VR 和 Visualization 前世今生

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Virtual Reality is a Dream

- Don't think of that thing as a *screen*, think of it as a *window*, a window through which one looks into a *virtual world*.
    -- Ivan Sutherland,1965,
     "The Ultimate Display"

Definition

- **Virtual Reality** — A computer simulation of a real or imaginary system that enables a user to **perform operations on** the simulated system and **shows the effects** in real time.

History

Morton Heilig wrote in the 1950s of an "Experience Theater" that could encompass all the senses in an effective manner, thus drawing the viewer into the onscreen activity. He built a prototype of his vision dubbed the Sensorama in 1962, along with five short films to be displayed in it while engaging multiple senses (sight, sound, smell, and touch). Predating digital computing, the Sensorama was a mechanical device, which reportedly still functions today. In 1968, Ivan Sutherland, with the help of his student Bob Sproull, created what is widely considered to be the first Virtual Reality and Augmented Reality (AR) Head Mounted Display (HMD) system. It was primitive both in terms of user interface and realism, and the HMD to be worn by the user was so heavy it had to be suspended from the ceiling, and the graphics comprising the virtual environment were simple wireframe rooms. The formidable appearance of the device inspired its name, The Sword of Damocles. Also notable among the earlier hypermedia and virtual reality systems was the Aspen Movie Map, which was created at MIT in 1977. The program was a crude virtual simulation of Aspen, Colorado in which users could wander the streets in one of three modes: summer, winter, and polygons. The first two were based on photographs – the researchers actually photographed every possible movement through the city's street grid in both seasons – and the third was a basic 3-D model of the city. In the late 1980s the term "virtual reality" was popularized by Jaron Lanier, one of the modern pioneers of the field. Lanier had founded the company VPL Research (from "Virtual Programming Languages") in 1985, which developed and built some of the seminal "goggles n' gloves" systems of that decade.

Morton Heilig

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In the 1950's it occurred to cinematographer Morton Heilig that all the sensory splendor of life could be simulated with "reality machines." He proposed that an artist's expressive powers would be enhanced by a scientific understanding of the senses and perception. His premise was simple but striking for its time: if an artist controlled the multi-sensory stimulation of the audience, he could provide them with the illusion and sensation of first-person experience, of actually "being there."

Inspired by short-lived curiosities such as Cinerama and 3D movies, it occurred to Heilig that a logical extension of cinema would be to immerse the audience in a fabricated world that engaged all the senses. He believed that by expanding cinema to involve not only sight and sound, but also taste, touch, and smell, the traditional fourth wall of film and theater would dissolve, transporting the audience into a habitable, virtual world. He called this cinema of the future "experience theater," constructing a quirky, nickelodeon-style arcade machine in 1962 he aptly dubbed Sensorama, that catapulted viewers into multi-sensory excursions through the streets of Brooklyn, as well as other adventures in surrogate travel.
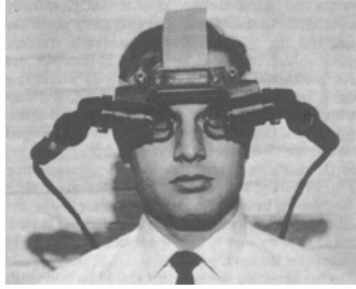
Sensorama
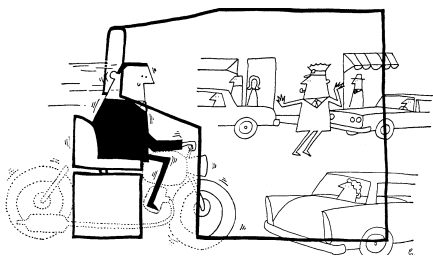
The Ultimate Display

- The ultimate display would, of course, be a room within which **the computer can control the existence of matter**. … With appropriate programming such a display could literally be **the Wonderland into which Alice walked.**
  -- Ivan Sutherland,1965,   "The Ultimate Display"
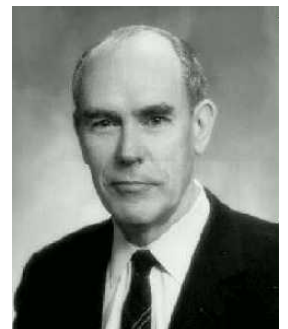
The sword of Damocles

Early work on head-mounted displays took place at Bell Helicopter Company. Designed to be worn by pilots, the Bell display received input from a servo-controlled infrared camera, which was mounted on the bottom of a helicopter. The camera moved as the pilot's head moved, and the pilot's field of view was the same as the camera's. This system was intended to give military helicopter pilots the capability to land at night in rough terrain. The helicopter experiments demonstrated that a human could become totally immersed in a remote environment through the eyes of a camera.

