Introduction to Augmented Reality & Virtual Reality

Dr. Kaushal Kumar Bhagat
Advanced Technology Development Centre
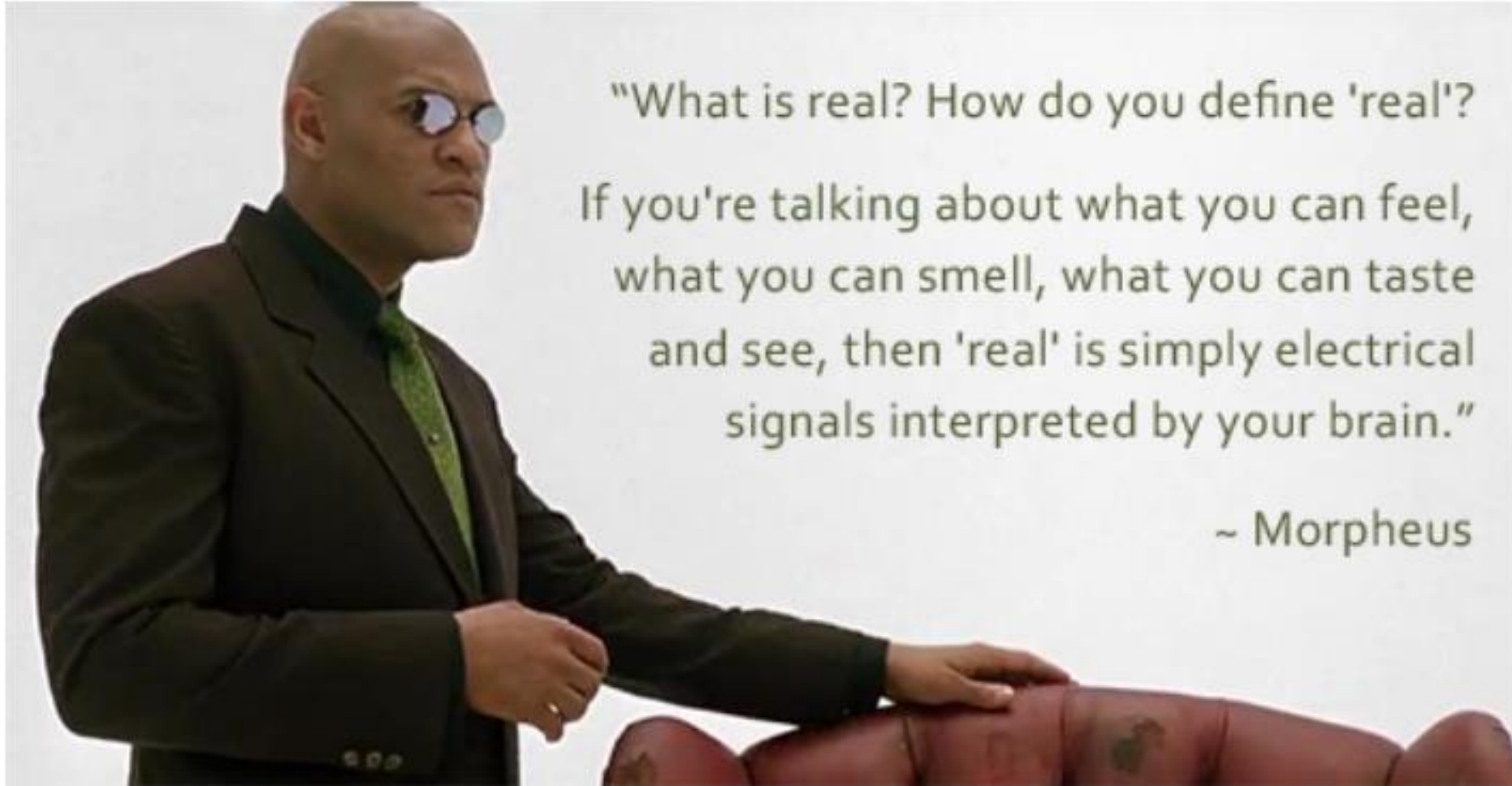
Concept of Presence in Virtual Reality

Are We Living In a Simulation?

https://www.youtube.com/watch?v=2KK_kzrJPS8

What is reality?

