

## *Attention and X-Reality*

--Real Reality --

--Augmented Reality--

--Virtual Reality--

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The work described herein is a collaboration with

**Dr. J. Kevin O'Regan of CNRS, Paris**

**Dr. Ron Rensink of Nissan Cambridge Basic Research**

**Dr. Heiner Deubel of the Max Planck Institut, Munich**

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## Perception and Virtual Reality

In Virtual Reality, one strives to provide a sense of immersion in the environment. The environment should be *perceived* to behave naturally.

This does not mean that the virtual environment *has* to behave naturally, only that it be perceived to do so!

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## Perception and Change Detection

We perceive our world by first detecting that something in the world has changed, and then perceiving what that change is.

Kevin O'Regan has suggested that people actually perceive very little about the world at any one time, and that the external world itself *is* our representation.

Thus, we actively search for information in the world, or, we *access the world as an external memory*.

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## Attention and Change Detection

Recent work has indicated that spatial attention plays a pivotal role in the detection of change.

Essentially, the idea is that one can detect a change *only* if one is paying attention to the location of the change.

If a change occurs, usually this produces a visual transient which *attracts* attention, which subsequently detects and recognizes the change.

Sometimes, the transient is *delocalized*, or masked, and changes become very difficult to detect.

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## What Is Changing in the Image?



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## This One Is Easier



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## Other Diversions

- Saccadic eye movements
- Blinks
- “Mudsplashes”
- Display changes

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## “Mudsplashes”

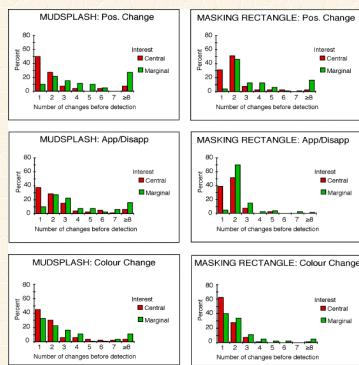


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## Without the Diversion



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## Attention and Augmented Reality

- In augmented reality one wants to supply additional information to the viewer
- This information should be quickly assimilated
- But, it should not disrupt perception of the real world

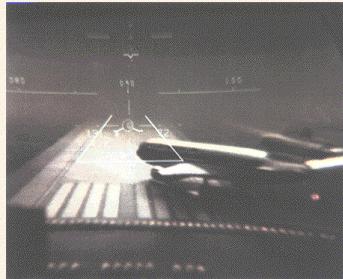
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## The Dangers of Huds



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## Attention can be trapped by a HUD



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## Huds and Attention

- Huds *attract* attention
- This is *good* as it allows rapid processing of the information displayed on the HUD
- It is *bad* as it shifts attention away from the external scene
- Visual transients on the HUD can mask important changes outside of the vehicle

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## Attention and Eye Movements

- Where your eyes are pointing is not necessarily where you are attending to...
- But, according to the *premotor theory of attention*, every shift of attention gives rise to a command to make an eye movement
- This command is usually *suppressed*
- The corollary to this is that, when you do move your eyes, they move to where you shifted your attention

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## Tracking of Attention

- As attention appears critical for updating knowledge of one's environment, it would be useful to know where one is focussing their attention
- Eye movements give one way in which attention can be tracked, but do not occur for all attention shifts
- Or do they? Our models suggest that subliminal motions may accompany attention shifts

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## Control of Attention

- The focus of attention can be reflexively attracted by highly salient events such as *flashes* of light, sudden object *motion*, appearance of brightly *coloured* objects and *high contrast* edges
- These events can be artificially generated to direct attention to a location where important information is to be obtained
- Or, attention can be directed *away* from locations where events will occur that shouldn't be perceived

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