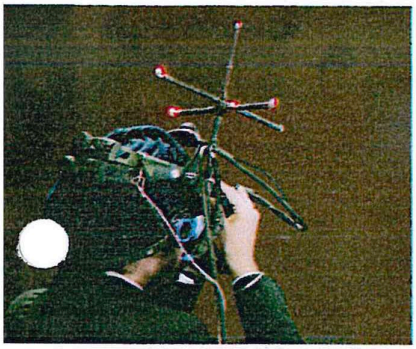
Moving Closer to Reality

AR can help people feel empathy and prepare them for natural disasters BY MONICA ROZENFELD

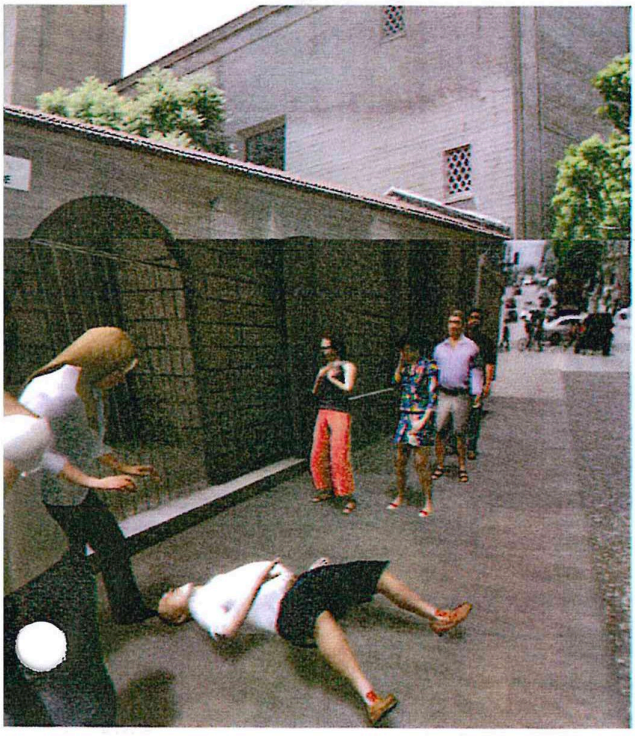


THE ANIMATED FILM *WALL·E* paints a dystopian future in which people are glued to their individual video screens, oblivious to their surroundings. In the real world, similar concerns are being raised about virtual reality. People who wear VR headsets can immerse themselves in virtual worlds and be conscious of little else.

VR headsets provide 360-degree views of digitally processed scenes filled with sights and sounds. Someone wearing a headset and standing on a virtual island might, for example, move her head to the right to see palm trees and to the left to see the ocean waves. A sense of embodiment is created—people wearing a headset feel part of the scene, as if they were physically there.

Some observers say they worry people might eventually prefer the virtual over the real world. But others say it's more likely that VR will instead help people better understand the world around them, and even themselves, in ways that were not possible before.

Here are several examples of how VR could bring people closer to reality.



Virtual reality headsets, like the one in the photo at top left, are being used to immerse people into news stories. Users can experience standing on line at a food pantry [left] as a man collapses from a diabetic coma. In the scene above, wearers witness the plight of children displaced in Syria's civil war.

EYEWITNESS NEWS

Va[illegible]g news reports about poverty [illegible]e can leave some viewers desensitized to the suffering in the world. VR could help people become more empathetic. When journalist Nonny de la Peña was filming reports about hunger and war, she wanted to find a way for viewers to connect with the people in her stories, so she used VR. De la Peña is the CEO of Emblematic Group, a company in Santa Monica, Calif., that develops content for VR systems.

De la Peña turned a news story about people lined up at a food bank into a VR experience to see how viewers would react to it. When people she had chosen put on VR headsets, they found themselves in a line with others waiting outside a food pantry. Suddenly, a man in the virtual line collapsed, his body shaking from a diabetic coma triggered by hunger [see photo, bottom left]. Those in de la Peña's group found themselves walking toward the man, as if they could help him. Some reported later that they had a feeling of helplessness because they couldn't do anything for the fallen man. A few shed tears. And this occurred even though they knew [illegible]ere really in an empty room.

Project Syria, de la Peña wanted to show viewers what it was like for Syrian children living through that country's civil war. She obtained news footage of children on the streets in Syria as bombs went off. Her VR viewers watched a girl of about 9 singing a song. After about 20 seconds a bomb exploded on the scene. The girl disappeared from the screen; others on the street ran to get away from the blast. Those wearing the headsets reported they felt alarmed and shaken.

Some said afterward they would donate to food banks and Syrian refugee programs.

"With VR," de la Peña says, "it turns out you can feel like you're in two places at once: in the virtual space as well as the space you're actually in—known as a duality in presence."

In a TED talk on the future of news reporting, she used those two examples of VR experiences to show how people can be prompted to tap into their empathy.

"It wasn't until I started working with virtual reality that I started to see really intense reactions from people to news stories," she says.