The power of this immersive technology was demonstrated in an example cited by Sutherland (1968). A camera was mounted on the roof of a building, with its field of view focused on two persons playing catch. The head-mounted display was worn by a viewer inside the building, who followed the motion of the ball, moving the camera by using head movements. Suddenly, the ball was thrown at the camera (on the roof), and the viewer (inside the building) ducked. When the camera panned the horizon, the viewer reported seeing a panoramic skyline. When the camera looked down to reveal that it was "standing" on a plank extended off the roof of the building, the viewer panicked!

Aspen Movie Map

The Aspen Movie Map was a revolutionary hypermedia system developed at MIT by a team working with Andrew Lippman in 1978 with funding from ARPA.
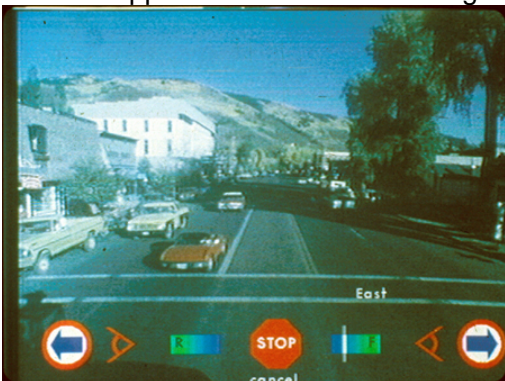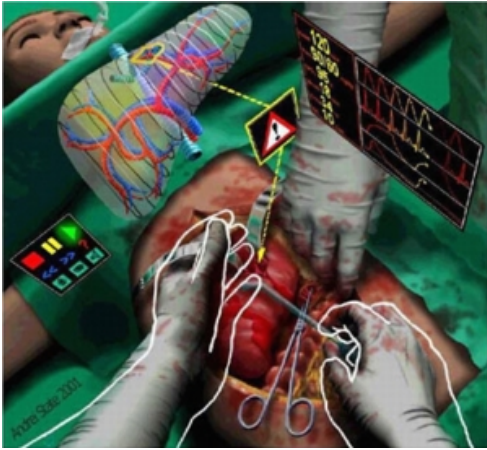

Virtual Reality

Jaron Lanier

- Coin the term "Virtual Reality".

- Founded **VPL** (Virtual Programming Language) **Research**, the first company to sell VR products.

Tele-immersion

Tele-Immersion will enable users in different locations to collaborate in a shared, simulated environment as if they were in the same physical room. It's the ultimate synthesis of networking and media technologies to enhance collaborative environments. In the tele-immersive environment, computers recognize the presence and movements of individuals and objects, track those images, and then permit them to be projected in realistic, multiple, geographically distributed immersive environments where individuals can interact with each other and

with computer generated models.

To make these new distributed immersive environments a reality, Advanced Network & Services has acted as a catalyst bringing together recognized experts in virtual reality and networking, let by VR pioneer Jaron Lanier, to identify the issues and develop plans to build a national tele-immersive research infrastructure. With goals of accelerating the development of better tools for research and educational collaboration, this plan will be woven into the fabric of many of the Next Generation Internet applications.

VR variety

- Graphics VR
  - 又稱 Geometry-based VR，場景中的所有物件都是實際存在的 3D Model，使用者可以**任意視角與路徑來觀看**

優點

- 互動性佳
- 可自由 Walk-Through
- 可產生虛擬的場景
- 提供立體視覺效果

缺點

- 製作過程難度高
- 硬體配備需求較高
- 場景大小受限於網路頻寬

- Image VR
  - 利用適當的軟、硬體設備產生 360°的環場影像，使用者可在定點以任意角度觀看場景。

    優點

      製作簡單迅速

      場景逼真自然

      不需高檔配備

      不受網路頻寬限制

    缺點

      互動性差

      只能定點觀看

      無法處理不存在之場景

      無法提供具景深之立體視覺

- Hybrid VR
  - 結合幾何式與影像式的虛擬實境發展環境，以汰除兩者之缺點，並結合兩者之優點為目標。

預期效益

互動性的提昇
製作過程的簡化
場景的自然呈現
減低工作平台的需求
減低網路頻寬之限制
不存在之場景亦可處理
虛擬實境的應用進入商業市場 (如 3D 互動式網站、線上購物中心、導覽系統…等)

Sony patent

- On April 7th, 2005 Sony went public with the information that they had filed for and received a patent for the idea of the non-invasive beaming of different frequencies and patterns of ultrasonic waves **directly into the brain** to recreate all five senses

Dream

- The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such room would be fatal. With appropriate programming such a display could literally be the Wonderland into which Alice walked.

-- Ivan Sutherland,1965,"The Ultimate Display"

"The Wonderland into which Alice walked"

http://accad.osu.edu/~waynec/history/lesson17.html
http://en.wikipedia.org/wiki/Virtual_reality
http://www.pcexpert.com.tw/
http://www.jaronlanier.com/
http://www.cs.unc.edu/~brooks/WhatsReal.pdf
http://www.informatik.umu.se/~jwworth/The%20Ultimate%20Display.pdf

Visualization 請參看 http://www.cs.ucdavis.edu/~ma/ECS272/lectures/Intro.pdf