

CS50 Virtual and Augmented Reality

Overview

It seems like virtual and augmented reality are talked about all the time as the future of technology these days. As the field grows and develops, we are led to wonder how VR and AR can change our world. What would happen if we can create thoroughly convincing versions of reality? Will VR and AR replace non-virtual interactions? For now, let's learn about how these technologies work, their technical challenges, and what we can do with them now.

Key Terms

- virtual reality
- augmented reality
- headset

Virtual and Augmented Reality

Virtual reality, or VR, refers to the field of technology that creates computer-generated environments and experiences that people can interact with as they would in real life. To do this, software and hardware technologies have to work together to appeal to all human senses in efforts to perfectly replicate how humans register their surroundings. In other words, technologies have to completely immerse the user in a virtual world; the user should be able to naturally interact with the world and the world should convincingly respond to the user's actions. By appealing to sight, sound, touch and less obvious senses like balance, virtual reality aims to minimize the user's awareness of the artificiality of the world. For example, in appealing to sight, virtual reality technologies have to take into account our peripheral vision, providing nearly 180° of graphics. Human physiology is central to the development of virtual reality technologies.

Augmented reality, or AR, is very similar to VR. However, instead of completely recreating a virtual realistic world, AR builds upon input from real life. AR often overlays some kind of visual information (graphics, text, etc) over a camera feed. Whereas VR can be used to create fantastical worlds, AR aims to enhance the experience of reality, connecting real life with resources and information of the virtual world.

Technologies

Creating immersive and interactive experiences requires new hardware devices and software technologies. Depending on the intended level of immersion, various types of hardware will be used. On a most basic level, as with all computers, the user needs some kind of output device to receive information about the virtual world and some kind of input device to interact with it. The most common VR device is some kind of **headset** that fits like a large pair of goggles. These headsets usually contain sensors to track a user's motions, lenses to reproduce how we see the world, and two display screens (one per eye). Along with a headset, VR may use input devices like joysticks and hand controllers to add haptic, or touch, interactions. VR and AR can also be used in more easily accessible devices such as smartphones and a headset with just a pair of lenses. On the software side, there are many JavaScript frameworks for programming VR and AR experiences. Additionally, Unity is a popular tool for creating 3D games and experiences.

Applications

VR and AR are being used in many fields today and will surely continue to expand their impact. VR and AR is perhaps most visible in the field of entertainment: many video games and films now take advantage of VR and AR, creating experiences of unparalleled engagement. VR and AR are also used often in education for professions in which realistic training can be risky or costly. This includes flight simulators for pilots and surgery simulators for doctors. Beyond professional training, VR and AR are used in treatments for psychological conditions like PTSD. VR and AR can also be used creatively. For example, they are used in architecture to create more realistic models and designs.

The cost of VR and AR technologies today remains quite high, however, as the cost is driven down, many predict that VR and AR will have a greater presence in our everyday lives. By hoping to unify technology more closely than ever with our experiences, VR and AR are revolutionary in their ability to humanize technology. As technology develops, the possibilities of VR and AR can only expand.