THE VERDICT IS IN

During many criminal trials, lawyers show jurors photographs and drawings in an attempt to explain what happened at a crime scene. But it can be difficult for jurors to comprehend details, like the trajectory of a bullet, by just looking at images. That's why a team at the University of Zurich is experimenting with VR headsets to immerse jurors in the scene and give them a better idea of what happened so they can deliver better-informed verdicts.

AN ESCAPE PLAN

After the 2011 Tohoku earthquake and tsunami in Japan, researchers from the Aichi University of Technology, in Gamagori, Japan, designed a VR program that simulates a tsunami moving through a city [see photo, top right]. By wearing a headset, people can experience an enormous wave rushing through the streets. The goal is to help citizens prepare so they can remain calm and think clearly during an actual tsunami.

In one tsunami simulation, the person wearing the VR headset is a driver whose car is in danger of being washed away by the rushing water. The scenario, designed to make headset wearers feel helpless, should teach them not to try to escape a tsunami in a car but abandon the vehicle and run to higher ground. To help make the scene realistic, the designers analyzed video footage taken from car-mounted cameras retrieved from the 2011 tsunami and interviewed survivors about their experiences.

VIRTUAL THERAPY

VR also might help people who suffer from anxiety, depression, and post-traumatic stress disorder. For those fearful of speaking in public, for example, the mobile app Public Speaking Simulator offers the experience of speaking in front of a virtual room packed with a large crowd [see photo, bottom right]. The size and behavior of the crowd can be adjusted. Would-be speakers can accustom themselves to the sounds a crowd makes, including potential distractions such as coughing and whispering. The app sounds an alert if the speaker spends too much time talking to one side of a room at the expense of the other, for example, or says "um" too often.

VR is also being used to treat soldiers with PTSD. The headsets bring them back to the sights and sounds of a war zone. The more the veterans are exposed to the virtual stimuli of gunfire and explosions, the thinking goes, the better they can be trained not to confuse them with the everyday sounds of, say, city traffic and firecrackers.

Researchers from the Aichi University of Technology Gamagori, Japan, developed a VR program [top] to help prep people for a tsunami. VR could also be used to relieve pe of their anxieties. The mobile app Public Speaking Simul [above] simulates a crowded room with ambient nois users can practice speaking in front of a live audie

The technology also is being considered for helping assault victims relive their experiences. Gradually the original debilitating memory will exert less power on their psyche. The same idea is being tried for victims of traumatic car accidents.

Researchers at University College London found that role-playing using VR can help people with depression by alleviating their negative thoughts and helping them be more compassionate to themselves. Patients observe a talk therapy session designed for th VR experience. Through the headse the patient sees the session from th therapist's perspective, and then fr the patient's. As the therapist, the wearer usually becomes concerned about the patient's well-being.

Nine of the 15 patients who participated in the study reported reduced symptoms of depression a three sessions—serving as a proof concept for researchers to continu work in this area.

SUMMARY OF PAST CLASS DISCUSSION of
"Moving Closer to Reality"

+ Increased productivity in the workforce
- Could lack deep knowledge of real experts

+ Prepare people for disasters
- Incomplete scenario could be represented in the simulation

+ Could create hope
- Could create false hope

If put actual footage (reality) in simulation:
+ Could condition first responders to not panic
- Could make reality shocking
- Could evoke other emotions that are not desirable (rage, depression, etc)

Could be used to subliminally deliver a message:
+ to overcome fears or addictions
- to mentally program someone to commit deviant behavior

+ Can create empathy
- Could desensitize people to horror

- The physics implemented might not be realistic

+ Could be used for therapy for mental health like PTSD
- Could magnify the memories of PTSD

- Could result in physical decay from people who should be practicing real physical first response to disasters

- Could accidently prompt people to behave badly

How Augmented Reality Is Changing the Way We Work

AR devices can assist in a number of ways BY AMANDA DAVIS

NDUSTRY IS A test bed for AR's capabilities. Workers on construction sites, in water treatment plants, and elsewhere are trying smart helmets and headsets that can display step-by-step instructions to help them fix faulty machinery. And they can communicate and share what they're looking at with colleagues, and ask their advice, even if they're thousands of kilometers apart.

These are just some of the benefits of wearables like the DAQRI Smart Helmet (DSH) [photo, center] and the Microsoft HoloLens headset [bottom].

HANDS-FREE

It can be awkward to repair or recalibrate a piece of complicated machinery while holding onto an operator's manual to read instructions. AR helmets from DAQRI will overlay the instructions on the machinery, freeing up the worker's hands. "This reduces the time it takes to complete a task and cuts down on errors," says Paul Sweeney, vice president of sales and general manager for the Los Angeles company.

DAQRI's 4D Studio software uploads 3-D models of machinery and interactive instructions for its repair to the DSH. Customers can add training videos, along with images and text from other manuals.

