

<b>Project No. :</b>	FP6 -2005 -IST -5No.035079
<b>Start :</b>	May 2006
<b>Duration :</b>	36 Months




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## DiFac Glossary

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<b>Project co-funded by the European Commission within the Sixth Framework Project (2002-2006)</b>		
<b>Dissemination Level</b>		
<b>PU</b>	Public	PU
<b>PP</b>	Restricted to other programme participants	
<b>RE</b>	Restricted to IMS Consortium and the IMS steering committee	
<b>CO</b>	Confidential, only for members of the DiFac consortium	

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<b>Due Date:</b>	January 2008
<b>Version:</b>	F

Version	Date	Comments
1.0	2007-02-23	Draft, published for partner additions
1.1	2007-05-14	Updated, incorporating input from ITIA (rec'd 30/3/07)
1.2	2008-01-10	Update of the document

<b>Keywords</b>	Glossary
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<b>Delivery date</b>	14 <sup>th</sup> May 2007

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## EXECUTIVE SUMMARY

This document presents the DiFac glossary of terms, as requested by the EU review board at the 6 month review in Paris, 2006. It also contains a table of abbreviations. This document was circulated for contribution from all partners, and will be published on the DiFac website.

The second release of the document contains new terms at this stage of the project (half way) and it will be implemented again in the future.

# 1. GLOSSARY

**6DOF** - Six degrees of freedom - Yaw, pitch, roll, up-down, left-right, front-back (or pan, zoom, swivel).

## A

**Accommodation** - Change in the focal length of the eye's lens.

**Actors** - CAD representations of players performing actions for them (see Agent, Character).

**Agents** - CAD representations of human forms

**Altered sense of time** - In flow experience persons deeply immersed in an activity, typically report time passing quickly.

**Antecedents (of flow)** - Necessary and sufficient characteristics to have a flow experience.

**Anxiety** - In the context of flow, anxiety refers to fear or apprehension that occurs when skills are lower and challenges higher than subjective mean.

**Anti-flow** - Psychic state characterized by disengagement, passiveness, loss of concentration and motivation.

**Apathy** - In the context of flow, apathy refers to boredom or lack of interest that occurs when skills and challenges are lower than subjective mean.

**Artificial Intelligence** - The attempt to mimic and automate human cognitive skills through rules and knowledge representation techniques (e.g., understanding visual images, recognizing speech and written text, solving problems, making medical diagnoses, heuristic knowledge, etc.).

**Artificial Reality** - Introduced by arts and computer visualization scholar Myron Krueger in the mid-1970s to describe his computer-generated responsive environments. Krueger has emphasized the non-intrusive (Second - Person VR) systems that track people with pattern recognition techniques and display them and the surround on projection systems (see CAVE).

**Auditory** - The subjective sensation of hearing something.

**Augmented Reality** - This uses transparent displays worn as glasses on which data can be projected. This allows someone to repair a real piece of equipment, for example, and have the needed virtual data displayed on the glasses while walking about in the real world.

**Augmented Virtuality** - This is similar to Augmented Reality. With augmented virtuality, most of the imagery is computer-generated. For example, you might see something real, perhaps even yourself, projected into an imaginary environment.

**Avatar** – digital representation of a human being

## B

**Being-there** - The phenomenological experience of being in a situation or environment.

**BOOM** - A 3-D display device suspended from a weighted boom that can swivel freely about so the viewer doesn't have to wear an HMD; instead, it steps up to the viewer like a pair of binoculars. The boom's position communicates the user's point of view to the computer.

**Browser** - Overviews such as indexes, lists or animated maps to provide a means of navigating through the physical, temporal, and conceptual elements of a VR.

## C

**CAVE** - A VR using projection devices on the walls and ceiling to give the illusion of immersion.

**Challenges** - Environmental opportunities for action.

**Channel** - In the model of Flow, each of eight 45° sectors, built on the Cartesian plane, with challenges on the y-axis and skills on the x-axis.

**Character** - A being with a virtual body in virtual reality (see Agent, Actor).

**Cluster (of PC)** - A set of Personal Computers linked together by a high-bandwidth network, and performing computations in an organised and synchronised fashion. Clustering is especially interesting for distributed rendering (visual or otherwise), to manage multiple-screens virtual environments.

**Collaboration** - The process of individuals or organizations sharing resources and responsibilities jointly to plan, implement, and evaluate programs to achieve common goals.