"What is real? How do you define 'real'?

If you're talking about what you can feel, what you can smell, what you can taste and see, then 'real' is simply electrical signals interpreted by your brain."

~ Morpheus

https://www.youtube.com/watch?v=aVLexf_dyCM&ab_channel=MohamedYasir

How do We Perceive Reality?
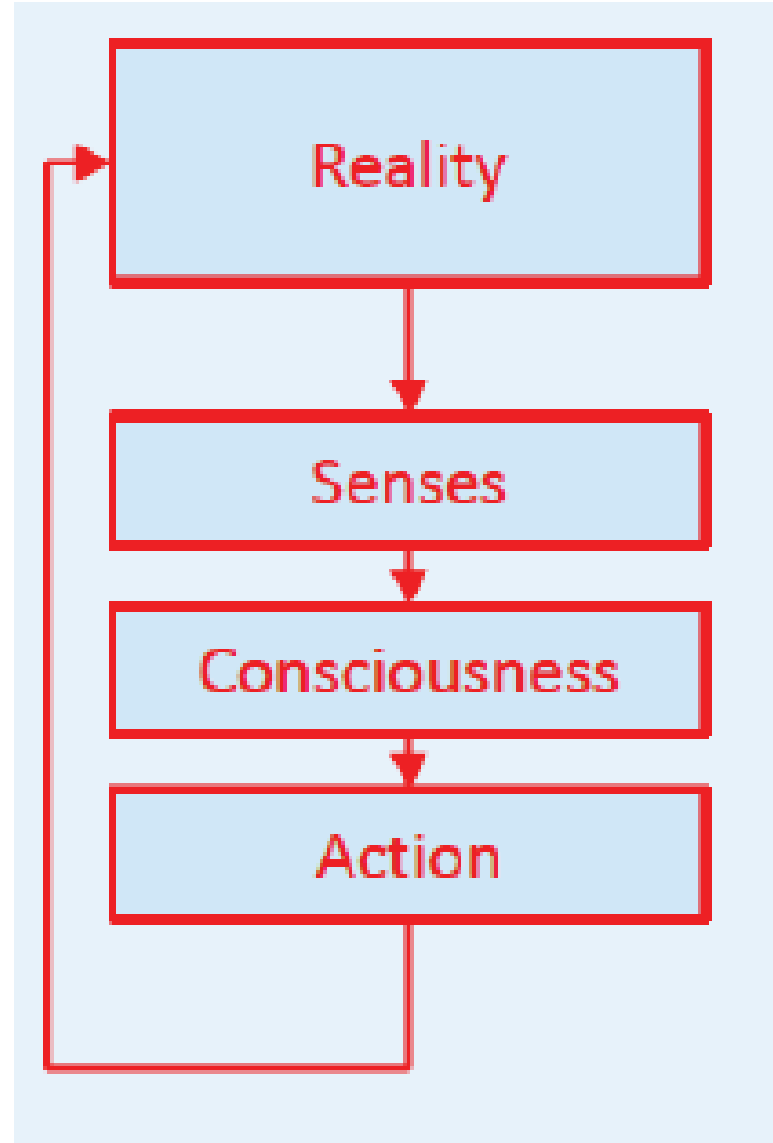
We understand the world through our senses:

• Sight, Hearing, Touch, Taste, Smell

(and others..)

Two basic processes:

• Sensation – Gathering information

• Perception – Interpreting information

Sensing/Perception Model

Goal of Virtual Reality

".. to make it feel like you're actually in a

place that you are not."