Safety lenses in the helmet double as a screen for the graphics. The Smart Helmet also has an embedded camera and transceiver so the wearer can contact and chat with a colleague in another location. This Remote Expert feature lets the wearer connect with a colleague via voice over Internet Protocol and share what he's seeing through the other person's computer.

Instead of GPS, the device uses Intellitrack technology, a location-based service that combines visual information from the front-facing camera, a 3-D map of the job site, and an internal sensor that detects a person's movement to keep track of where the helmet is in relation to its surroundings.

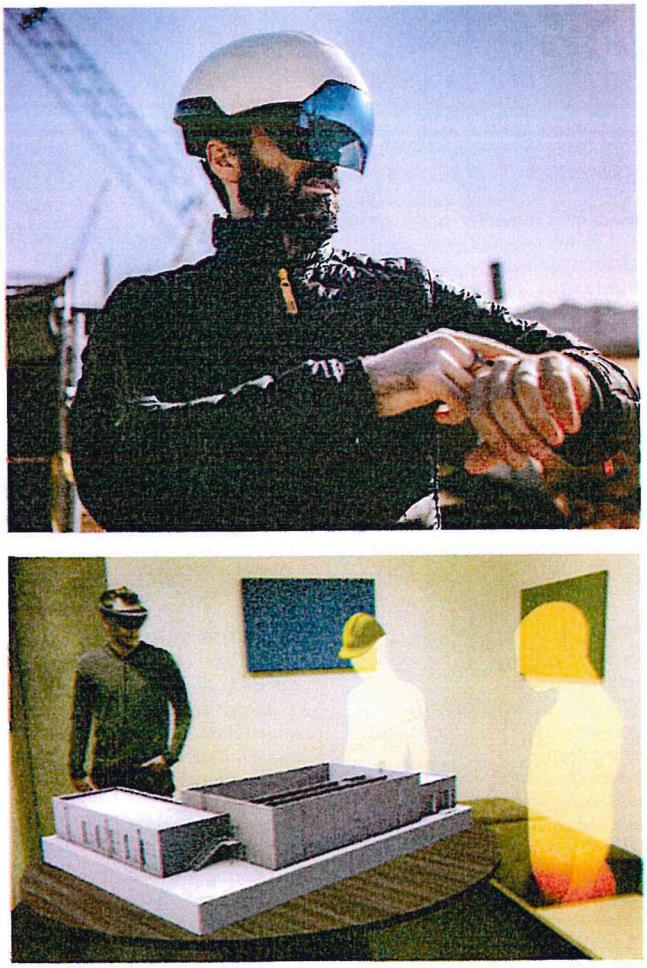
Also, thermal cameras in the DSH can visualize for the wearer the temperature of the surrounding area. That view can help predict equipment failures before they happen because, notes Sweeney, many machines "run hot" before they break.

Several companies, including Emerson Electric, a software and service provider in St. Louis, and Parker Hannifin, an engineering firm in Mayfield Heights, Ohio, are beta-testing the helmet, which costs US $15,000.

VIRTUAL COLLABORATION

Microsoft HoloLens headsets can make their wearers feel like they're in two places at once. It allows them to see their surroundings while 3-D holographic images of walls, machinery, and equipment are projected in front of what they're viewing.

I tried out the $3,000 headset at this year's Augmented World Expo, courtesy of Scott Aldridge, leader of the innovation group at CDM Smith, an engineering and construction company based in Boston. The group is exploring possible applications for AR and VR devices for its customers.



The DAQRI Smart Helmet [top] projects instructions on machinery to let people work hands-free. The Microsoft HoloLens [bottom] projects images in front of the wearer and allows workers to collaborate with each other in the form of avatars.

The headset lets people seemingly walk around and through a 3-D model of, say, a construction site or manufacturing plant, or even a virtual blueprint of a proposed building. I walked through a model of a water treatment plant projected by the headset. Even though I was walking around the Expo's press room, I felt like I was inside the facility.

HoloLens wearers can use gesture control (a wave or a pinch of their thumb and forefinger in front of the headset) to get a bird's-eye view of the building or zoom in and "step inside" a room and see its walls and machinery.

They also can bring up and apply a virtual measuring tape. Just look at the corner of one wall, trace a line to the next corner, and say the words "create measurement," and the tool measures the distance between those two points. The virtual measuring tool is especially useful for customers planning to install equipment in a new building: They can create a hologram to scale of a large piece of equipment destined for the building, and make sure it fits where they want it to before they pay for a crane to haul it in.

If two or more people are wearing the headsets uploaded with the same 3-D model, they can communicate with one another through embedded microphones and see each other as holographic avatars, even if they're in different locations.

"We've had as many as 12 participants in a dozen different locations working together inside a model using our HoloLens communication and collaboration application," Aldridge says. "Even if you don't have HoloLens you can participate from a laptop and be represented in the environment in avatar form."

