

# Perception of size in vehicle for architecture studies


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Technical Center for Simulation | Tuesday October 7, 2008 | Intuition, Turin October 6-8, 2008

## Introduction

- Virtual and Augmented Reality at Renault for Vehicle Architecture
  - Combe et al, 2008
  - Kemeny et al, 2003




View of a Numerical Cockpit for Architecture Simulation inside of the Head Mounted Display at Renault, CTSD




Head Mounted Display : SEOS at Renault, CTSD

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## Methods and test conditions



Cylindrical screen and experimental apparatus



Head Mounted Display and experimental apparatus

- Filliard et al, 2008
- Paillé et al, 2005


**CONDITIONS**

VR : the body of subject is not seeing


AR and projection on screen : the subject can observe his body as a reference to scale the cockpit

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## Methods and test conditions



Virtual cockpit scale lower than 1



Virtual cockpit 1:1 scale



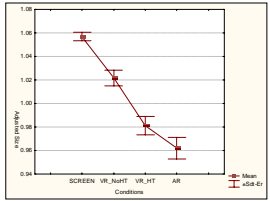
Virtual cockpit scale higher than 1.

**Question : which is the size near of the scale 1:1 from the view of a numerical cockpit ?**

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## Results and Observations

- Participants : 9 subjects
- Observations :
  - Significant differences between - screen condition & reference scale 1
  - AR & cylindrical conditions



Mean adjusted cockpit sizes using curved screen as well as VR ( with and without head tracking) and AR systems

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## Methods and test conditions

**SEOS AR systems**

- Field of view: 2x80° simultaneous High Definition Images with 50% overlay
- Color key AR systems
- ART Track for VR and AR

- Active stereo generation on the cylindrical display systems
  - 3m radius
  - 120cm eye height
  - No head tracking
- ART Track tracker only for the VR and AR
- Observers tasks : adjust virtual cockpit size
  - NB : ART Track tracker only for the VR and AR

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## Discussion

### Distance estimates in Virtual environments

Reduced visibility may produce underestimation of distance perception

- Magne and Coello, 2002
- Loomis and Knapp, 2003
- Hale and Stanney, 2006

Influence field of view on distance perception in real and virtual environments

- Alfano and Michel, 1990
- Hagen et al., 1978
- Knapp and Loomis, 2004
- Paillé et al., 2005

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## Discussion

### Distance estimates in Virtual environments

Comparison of distance estimation with 60°, 90°, 120° and global FOV-s in real and virtual environments ( Paillé et al., 2005)

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## Discussion

### Observation using cylindrical screen

Figure 10: The same view of a real-world street with different resolution. Bottom: The same environment viewed from the same situation without dynamic resolution correction (Howard et al., 2007)

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## Discussion

### Motion parallax

- Motion parallax, a strong visual cue for distance perception
  - Howard and Rogers, 1995
  - Beall et al., 1995
  - Panerai et al., 2002

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## Discussion

### Augmented Reality (AR) Head Mounted Display (HMD)

- Reduced visibility conditions due to the discrepancy between the camera provided and HMD displayed images
  - Coello and Grealy, 1997
  - Paillé et al., 2005
- Discrepancies in merge and accommodation may also affect both observer fatigue and perceived depth
  - Watts et al., 2005

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## Augmented Reality (AR) Head Mounted Display (HMD)

Visualisation using the 120°cylindrical stereoscopic screen, Renault CTS

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## Conclusion

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graph LR; A([Virtual Reality for engineering design]) --> B([Véhicule architecture]); A --> C([Interior Design studies]); B -- example --> D[Image of VR Cave @ PSA Peugeot]; C -- example --> E[Image of VR Interior Design studies];
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The diagram illustrates the application of Virtual Reality in engineering design. It starts with a central concept, 'Virtual Reality for engineering design', which branches into two specific areas: 'Véhicule architecture' and 'Interior Design studies'. Each area is supported by a 'VR example' image. The 'Véhicule architecture' example shows a person in a VR cave environment, labeled 'Cave @ PSA Peugeot'. The 'Interior Design studies' example shows a person in a VR environment, labeled 'VW Sharan (Data courtesy of Volkswagen)'.

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