Palmer Luckey

Co-founder, Oculus

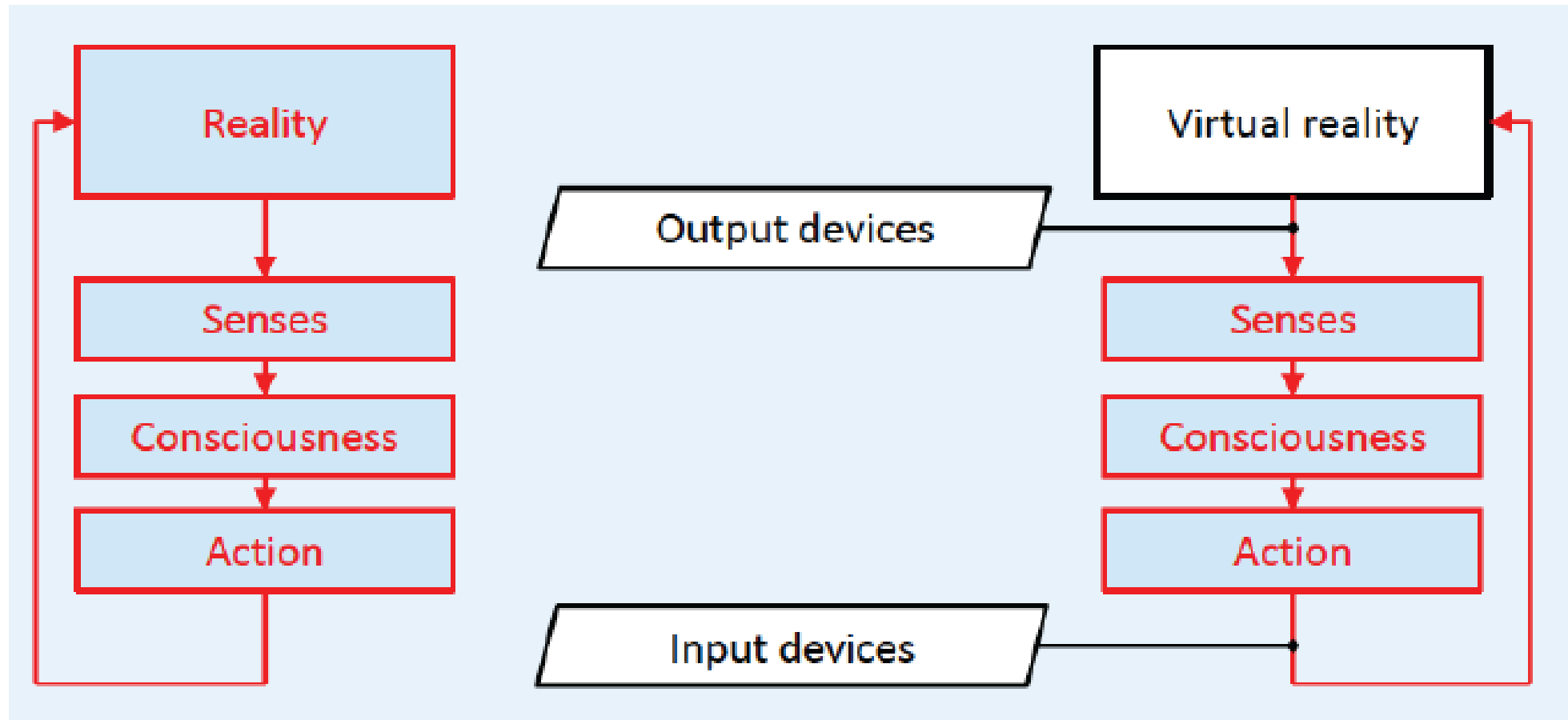# Creating the Illusion of Reality

Fooling human perception by using technology to generate artificial sensations

• Computer generated sights, sounds, smell, etc.