In my demo, Aldridge's avatar was a faceless yellow figure wearing a hard hat. I could even see what he was looking at in the virtual room, because a dotted line went from his avatar's face to a piece of equipment. This feature can make colleagues thousands of kilometers apart feel as though they're in the same space, figuring out together the best location for, say, water pipes.

In addition to the HoloLens, Aldridge's group is exploring similar industry applications for other devices, such as the Oculus Rift and HTC Vive virtual-reality headsets. They also plan to try the Playstation VR headset and Meta One AR smartglasses once those are available.

"We believe that mixed reality experiences will empower the next generation of collaboration in industry, going far beyond what today's video conferencing and screen sharing programs can provide," he says.

SUMMARY OF PAST CLASS DISCUSSION of
"How Augmented Reality is Changing the way we work"

+ See a house to maybe buy, from far away
+ Get a virtual tour of a college, from far away

- Could be used to commit crimes
- Could be used to infringe on privacy

- Could be used to interfere with real hands-on skills

+ Use to overlay schematics on broken equipment

+ Allows unskilled worker to do skilled work

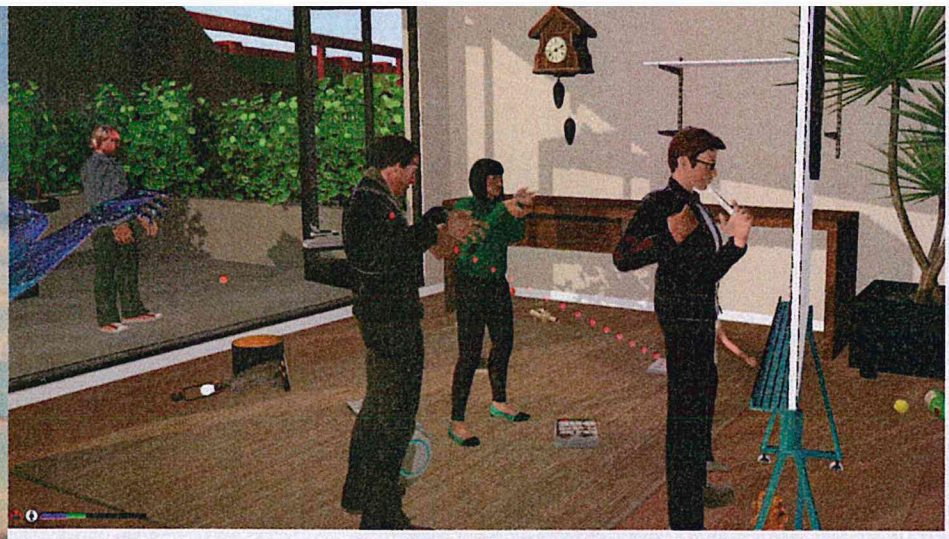
+ A network of people could work on the problem at the same time through one set of eyes in the real world
- Too many people trying to solve the problem simultaneously could be like "designing by committee" -- which is a bad thing

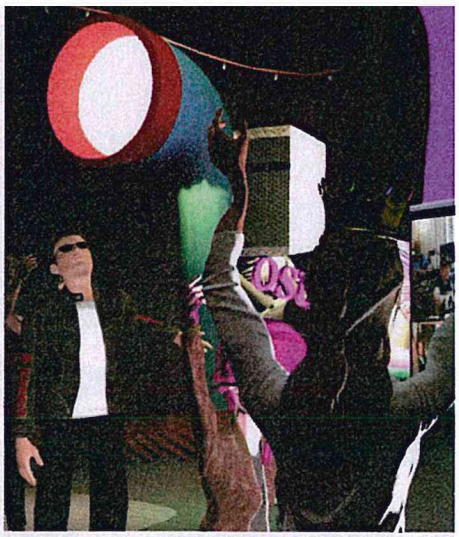
Second Life Founder's Second Act

By David Kushner

Photo-illustration by Sinelab
Original photo: Gabriela Hasbun

Virtual-reality pioneer Philip Rosedale is back with an even bigger plan





HOUSE PARTY: In High Fidelity, users build their own homes and invite friends to join them in-world or through streaming video.

Philip Rosedale, the Willy Wonka of virtual reality, is giving me a tour of his bustling office in San Francisco in August when his blue eyes sparkle with a better idea. "Let's just go in-world instead," he suggests. I follow him to a windowless back room. Waiting there for us are a large HDTV screen, a computer, a few cardboard boxes, and two small, black infrared light-emitting beacons that point down from the high corners.

We slip on our beveled, black HTC Vive headsets, and my eyes adjust to the virtual world. Instantly, I'm teleported to a large living room filled with playthings. A dart board hangs on the wall, a jukebox sits in the corner, a craps table stands beside me. Bows and arrows litter the floor. "My God, it's a mess in here," he says through my headset.

In the physical world, Rosedale is a graying 48-year-old in Converse sneakers. Here, Rosedale's avatar is an almond-eyed woman with short dark hair and blue jeans. I follow Rosedale outside by pushing a button on a controller in my hand and feel a woozy disparity between the motion in-world and my actual stasis. "We're going to fix that," Rosedale reassures me.