**Computer Graphics** – The interactive production and layout of graphic material, text and images, by means of computers and dedicated interfaces. These are a major component of VR systems.

**Concept Map** - A browser or terms, definitions, or icons arranged in semantic proximity.

**Constructive simulation** - A simulation involving simulated people operating simulated systems. Real people stimulate (make inputs to) such simulations, and in turn are stimulated by (receive outputs from) them, but are not directly involved in determining the outcomes. Wargames are classical examples of constructive simulations in the military field.

**CPU** – Central Processing Unit. The heart of modern computers, where most elementary mathematical computations are performed. See also GPU.

**Cyberspace** - 1. A place filled with virtual "stuff" populated by people with virtual bodies. A special kind of virtual space which promotes experiences involving the whole body. (Walser, 1991). 2. A term coined by William Gibson in his book *Neuromancer* (1984) to describe a shared virtual universe operating within the sum total of all the world's computer networks. (See Artificial Reality and Virtual Reality)

## D

**Database schema** - A computer database is a structured collection of records that can be accessed by using a query language. The database schema defines the structure within the database. Tables are the main components of the schema.

**DataGlove** - A glove wired with sensors and connected to a computer system for gesture recognition. It is used for tactile feedback and it often enables navigation through a virtual environment and interaction with 3-D objects within it. The Cyberglove (TM) is the most popular dataglove to date.

**DataSpace** - A visualized representation of complex information.

**DataSuit** - Same as a DataGlove, but designed for the entire body.

**Deck** - A physical space containing an array of instruments which enable a player to act within, and feel a part of, a virtual space.

**Demo scenario** – The application of a Digital Activity to specific industrial needs and requirements.

**Digital Activity** - A set that can contains Software tools (S) , Methodologies (M) and Guidelines (G) for the enhancement of the identified key aspects: PRESENCE, ERGONOMICS and COLLABORATION. The Digital activities contain the appropriate services for supporting specifically the processes/tasks within such activity or the tool that are customised for it.

**Digital Factory** - A rich virtualized environment representing a variety of factory activities which facilitates the sharing of factory resources, manufacturing information and knowledge and helps with the simulation of collaborative design, planning, production and management among different participants and departments.

**Digital Human Model** - A generic term used to describe various software applications that attempt to replicate the human body's form and function as avatars.

**Direct Manipulation** - A term coined by Shneiderman to reflect the use of computer icons or text as if they were real objects.

**Discrete Event Simulation (DES)** - It's a type of simulation where a system is represented as a chronological sequences of events. Each event occurs at an instant of time and marks a change of state in the system.

- In discrete event simulation, the operation of a system is represented as a chronological sequence of events. Each event occurs at an instant in time and marks a change of state in the system. In DiFac the processes in manufacturing systems are modelled with discrete event simulation software.

**Disorientation** - Confusion about distances and directions for navigation.

**Dreaming** - A state of mind during sleep where vivid coloured imagery becomes realistic and immersive. A natural counterpart to VR.

**Dynamics** - The way that objects interact and move. The rules that govern all actions and behaviours within an environment.

**Dynamic Lighting** - Changes in lighting effects on objects as they and the observer move.

**Dynamically Linked Library (DLL)** - In computer science, a DLL is a collection of subroutines, that provide services to independent applications and that can be loaded during the application's runtime.

## E

**Effectors** - The output techniques that communicate a user's movements or commands to the computer and to the VR.

**Environment** - A computer-generated model that can be experienced from the "inside" as if it were a place.

**Ergonomics** - Ergonomics and Human Factors are both synonymous terms for the theory and practice of learning about human characteristics and capabilities, and then using that understanding to improve people's interaction with the things they use and with the environments in which they do so.

**Eye Tracking** - Devices that measure direction of gaze. Most HMDs do not currently support eye tracking directly.

**Exoskeletal Devices** - In order to provide force feedback designers have added rigid external supports to gloves and arm motion systems.

**Experience in VR** – There are two different levels of experience based on different technologies:

- **Passive experience** - path and surfing into the environment are defined by the software. The user is an observer in front of something that is happening, he can decide the beginning and the end of the experience
- **Interactive experience** - The user can decide different paths and movements inside the environment the view point and he can interact with objects in the environment.

**External Factors** - The technological characteristics that determine the Presence (i.e. image quality; level of multisensorial input; etc.)

