different scales

Model-scale for figural space

Panoramic-scale for environmental space

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Editing a design

Panoramic view

Switching scales
# Concept of flexible Immersion

<table>
<thead>
<tr>
<th>Model combined with</th>
<th>mono</th>
<th>stereo</th>
</tr>
</thead>
<tbody>
<tr>
<td>black background</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holographic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camera feed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen-display</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUD</td>
<td>Heads-up display, e.g. Hololehs</td>
<td></td>
</tr>
<tr>
<td>HMD</td>
<td>Heads-mounted display, e.g. Vive, Oculus</td>
<td></td>
</tr>
</tbody>
</table>
Flexible Immersion

\[ P - G = n \times (R + V) \]

normal overlay

stereo

holo
Tools in 3-dimensional spaces

New and old ARPen

ARPen

New pens with markers

App from RWTH Aachen

https://hci.rwth-aachen.de/arpen-ios
Markers for Multi-tool

6 magnetic markers

aruco markers

inside the pens
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... as presented there
## Future development

- occlusion
- semantic segmentation
- transparent models
- smart markers
- chip inside
- IDs
- some lighting
- feedback on the pen
- visual and haptic
- gestures
- collaboration
- networking
- even more markers for different users

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XXIII SIGraDI/37th eCAADe Conference in Porto, PT 2019.
Obrigado!

Thank you!