



## GLOSSARY

### **2D and 3D GUI (Graphical User Interface):**

A 2D GUI (pronounced 'gooey') is the graphical interpreter between man and computer that allows a more intuitive interaction with the computer (example: Microsoft Windows). A 3D GUI has not only height and width, but also depth to maintain 3D objects.

### **2 DOF (2 Degrees of Freedom):**

2 Degrees of Freedom refers to the ability of an input device to control the position along only the X- and Y-horizontal and vertical axes. An example of A 2 DOF input device would be a standard computer mouse.

### **3D Graphics:**

Displayed representation of a scene or an object that appears to have three axes of reference: height, width, and depth (x, y, and z in Cartesian Space).

### **3D Object:**

An image created with polygons, which displays height, width and depth on a computer screen.

### **6 DOF (6 Degrees Of Freedom):**

Refers to the ability of an input device to control the position and orientation of a 3D object. Position is measured along the X, Y and Z axes which correspond to width, height and depth respectively. Orientation is expressed as pitch, roll and yaw, or degrees of movement around the X, Y and Z axes.

A 6DOF input device is a specific medium for VR systems with the ability to track movements among these dimension and translate the information into computer data.

### **Active and Passive:**

There are two types of tracking systems: active and passive. Active tracking systems use two-way signals to process input data. This system tracks the user's position and orientation via transmitters, with the data captured by sensors which are attached to the system. A passive tracking system uses a one-way signal to process input data. Only one sensor is used to track position and orientation in this system—there are no transmitters involved. Passive systems are used less frequently than active systems.

### **Agents:**

Agents are 3D computer aided models used to fill a virtual environment. These models can take on many forms such as humans, animals, insects, or even robots. Agents have multiple purposes when placed in a virtual world. They can be used as the following: guides who navigate the user through the virtual worlds; trainers who talk and help the user through a difficult situation or procedure; assistants who are off in the wings waiting to step in and help the user by giving advice or answering questions. Most agents are actors that play out assigned scripts in the virtual scenario, but some intelligent agents autonomously decide how to accomplish goals. Sometimes agents are main characters that interact and respond to the user's actions; other times, they are extras that just populate the background of the action.

### **AI (Artificial Intelligence):**

The attempt to mimic and automate human cognitive skills through rules and knowledge techniques.

### **Animation:**

The movement of elements through time and space. Also, the process of creating and recording images that change over time. Everything in a scene is represented by numeric values and, as such, animation is also the process of changing these values—position, color, or any other property—over time.

### **Anti-Aliasing:**

A technique used in imaging systems to alleviate the jagged appearance of graphics produced on low-resolution devices such as computer monitors. It involves the interpolation of a neutral color between the edge of one color plane and another.

### **API (Application Programmer's Interface):**



An API is a standardized and documented set of protocols and data structures. It supports consistent interfacing by external software applications to primary software systems. API's define sets of operations available to a programmer at a given level of abstraction.

**Artificial Reality:**

Basically the same as Virtual Reality, Artificial Reality was the term used by VR pioneer Myron Krueger to describe the illusion of reality created in computer-created video environments.

**Augmented reality:**

An augmented reality system generates a composite view for the user. It is a combination of the real environment viewed by the user and a computer-generated scene that augments and enhances the environment with additional information.

**Autostereoscopic:**

The observer can see 3D image content spatially with real depth, without additional accessories like head-mounted display glasses or similar devices.

**C++:**

An object-oriented extension of C language, it has been adopted as the standard programming language of computer companies and major software developers.

**CAD (Computer Aided Design):**

A form of automation that helps designers prepare drawings, specifications, parts lists, and other design-related elements using special graphics and calculations-intensive computer programs. The technology is used for a wide variety of products in such fields as architecture, electronics, and aerospace, naval, and automotive engineering. Although CAD systems originally merely automated drafting, they now usually include three-dimensional modeling and computer-simulated operation of the model.

**CAM (Computer Aided Manufacturing):**

A form of automation where computers communicate work instructions directly to the manufacturing machinery. A single computer can control any number of machines and tools, moving the product from machine to machine as each step in the manufacturing process is completed. The most advanced systems, which are often integrated with computer-aided design systems, can also manage such tasks as parts ordering, scheduling, and tool replacement.

**Cartesian space:**

A 3-dimensional space where every point is described by three coordinates: X, Y and Z-where X stands for the horizontal position, Y describes vertical position and Z gives the position along the line of sight, or depth position. Cartesian space is based on the Cartesian coordinate system and is an essential element in computer graphics and CAD. Computer graphics software uses algebraic transformations to alter the position, size and shape of objects within the coordinate system.

**CAVE (Cave Automatic Virtual Environment):**

The Cave is a surround-screen, surround-sound, projection-based virtual reality system. The illusion of immersion is created by projecting 3D computer graphics into the walls of a 10'x10'x10' cube composed of display screens that completely surround the viewer. It is coupled with head and hand motion tracking systems to produce the correct stereo perspective and to isolate the position and orientation of a 3D input device. A sound system provides audio feedback. The viewer explores the virtual world by moving around inside the cube and grabbing objects via input devices, such as data gloves.