Reality vs. Virtual Reality

In a VR system there are input and output devices between human perception and action

Example: Virtual Cocoon

Virtual Cocoon concept

• Univ. Warwick, Univ. York (2009)

Multi-sensory VR display

• All 5 senses stimulated

• Visual, 3D audio, smells, etc

Cross modal effects improve

VR experience

• E.g. taste + sound > taste alone

https://www.youtube.com/watch?v=c5sjrYr3JJQ&ab_channel=VitoDiBari

Chalmers, A., Howard, D., & Moir, C. (2009). Real virtuality: a step change from virtual reality. In Proceedings of the 25th Spring Conference on Computer Graphics (pp. 9-16). ACM

Birdly: Create illusion of flying like a bird

Multisensory VR experience

- Visual, audio, wind, haptic

https://www.youtube.com/watch?v=gWLHIusLWOc

Types of Human Experience

Lee, K. M. (2004). Presence, explicated. Communication theory, 14(1), 27-50.
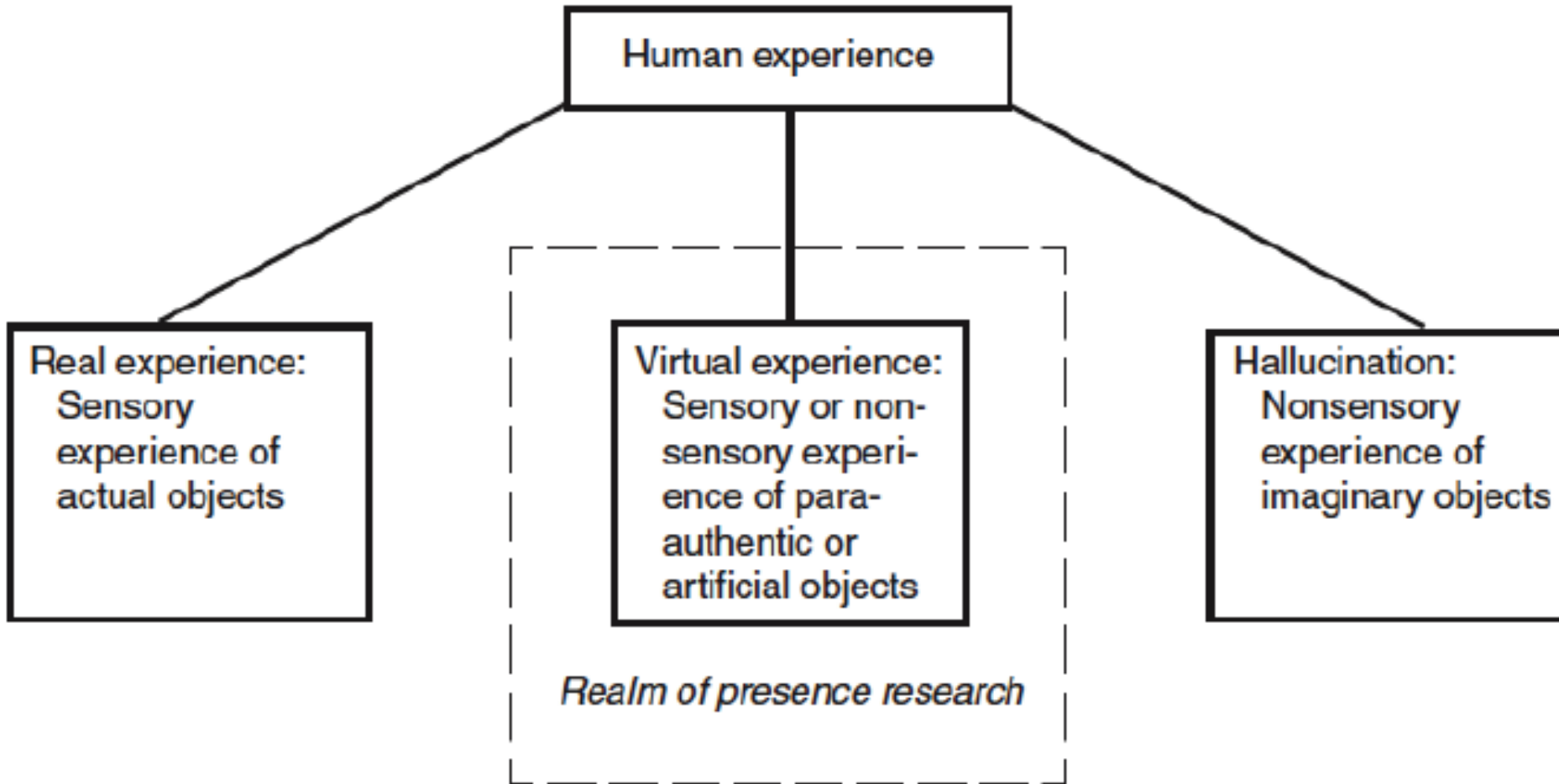
What is Presence?