## E

**Field of View** - The angle in degrees of the visual field. Most HMDs offer 60 to 90 degrees FOV. Since our two eyes have overlapping 140 degree FOV, binocular or total FOV is roughly 180 degrees in most people. A feeling of immersion seems to arise with FOV greater than 60 degrees.

**Finite element modelling** - Decomposition of complex structures into small, simple elements so that engineering computations are manageable.

**Flow** - A subjective state that people report when they are completely involved in something to the point of forgetting time, fatigue, and everything else but the activity itself. It is what we feel when we read a well-crafted novel, or play a good game of squash, or take part in a stimulating conversation. The defining feature of flow is intense experiential involvement in moment-to-moment activity. Attention is fully invested in the task at hand, and the person functions at his or her fullest capacity.

**Flow Conditions** - Clear goals, optimal challenges, and clear, immediate feedback are necessary features of activities that promote the intrinsically rewarding experiential involvement that characterizes flow.

**Force Feedback** - The computer guides a machine to offer just the degree of resistance to motion or pressure a situation would offer in real life. Representations of the inertia or resistance objects have when they are moved or touched.

## G

**Gesture** - Hand motion that can be interpreted as a sign or signal or symbol.

**Goggles** - Often used to refer to HMD or other displays.

**GPM** – Group Presence Modeller, one of the three pillar components of the DiFac framework. It's composed of both methodologies and software

**Guidelines** – Other component of the Digital Activity (with SW and Methodology). The guidelines help the application either of the SW part and the methodology.

## H

**Haptic Interfaces** - That use all the physical sensors that provide us with a sense of touch at the skin level and force feedback information from our muscles and joints.

**Head-coupled** - Displays or robotic actions that are activated by head motion through a head tracking device.

**Head Tracking** - Monitoring the position of the head through various devices.

**Heuristics** - "Rules of thumb" based on experience-derived knowledge which enable people to make judgements quickly and effectively.

**Hierarchical task analysis**- A human factors technique which is used to analyse the interaction between the human and technology or wider system. It involves the successive decomposition of overall goals into subtasks, which must be completed to achieve the high-level goals.

**HUD (Head Up Display)** - A head mountable display device that lets users see graphics superimposed on their view of the world. (Created for aviators to see symbols and dials while looking out the window.)

**Human factors** - Ergonomics and Human Factors are synonymous terms for the theory and practice of learning about human characteristics and capabilities, and then using that understanding to improve people's interaction with the things they use and with the environments in which they do so.

**Hypermedia** - The combination of digital text, video, and sound with navigation techniques like buttons, links, and hotspots into one system.

**HyperSpace** - The space of hypertext or hypermedia documents.

## I

**Immersion** - The feeling of presence, of "being there", surrounded by space and capable of interacting with all available objects that is the hallmark of good VR.

**Interface** - A set of devices, software, and techniques that connect computers with people to make it easier to perform useful activities.

**Internal Factors** – The personal characteristics that determine the Presence (i.e. stress and motivation of the subject; psychological tendency to the involvement; etc.)

**Inverse Kinematics** - A specification of the motion of dynamic systems from properties of their joints and extensions.

**Involvement** - To feel engaged, motivated and connected in a action in an activity or in a decision.

**Interactivity** - "The degree to which users ... can influence the form or content of the mediated environment" (Steuer, 1992, p.80).

**Internet** - A world wide digital network.

J

**JACK** – Digital Human Modelling software originally developed at the University of Pennsylvania, but currently owned and marketed by UGS (<http://www.ugs.com/products/efactory/Jack/>)

**Joystick** - Graphic interface device, combining a handle (usually dedicated to navigation) and some buttons (trigger actions). Some joysticks have force or haptic feedback.

K

**Kinaesthetic Dissonance** - Mismatch between feedback or its absence from touch or motion during VR experiences.

L

**Lag** - Delay between an action and its visual, acoustic, or other sensory feedback, often because of inherent delays in the tracking devices, or in the computation of the scene.

**Latency** - see Lag, Sensor Lag.

**Layers of Self** – Different levels of Self-Consciousness:

- **Proto Self** - A coherent collection of neural patterns that map, moment by moment, the physical state of the organism
- **Core Self** - A transient entity, which is continuously generated through encounters with objects
- **Extended Self** - A systematic record of the more invariant properties that the organism has discovered about itself.