Rosedale relishes the surreal possibilities of life inside VR. He hands me a garden gnome and suggests we play tetherball. He uses a sword to smack the ball in my direction and urges me to whack it back with the gnome. Tossing the sword on the ground, Rosedale shows me how I can "rez"—or create—my own objects to play with by selecting them from a menu. I use my controller to click something called the Floating Space Cantina, and a huge purple gazebo crashes from the sky onto the lawn before me. "Wow, that's cool," Rosedale says, marveling at the structure. "I guess someone just made that."

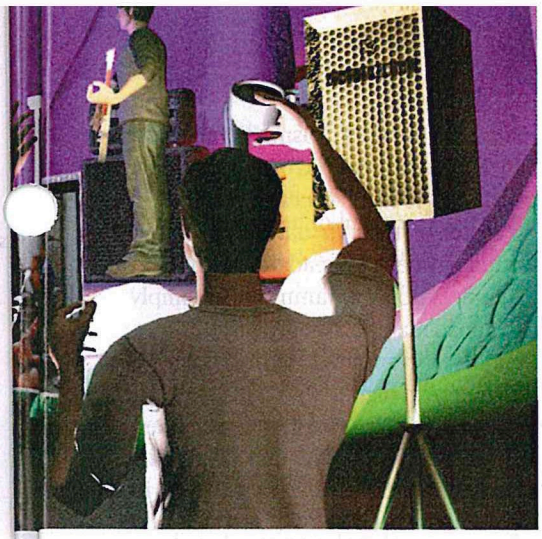
This is a beta demonstration of High Fidelity, open source software created by Rosedale's company of the same name that lets you build and deploy your own virtual world. Rosedale calls this "social VR." Most VR experiences—such as games and films—are designed for a single person. Social VR is all about sharing moments with others. The concept is an evolution of his pioneering virtual world, Second Life, which he created in 2003.

VR PRO: Serial entrepreneur Philip Rosedale fell in love with virtual reality as a teen. Now, he's obsessed with building his new social-VR company, High Fidelity.

Having seen, and monetized, the first Internet boom, Rosedale wants High Fidelity to do for VR what the World Wide Web did for the Internet: provide a new means through which people can stake out ground online. Instead of surfing to people's Web pages, you'll be teleporting to virtual worlds they're running on their own computer servers. To get from one place to the next, rather than clicking on a hyperlink, people will simply click on a 3D object or "portal." Coded using that favorite of Web programmers, JavaScript, it will connect them to another's server, allowing them to open the door of someone's castle or step into the hut of someone's tropical island. "What we believe is going to happen is the Internet all over again," he declares.

This master plan is similar to the one that inspired Second Life, which supported 1.1 million active users per month at its peak. But despite the hype, Second Life never reached mass adoption. Achieving full Internet-scale VR, Rosedale has realized, comes down to the servers.

Second Life had at least 10,000 servers around the country all run by his former company, Linden Lab. As Second Life's popularity grew, his employees became bogged down with maintenance and capacity issues. The question for High Fidelity became how to break that model and put the servers out in the wild. By distributing High Fidelity online for free, Rosedale wants to foster a do-it-yourself, interconnected community that transforms our virtual lives. "We are



closer than probably people think to having an Internet-scale set of servers that present interconnected personal spaces," he says.

Rosedale has a knack for painting utopian visions of the future. But to reach the masses, High Fidelity will need to develop far beyond quirky gnome-and-gazebo demos. His team must create sophisticated synchronization software that is also easy to use, writing code that lets people transform their laptops into VR servers while also handling the job of instantly coordinating people's actions across worlds. Ultimately, these systems must be able to scale to handle the millions whom he hopes will join him in his funky alternative universe.

Weaned on science fiction and "Star Trek," Rosedale had an early fascination with the potential of virtual worlds and tried to build his own head-mounted display in his teens. Studying physics at the University of California, San Diego, he devoted himself to solving the software challenges of VR instead. The video compression technology he coded caught the attention of RealNetworks, an early streaming company in Seattle, which bought his wares and made him its chief technology officer. But it was seeing the simulated future presented in the seminal sci-fi film *The Matrix*, in 1999, and reading the 1992 science fiction novel *Snow Crash* (which popularized the use of the term "avatar" to mean an online stand-in), that inspired Rosedale to leave Real, move to San Francisco, and make his own virtual world. "I was obsessed," he says.

In 2003, his company, Linden Lab, launched Second Life as the Net's first free-form virtual reality community. People could create their own avatars and online homes. Fueled by media buzz, Second Life attracted individuals, corporations, and governments (even the IEEE invested in a Second Life island). Users spent over US $500 million annually worth of virtual cash (in lindens), and developed their own political systems, newspapers, and in-world design firms. It was like virtual reality's pioneer town—predating the kind of activity we'd later see with large community games like *Minecraft* or *World of Warcraft*.