**Collision Detection:**

The way a computer program determines if two virtual objects intersect each other and what the two objects do after the intersection.

**Computer-Based Training (CBT):**

The use of computers to deliver instructional material and to test the user's grasp of that material in education and training.

**Cyberspace:**



The non-physical terrain created by computer systems and which contains objects and different modes of information transportation and delivery.

**Data Glove:**

A glove that is wired with sensors and is connected to a computer; the computer reads the sensor information from the glove and, in turn, allows for gesture recognition as well as display in a 3D environment.

**Environment:**

A computer generated simulation that can be experienced from the inside and gives the illusion of being in an actual place.

**FMD (Face Mount Display):**

Similar to the HMD, face mounted display glasses are worn like sunglasses but contain small monitors positioned in front of each eye. These monitors allow the user to view generated images, and they provide a sense of immersion when used in a virtual reality setting.

**Force Feedback:**

Responses provided by a device in order to simulate opposing force and resistance.

**Graphics Display:**

A computer interface that presents synthetic world images to one or several users interacting with the virtual environment. A personal graphics display is intended for one user and can be displayed using a head or face mounted display. Graphics displays for a number of people can be shown on a projection screen or monitor.

**GUI (Graphical User Interface):**

GUI, pronounced 'goeey,' is a simple way for a person to interface with a computer. An example of this is Microsoft Windows, in which the user clicks on a visual screen (icons, windows and menus) by using a tracking device, such as a mouse.

**Haptic:**

Haptic is derived from a Greek word meaning 'the science of touch.' Tactile cues are sensations like textures, vibrations, and bumps, whereas kinesthetic cues are contours and shapes and sensations like the weight of a stone or the resistance of stirring molasses. These cues help give direction and guide our movements. Haptic technology can simulate these kinds of tactile and kinesthetic sensations so that computer interfaces not only look but also feel like the interfaces from the real world.

**Haptic Feedback:**

Applying tactile sensation to human interaction with computers. A haptic device involves physical contact between the computer and the user through an input/output device (data gloves), which senses the body's movements. Users can also receive information from the computer in the form of a felt sensation on some part of the body.

**Head Tracker:**

A marker device placed on the top of the head. Monitors and displays the user's head movements and sightline in the virtual environment.

**HMD (Head Mounted Display):**

A stereoscopic screen mounted in a helmet or visor. Used for creating 3D computer graphic displays.

**Immersion:**

The feeling of presence, of being surrounded by virtual space, and the capability of interacting with all available objects

**Inertial Tracker:**

Measures the accelerations on masses (using accelerometers) and the orientation of spinning masses (using gyroscopes). The output from the tracker needs to be integrated to determine orientation, however, integration causes the actual positions and orientations to be sensitive to drift and have to be recalibrated periodically.

**I/O (Input/Output):**

The term I/O is used to describe any program, operation or device that transfers data to or from a computer and to or from a peripheral device. Every transfer is an output from one device and an input into another. Devices such as keyboards and mice are input-only, while devices such as printers are output-only. In a virtual reality environment, I/O devices include data gloves and FMDs.

**Intelligent Agent:**

An intelligent agent is an inhabitant of a virtual environment, has a goal, and autonomously decides which actions to take in the current situation to maximize progress. These intelligent agents are built with artificial intelligence. As such, they have the ability to learn from experience and, consequently, respond in flexible and possibly unforeseen ways to particular situations. This gives them the appearance of personality and believability.

**Interface:**

The point of interaction or communication between a computer and any other entity, such as a printer or human operator. Also, the layout of an applications' graphical or textual controls (as in graphical user interface-GUI).

**JAVA:**

A high-level programming language developed by Sun Microsystems, Java is an object-oriented language similar to C++ but simplified to eliminate language features that cause common programming errors. The language can be used for many different applications and on many different systems including handheld devices and as platform-independent 'applets' on the World Wide Web.

**Joystick:**

A device consisting of a hand held stick that pivots about one end and transmits its angle in two dimensions to a computer. Joysticks are often used to control games and usually have one or more push-buttons whose state can also be read by the computer.

**Lag:**

Lag is the time delay between the VR user's movement and the computer actually displaying the effects of those movements.

**LCD (Liquid Crystal Display):**

A digital display that uses liquid crystal cells that change reflectivity in an applied electric field; used for portable computer displays. LCDs are lighter and consume much less power than other computer displays. Liquid crystals are rod-shaped molecules which spiral when they are exposed to an electrical charge.

**LOD (Level of Detail):**

A model of particular resolution among a series of models of the same object. (Used to increase the graphics performance by drawing simpler geometry when the main object is viewed from a greater distance; objects seen from afar appear smaller, so a less detailed model is all that is required during processing.)