**Layers of Presence** – Different levels of Presence in reference to the different levels of Self:

- **Proto Presence** - Based in embodiment, of what is the self versus what is not, and depends on the level of sensori-motor coupling. Related to Self (*Proto*)
- **Core Presence** - Depends on the ongoing conscious perception of the current state of the world in which a person finds herself, of being in a perceived world. Related to Self (*Core*)
- **Extended Presence** - Depends on the cognition of relations between the current situation and past or imagined future situations, of the self in relation to what is happening in the world. Related to Self (*Extended*).

**LCD (Liquid Crystal Display)** - Display devices that use bipolar films sandwiched between thin panes of glass. They are lightweight and transmissive or reflective, and ideal for HMD.

**Live simulation** - a simulation involving real people operating real systems.

M

**Magic Wand** - A 3D interface device used for pointing and interaction; an elongated 3D mouse

**Manikin** – Digital representation of a human being (see avatar)

**Metaphor** – In a virtual environment the user should be able to operate within this world. Human interface metaphors are tools which allow the users to interact in intuitive way with the virtual environment, for example it allow selecting or manipulating objects.

**Methodologies** – The methodological approach for measuring the three pillars or human factors that are basis for the development of the environments

**Mixed Reality (MR)** – A continuum defined as a combination of the real environment (as perceived by humans) and a virtual environment (created by computer). In this continuum, one goes from reality alone to Augmented Reality to Augmented Virtuality (displaying real objects in a computer-generated world) to pure VR (See P. Milgram 1994).

**Modality** – A perceptual channel, e.g. visual modality

**Monitor** - Display, HMD, Goggles, HUD, LCD, DLP.

**Motion Captur or MoCap** - A technique of digitally recording the movements of real things — usually humans — so their movements can be played back within a virtual framework. Aside from VR, this technique is used increasingly in cinema and in video games. A motion capture session only records the movements of the subject, not his visual appearance.

**Motion Parallax** - Objects at different distance and fixation points move different amounts when the viewpoint is dollied along the x axis (left- right).

**Motion Platform** - A controlled system that provides real motion to simulate the displayed motion in a VR.

**Motivation** - A psychological need, drive, or feeling that raises the intensity of an action. Motivation is key for VR use.

**Multimodality** – Perception in VR takes place through different sensory channels (audio, image, haptics ...). Multimodality is the process by which these modalities are combined together to achieve better immersion and enhance VR experience in general.

## N

**Navigation** - Moving through virtual space without losing one's way

**Non-mediation** - When a person fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there.

## O

**Objects:** Graphical entities that can be dynamically created or loaded from model files. Many functions act upon them:

- Tasks: each object performs a task per time frame;
- Hierarchies: objects can be "linked" together;
- Sensors: objects can be connected to sensors;
- Modify: geometry, color, texture, scale, etc;
- Collision Detection: between objects and polygons.

**Occlusion** - Hiding objects from sight by interposition of other objects.

**Optical 3D tracking** - A specific tracking technique (see Tracker) using a set of optical cameras to determine the location of objects or subjects in real space. The cameras can operate in a variety of wavelengths (visible and infrared are the most common choices). Tracking can also be facilitated by specific reflective objects called Markers.

**Optimal experience** - Positive, complex, rewarding and gratifying state of consciousness.

## P

**Perceptual** - Indicates a continuous (real time) responses of the human sensory, cognitive, and affective processing systems to objects and entities in a person's environment.

**Perspective** - The rules that determine the relative size of objects on a flat page to give the impression of 3D distance

**Photorealism** - An attempt to create realistic appearing images with much detail and texture

**Pillars** – The 3 human based components of the project (presence, collaborations, ergonomics)

**Pitch** - The angular displacement of a view along the lateral axis (front - back).

**Pixel** - The smallest element of a display that can be adjusted in intensity.

**Polarized glasses** – Optically polarized eyepieces used to see stereoscopically when associated to corresponding projection devices.

**Presence** - A defining characteristic of a good VR system, a feeling of being there, immersed in the environment, able to interact with other objects there.  
The Perceptual illusion of non-mediation.

**Presence (Measurement of)** – Techniques, tools and instruments (qualitative and quantitative) to evaluate the sense of Presence.