By 2009, however, Rosedale realized the pressure of running a $100 million company with about 200 employees was distracting him from his lifelong goal of making a truly immersive VR experience, so he resigned as CEO (though he remains a shareholder). He had seen Second Life run up against its natural limits in employee and server capacity and was eager to obliterate those limits. "How do we do the kind of thing that Second Life did so well for a million people with mice and keyboards but scale that up to a billion?" Rosedale recalls asking himself.

Part of the answer, it turns out, was to wait for virtual reality to go mainstream. Serious research into virtual reality dates back to the late 1960s, but for decades the goggles were unwieldy, the graphics too unconvincing, and the latency—the lag between making a movement and getting visual feedback on that movement—was too stomach-churning to reach the masses. But improvements in device design and new software for producing 3D objects and environments have made it a far more compelling technology. As gaming, Hollywood, the military, theme parks, and others race to cash in, Goldman Sachs predicts virtual and augmented reality (the latter differs in that it displays a layer of computer-generated graphics over a view of the real world) will become an $80 billion industry by 2025.

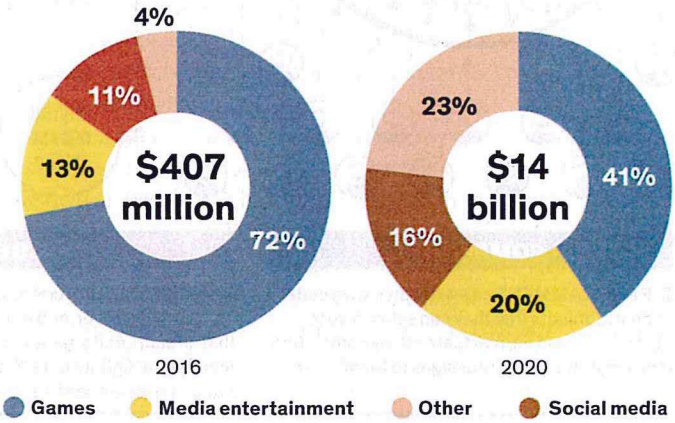
Now, Rosedale is betting his software is best positioned to make social VR a reality. And he's persuaded others of this too. In 2015, High Fidelity secured an $11 million investment from Microsoft cofounder Paul Allen. In December, Rosedale said the company has raised an additional $22 million from investors, and a total of $37 million to date.

Jaron Lanier, the pioneer who popularized the term *virtual reality*, has tried High Fidelity and hopes it can deliver the kind of shared experiences he'd always imagined. "I like the idea of networked virtual worlds a lot," he says. "I'd love to see one take off in a huge way."

In the High Fidelity office, which has the kind of geeky funhouse vibe indigenous to a San Francisco startup, a team of 25 engineers, including several recruits from Linden Lab, have been working like elves to bring Rosedale's dream to life. Scruffy coders rattle at their computers as multicolored balloons from a birthday party nudge the ceiling. A telepresence robot—a wheelie machine with an iPad affixed on top—rolls around so that the chief technology officer in Seattle can tune in.

Consumer VR Software Revenue

Technology-research firm SuperData expects the majority of revenue from consumer VR software to shift from gaming to media, social programs, and other applications by 2020.



SOURCE: SUPERDATA RESEARCH

Since 2013, when the company was founded, this team has focused largely on creating the software that provides the technology's essential structure: its distributed client-server system. This means that people can readily deploy it on their own computer servers, without having to rely on a hosting service.

Such a client-server system allows people to essentially put up anything they want–just as if they were running a Web server. High Fidelity allows people to transform their own computers into servers that can support up to 20 people at a time. To run the program, a computer needs access to a broadband connection with a speed of 10 megabits per second or higher. That's well within reach of many people in the United States, where broadband networks currently provide an average connection speed of 15.2 Mb/s (some other countries, such as Norway and South Korea, do considerably better). Over time, Rosedale thinks Internet service providers everywhere will readily offer enough bandwidth to support a massive virtual world because customer demand will be so great.