**Motion Capture:**

A process by which external devices can be used to capture movement data from various live sources. This data is then transmitted to the computer, where 3D simulation software displays it in real-time applied to a virtual actor.

**Motion Platform:**

A system that provides a real motion to simulate the display motion in a VR environment.

**Neural Network:**

An artificial neural network is a computer or computer program composed of interconnected processing units that mimic neurons in a human brain. Like in the brain, all of the neurons function in parallel and have the ability to adapt to new environments. Neural networks differ from typical computers because they solve problems more like the way in which human brains solve problems. Rather than using a digital model, in which all computations manipulate zeros and ones, a neural network works by creating connections between processing elements. They excel recognition and classification types of problems, such as speech-to-text conversions, credit card use patterns and stock selection decisions.

**Optical Tracking System:**

An optical tracking system consists of data collection hardware, such as a motion-capture camera, with software that translates that data into a virtual environment. The software analyzes output from the devices, finds the object of interest, and renders it on a computer screen.

**Pixel:**

A picture element—the smallest element that can be displayed on a video screen or computer monitor. Pixels are often used as a unit of measurement for image size and resolution. The number of pixels (width and height) in an image defines its size; the number of pixels in an inch defines the resolution of the image. The higher the number of picture elements in the display, the higher the resolution of the display.

**Polygon:**

A figure confined to a plane and that has many angles. As a consequence of such angles, this figure has many sides. The perimeter of this figure normally consists of five or more sides.

**POV (Point Of View):**

The changing view in a virtual world created by the user's changing line of sight.

**Projected Reality:**

A virtual reality system that combines a live performance or a video image of the user with a projected computer environment.

**Real Time:**

Computer mediated action happening fast enough to give the appearance to human perception that the action happens instantly.

**Rendering:**

The computer process of calculating and drawing images on a display; the conversion of a high-level, object-based description into a graphical image for display; or the process of turning a model into a picture or turning a data structure into pixels.

**SDK (Software Development Kit):**

A programming package that enables a programmer to develop applications for a specific platform. Typically an SDK includes one or more application program interfaces, programming tools, and documentation.

**Space Mouse:**

A Space Mouse is a device similar in purpose to a joystick, but a Space Mouse additionally provides movement along all degrees of 3D space. It allows precise positioning and rotation of viewpoints and objects and is thus called a six-degree-of-freedom device.

**Stereoscopic:**

An optical instrument with two eyepieces used to impart a three-dimensional effect from two photographs of the same scene taken at slightly different angles.

**Support Vector Machine:**

SVMs are learning machines that can perform binary classification (pattern recognition) and real valued function approximation (regression estimation) tasks.

**Tactile Display:**

Devices like force feedback gloves, buzzers and exoskeletons that provide tactile, kinesthetic and joint sensation. Tactile display devices stimulate the skin to generate these sensations of contact. The term "tactile display" is sometimes used to describe any apparatus that provides haptic feedback, but it is useful to distinguish between systems for vector force feedback and devices that convey distributed sensations. The skin responds to several distributed physical quantities, the most important of which are high-frequency vibrations, small-scale shape or pressure distribution, and thermal properties.

**Telepresence:**

The sensation of being physically located in a real place other than where one is actually located.

**Thermal Feedback:**

A response from a device to simulate a temperature value

**Trackers:**

A device that emits numeric coordinates for its changing position in space

**Virtual Engine:**

A virtual engine or 'reality engine' is the heart of any VR system because it processes and generates the virtual world. It can consist of a single computer or a group and follows software instructions in order to assemble, process and display all the data involved in the virtual world. The computer known as the virtual engine handles three types of tasks: data input, data output and virtual world management. Keyboards, mice, data gloves and motion trackers are typical input devices and all have to be compatible to the main engine. Everything in the virtual world has to run in real-time, requiring the virtual engine to have fast processors and possibly several processors working together.

**Virtual reality:**

VR is the simulation of real life through real-time 3D modeling, position-tracking and stereo audio/video techniques. VR breaks away from the convention of the user-screen interface and surrounds participants with an interactive reality that enables them to experience the dynamics of real life in a computer generated and programmed environment. Users can directly interact in simulations of any scale or scope-a machine in operation, a biological system under attack by an organism, a now extinct culture, a manufacturing system, or a civil emergency.

The 'reality' is created through computer technology in which three-dimensional graphics are programmed with a response repertoire so that the environment looks and acts like the real world. The environment is created with a combination of art and programming, and you can interact with objects in the world via your voice, hands, and sometimes even your eyes to alter and respond to the conditions of the virtual surroundings.

There are two main types of virtual reality: immersive and non-immersive. Immersive virtual reality involves the use of Head-Mounted Displays and other devices that allow you to actually immerse yourself inside the virtual world for a more realistic experience. Non-Immersive virtual reality is when a standard computer or television monitor is used to display the virtual setting and the user interacts with that display.