- Subjective measures – Subjective measures of presence require study participants to produce a conscious, introspective judgment regarding their experience
- Objective measures – Objective measures of presence record study participants' physiological and/or behavioral responses that are logically correlated with their relevant psychological responses

**Presence (Social)** - The salience of the other in a mediated communication and the consequent salience of their interpersonal interactions.

**Projected Reality** - A VR system that uses projection screens rather than HMDs or personal display monitors, e.g. CAVE

## Q

## R

**Radiosity** - A diffuse illumination calculation system for graphics based on energy balancing that takes into account the multiplereflectances off many walls.

**RAMSIS** - Digital Human Modelling software originally developed by the German automobile industry, now marketed by Human Solutions ([http://www.human-solutions.com/automotive\\_industry/ramsis\\_en.php](http://www.human-solutions.com/automotive_industry/ramsis_en.php)).

**Raytracing** - A rendering system that traces the path of light from objects to light sources (see Backward Raytracing).

**Real-time** - Appearing to be without lag or flicker (e.g. 60 cps displays; highly interactive computation).

**Relaxation** - In the context of flow, relaxation refers to loosening of physic tension and mental strain that occurs when skills are higher and challenges lower than subjective mean.

**Relevance theory** – It's measured the different states of the subject in a precise experience, it measures the different degrees to arrive to the Flow state.

**Render** - Convert a graphics object into pixels.

**Resolution** - Usually the number of lines or pixels in a display, e.g. a VGA display has 640 by 480 pixels.

**Roll** - The angular displacement of a view along the longitudinal axis (left - right).

## S

**SafeWork** - Digital Human Modelling software marketed by SafeWork Inc. (<http://www.safework.com/>)

**Scenario** – The application of the SW, methodology and guidelines to a specific industrial framework

**See-through device** - A display technology that enables the viewer to perceive both virtual and real world simultaneously. There are currently two approaches: the optical see-through type directly merges the real scene with virtual reality spaces using half mirrors. The video see-through type can display computer graphic images on the real scene captured by video camera.

**Sense of control (flow)** - A lack of anxiety about losing control.

**Sensitivity analysis**- It's the study of how the variation in the output of a simulation model can be apportioned to different variation of input.

**Shared Worlds** - Virtual environments that are shared by multiple participants at the same location or across long distance networks

**Shutter Glasses** - LCD screens or physically rotating shutters used to see stereoscopically when linked to the frame rate of a projector or monitor.

**Simulation** - It's a mathematical and computer modelling technique for the imitation of a system over time with the purpose either understanding the behaviour of the system or of evaluating various strategies for the system.

- A simulation is an imitation of some real thing, state of affairs, or process. The act of simulating something generally entails representing certain key characteristics or behaviours of a selected physical or abstract system.

**Simulator Sickness** - The disturbances produced by simulators, ranging in degree from a feeling of unpleasantness, disorientation, and headaches to nausea and vomiting. Many factors may be involved,

including sensory distortions such as abnormal movement of arms and heads because of the weight of equipment; long delays or lags in feedback, and missing visual cues from convergence and accommodation.

**Skills** = Proficiency, facility, or dexterity that is acquired or developed through training or experience

**Sound** – A VR modality. Accurate localization of sounds without individualized head transfer functions remains a problem.

**Stereopsis** - Binocular vision of images with horizontal disparities. The importance of stereopsis for immersion is not established.

**Synthetic Environments** - VR displays used for simulation.

## I

**Tactile Displays** - Devices like force feedback gloves, buzzers, and exoskeletons that provide tactile, kinaesthetic, and joint sensations.

**Tactile Stimulation** - Devices like force feedback gloves, buzzers, and exoskeletons that provide tactile, kinaesthetic, and joint sensations.

**Taxonomy** – Taxonomy is defined as the science of classification, but it has also come to mean a specific classification scheme. There are many different types of taxonomies but the main goal of these types is to organize a particular set of objects so that they can be thought about systematically.

**TCP/UDP** - TCP and UDP are protocols for network communication between different computers. They are both core protocols of the Internet protocol suite. The transmission of messages is faster with UDP, but sometimes messages get lost with that protocol. In contrast to UDP, TCP is a reliable protocol.

**Tele-existence** - Remote VR.

**Telepresence** - VR with displays of real, remote scenes.

**Tracker** - A device that emits numeric coordinates representing its position and orientation in space.

**Training simulation** - A simulation used to train people at performing certain tasks. Training simulations are usually classified in three categories, either live, virtual, or constructive simulations (see the respective entries for their commonly accepted definitions). However, there is no clear division between these categories. The degree of human participation in the simulation is variable, as is the degree of equipment realism.