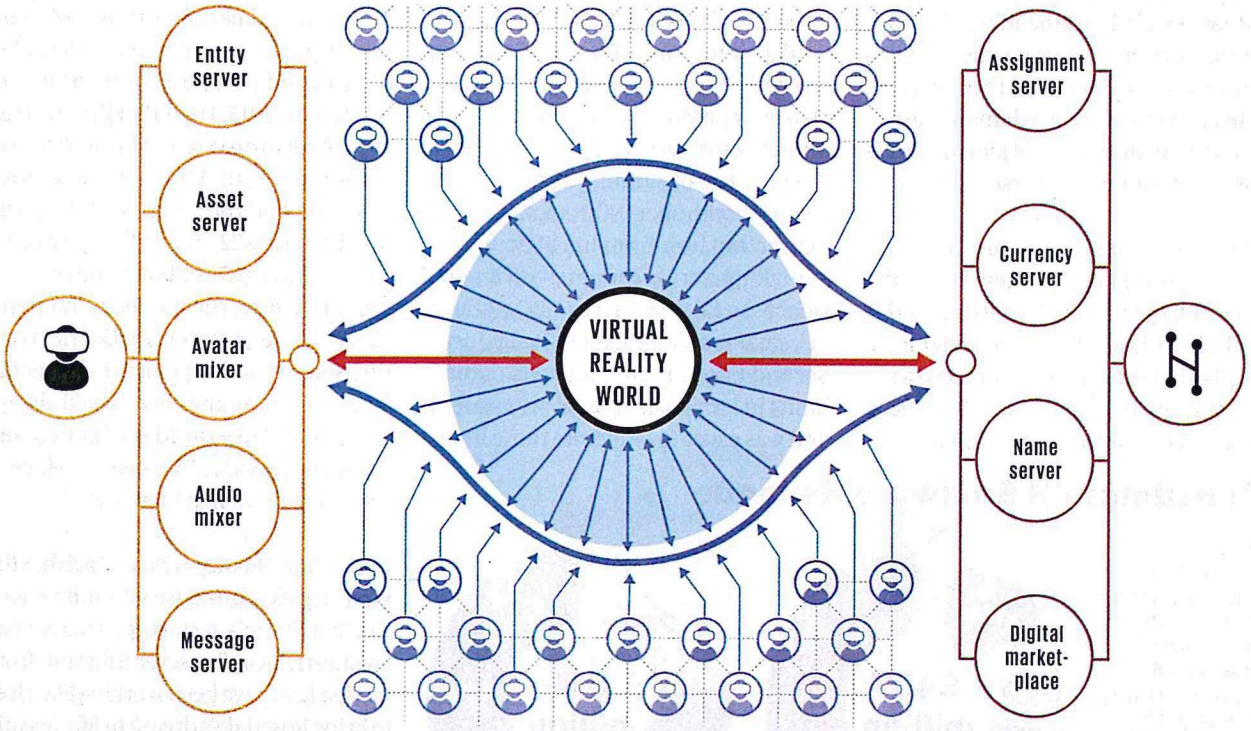
All of the content exchanged on these servers can be user generated, built on JavaScript. Users can design basic objects through graphical interfaces, or create more advanced objects and environments by writing code. Programmers wanting to tinker with the underlying High Fidelity client/server platform can do so: The platform is open source, written in the popular programming language C++, and licensed under the Apache 2.0 open source software license.

For ease of use, the High Fidelity platform supports two popular file formats called FBX and OBJ, which let people open 3D-vector graphics that were originally created in different formats. The platform will also be compatible with emerging standards like the GL Transmission Format (also known as "the JPEG of 3D") so people can quickly load 3D scenes and move models around in their virtual worlds.

Alternatively, instead of wading into 3D coding, nonprogrammers can simply download materials from a marketplace. People can even earn virtual cash by selling their own digital objects through the marketplace (High Fidelity will not take a cut of these sales). This leaves High Fidelity, the company, to make money by providing services like domain name translation, user identification, and possibly advertising to all these personal worlds.

Back in-world, Rosedale shows me how someone can drag and drop objects from the marketplace into the world. In his virtual backyard, he calls up another menu which connects us to Clara.io, a library of free 3D models. All I have to do is click on, say, a cactus, a conga, or a steam locomotive and drop it into my

High Fidelity Network Architecture



SANDBOX

1. HIGH FIDELITY users install Sandbox, a free software platform. It includes a domain server and five other servers to handle in-world elements, such as an audio mixer for 3D sounds and an entity server to track objects.

COMMUNITY

2. PROGRAMMERS can write their own code to create objects that they can sell or give to other users, and earn virtual cash by completing tasks that High Fidelity assigns to them.

HIGH FIDELITY

3. HIGH FIDELITY runs a name server, an assignment server, and a currency server that all support its many virtual worlds. It also manages a digital marketplace where users buy or sell new scenes and items.

ILLUSTRATION BY E[illegible]rielin[illegible]

world, and it's ready for use. For now, the marketplace is focused on digital objects—such as furniture and toys—but it could include textures and color palettes that people can use to build their own scenery at some point.

A key challenge here is keeping the appearance and behavior of objects consistent and synchronized among all the users visiting a given world. If a high school art teacher holds a distance learning class inside High Fidelity, students need to be able to smoothly hand each other their virtual sculptures.

To facilitate this, Rosedale's team wrote their own "synchronization engine" software. It relies on an "entity server"—a database that maintains, tracks, and manages all virtual objects, or entities. Once a person has connected, the entity server performs lookups to find out what a client is able to see based on the person's position and viewing direction. Then it sends information back to the client about which entities are in view and describes any changes as they occur. For example, if someone fires a gun, Rosedale says, the client will send a message to the entity server to request that it create a "bullet" entity at the client's location and move it along a specific path through the air.