"Presence is a psychological state .. In which even though part or all of an

individual's current experience is generated by .. technology, part or all of

the individual's perception fails to .. acknowledge the role of

the technology in the experience."

International Society for Presence Research, 2016

https://ispr.info/

What is Presence?

"The subjective experience of being in one place or environment even when physically situated in another"

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence"questionnaire. Presence: Teleoperators and virtual environments, 7(3), 225-240

Immersion vs. Presence

Immersion: describes the extent to which technology is capable of delivering a vivid illusion of reality to the senses of a human participant.

Presence: a state of consciousness, the (psychological) sense of being in the virtual environment.

So Immersion, defined in technical terms, is capable of producing a sensation of Presence

Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments. *Presence: Teleoperators and virtual environments*, *6*(6), 603-616.

Three Dimensions of Presence

- ***Personal Presence,*** the extent to which the person feels like he or she is part of the virtual environment;

- ***Social Presence,*** the extent to which other beings (living or synthetic) also exist in the VE;

- ***Environmental Presence,*** the extent to which the environment itself acknowledges and reacts to the person in the VE.

Heeter, C. (1992). Being there: The subjective experience of presence. Presence: Teleoperators & Virtual Environments, 1(2), 262-271..

Benefits of High Presence

- Leads to greater engagement, excitement and satisfaction

- People more likely to behave like in the real world

- More natural communication (Social Presence)

Note: The relationship between Presence and Performance is unclear – still an active area of research

How to measure Presence?

Presence is very subjective in nature

Subjective Measures

- Self report questionnaire

University College London Questionnaire (Slater 1999)

Witmer and Singer Presence Questionnaire (Witmer 1998)

ITC Sense Of Presence Inventory (Lessiter 2000)

How to measure Presence?

Objective Measures

Behavioural

- reflex/flinch measure, startle response

Physiological measures

- change in heart rate, skin conductance, skin temperature

Typical Subject Behaviour

Pit experiment

How to Create Strong Presence?

Use 3 Dimensions of Presence

• Create rich multi-sensory VR experiences

• Include social actors/agents that interact with user

• Have environment respond to user

What Influences Presence

• Vividness – ability to provide rich experience (Steuer 1992)

• Using Virtual Body – user can see themselves (Slater 1993)

• Internal factors – individual user differences (Sadowski 2002)

• Interactivity – how much users can interact (Steuer 1992)

• Sensory, Realism factors (Witmer 1998)

Presence Guidelines (Sadowski 2002)

Factors	Guideline
Ease of Interaction	Provide seamless interaction such that users can readily orient in, traverse in, and interact with the virtual environment.
User-initiated control	Provide immediacy of system response, correspondence of user-initiated actions, and a natural mode of control.
Pictorial Realism	Provide continuity, consistency, connectedness & meaningfulness in presented stimuli.
Length of Exposure	Provide sufficient exposure time to provide VE task proficiency, familiarity with the VE, and sensory adaptation.
Social Factors	Provide opportunities to interact with and communicate with others verbally or by gestures. Provide confirmation that others recognize one's existence in the VE.
Internal Factors	Identify the types of individuals who will use a VE system and their preferred representational system (i.e., visual, auditory, kinesthetic).
System Factors	Providing stereopsis, head-tracking, a large field of view, increasing update rates, multi-modal interaction, and ergonomically sound sensors/ effectors facilitate presence.