**Transparency** - How invisible and unobtrusive a VR system is.

## U

## V

**VRactors** - Virtual actors, either autonomous or telerobotic in a VR theatre.

**Vibro-tactile feedback** – Additional hardware that equips a dataglove (see Dataglove) to provide sensing of objects through vibrations.

**Viewpoints** - Points from which ray tracing and geometry creation occurs. The geometric eye point of the simulation. You can have multiple viewpoints. They can be attached to multiple sensors.

**Virtual Prototyping** - The use of VR for design and evaluation of new models.

**Virtual Reality** - An immersive, interactive simulation of realistic or imaginary environments. (Jaron Lanier). With VR, a human operator can perceive and interact with numerical data in a virtual world by means of computerized systems.

**Virtual Environments** - Realistic simulations of interactive scenes. Another acceptance of Virtual Environments is the sets of technological and software material (VR or AR devices, dedicated computers or hardware, dedicated libraries and software) which allow to develop any VR or AR application.

**Virtual simulation** - A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing resources to action), or communication skills (e.g., as members of a team).

**Visualization** - Use of computer graphics to make visible numeric or other quantifiable relationships.

**VRISE** (Virtual Reality-Induced Symptoms and Effects) - Term describing the health effects associated with the use of virtual environments.

## W

**Windows** - On some hardware platforms, you can have multiple windows and viewpoints into the same virtual world.

**Wire Frame Outlines** - Displays of the outlines of polygons, not filled in.

## X

**XML (Extensible Markup Language)** - A markup language provides a way to combine a text an extra information about it, e.g. structure, layout. HTML is a markup language commonly used for publishing content in the World Wide Web (WWW). Extensible means, that the user is allowed to define and add his own elements. XML is written in plain text.

## Y

**Yaw** - The angular displacement of a view around the vertical, y axis (up - down).

## Z

## 2. ABBREVIATIONS

AI	Artificial Intelligence
AR	Augmented Reality
CAD	Computer Aided Design
CME	Collaborative Manufacturing Environment
CVE	Collaborative Virtual Environment
DHM	Digital Human Modelling
DOF	Degrees of Freedom
FP5	Fifth Framework Programme
FP6	Sixth Framework Programme
FQ	Flow Questionnaire
GUI	Graphical user interface
HBR	Human Behaviour Representation
HCI	Human computer interaction
HMD	Head Mounted Display
HMI	Human machine interaction
HF	Human Factors
ICT	Information and Communication Technologies
I/O	Input/Output
MR	Mixed Reality
PQ	Presence Questionnaire
VEs	Virtual Environments
VEDs	Virtual Environment Development Structure
VR	Virtual Reality
VRISE	Virtual Reality Induced Symptoms and after Effects
UI	User interface
WIMP	Windows, icons, menus and pointing devices

### 3. REFERENCES

This glossary was based upon that used for the FP6 EU project "Intuition". (Available from <http://www.intuition-eunetwork.org/index.php?page=glossary>, accessed on-line February 2007).

Benedikt, M. (Ed.), (1991) *Cyberspace: First Steps*. Cambridge, MA: The MIT Press.

Earnshaw, R. A., Gigante, M. A., Jones, H. *Virtual Reality Systems*, New York: Academic Press.

Ellis, S. R. (Ed.), (1991) *Pictorial Communication in Virtual and Real Environments*. London: Taylor and Francis.

Kalawsky, R., (1993) *The Science of Virtual Reality and Virtual Environments* New York: Addison-Wesley.

Kalawsky, R., S, Bee, S., T and Nee, S., P (1999). "Human Factors Evaluation Techniques to Aid Understanding of Virtual Interfaces." *BT Technical Journal* 17(1): 128-141.

Latham, R., (1991) *The dictionary of Computer Graphics Technology and Applications*. New York: Springer - Verlag.

Laurel, B., (1991) *Computers as theater*. New York: Addison-Wesley Publishing Co.

Pimentel and Teixeira, (1992) *Through the looking glass*. Intel.

Rheingold, H., (1991 ) *Virtual Reality*. New York, Simon & Schuster.

Steuer, J.S. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, 42(4), 73-93.