This is something Rosedale's crew first had to tackle in Second Life but now aims to get working with a latency of under 100 milliseconds, so that the action feels smooth and cohesive. Rosedale admits High Fidelity can't guarantee such low latency across all the worlds added to its online universe, but he expects that the builders of the most popular virtual locations will use high-performance servers and network connections to minimize delays. But, as in the early days of the Internet, the results may not always be perfect. "If one server is slower, information from that space might show up more slowly," Rosedale says.

In addition to the delivery issues, High Fidelity's software must also cope with a slew of demands inherent in any virtual reality within its distributed architecture. One of the biggest challenges, Rosedale says, is creating three-dimensional audio so that noises and voices in-world sound

A STRANGE LAND: High Fidelity operates a marketplace for creators to share tools, toys, and unique avatars.

as though they are actually coming from the places where objects and people appear. To create an illusion of space—such as the sound of a ball dropping far across a room—High Fidelity employs its own patented process.

It starts with a database of thousands of standard WAV files, including, for example, the sounds of dropped balls of various sizes and shapes. An audio-mixing server measures the distance and angle of each sound relative to a person's position inside the virtual world, and then mixes it, adjusting the frequency and delay for the desired effect before sending it out to the client.

By opting to release the platform under an open source license, Rosedale let developers outside the company help engineer solutions that work for everyone. And he's not worried about competitors. "If we're successful and I'm right," he says, "it doesn't matter that it's open source because everybody's going to want to deploy a standard system because they want to interconnect to each other."

After using my garden gnome to play a xylophone in Rosedale's virtual backyard, I wander toward a side wall, where a whiteboard hangs on the bricks. Rosedale shows me how I can pick up one of the virtual markers and draw a smiley face. "This is what I like best," he tells me, through my headset, "just seeing people drawing on here."

This seems like a far cry from the guy who spent the previous decade ruling the minions of Second Life. But while Rosedale is engineering a democratic social future of VR, he's no less bombastic. By his calculations, if he can get his software on each of the billion Internet-connected machines deployed in the last four years, the virtual world—in sheer landmass—would exceed that of our actual world. "You'd have a space the size of Earth," he says, eyes widening, "so talk about high fidelity. I mean, we're going to go beyond planet Earth!"

But even though High Fidelity software is free, people will still need to buy their own headsets to join Rosedale's dream world and find enough free time to dilly-dally around inside. A $600 Oculus Rift headset, for example, also requires a high-end PC with a central processing unit equivalent to an Intel Core i5-4590 processor and a powerful graphics card. Such a PC costs $800 or more.

If we join him, though, Rosedale's convinced that we'll never look at our old planet the same way again. He thinks we'll spend most of our time immersed in VR, and drop back into reality only when we want to do things we simply can't do in-world. "When you think about the Earth in 20 years," he says, "you're going to think of it as a museum."

And, he goes on, the days of me coming out here to do this interview are numbered. "You won't have to drive here. That's nuts," he says. He motions to the screen—"You'll just be able to sit with me in there." ■

SUMMARY OF PAST CLASS DISCUSSION of
"Second Life Founders Second Act"

+ "Open Source" allows everyone to program it

+ Everyone owns a certain virtual place

+ It can be scaled to a very large community of online players because everyone is essentially running a separate server

+ Highly socially networked virtual reality

+ You can start actual real businesses for making money in the virtual reality world

+ Realistic sound created through accurately modeling the physics of sound

http://users.etown.edu/w/wunderjt/TSOJIN_ranks.pdf

Elizabethtown College Architectural Servers

TSOJIN SERVER IP:174.54.14.202

Including FYSworld for Etown College Freshmen

EARNED TSOJIN RANKS: Guest, Member Builder, Architect, Master, Admin, Grandmaster

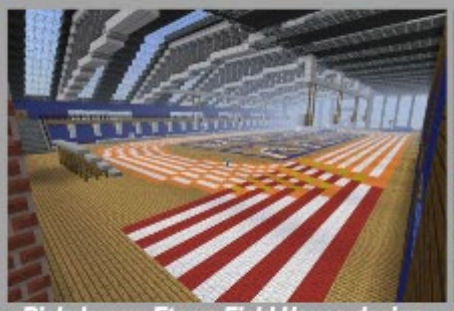
Robie House by Joseph (USA)
VIDEO

Four GREEN Towns in FYSworld
VIDEO VIDEO VIDEO VIDEO

*DigitalDesignWorld **EGR332** Digital Circuit*

RICKY STURZ SERVER IP:199.188.100.104:25575

***FYS** Team-Build of Etown Housing*
VIDEO



*Ricky's new Etown Field House design, and **FYS** Team-Build of Masters Center*
VIDEO

*RedstoneWorld **EGR332** Digital Circuit*

NEWS (2012): United Nations uses Minecraft for Sustainable Design (300 sites)

Read more here:

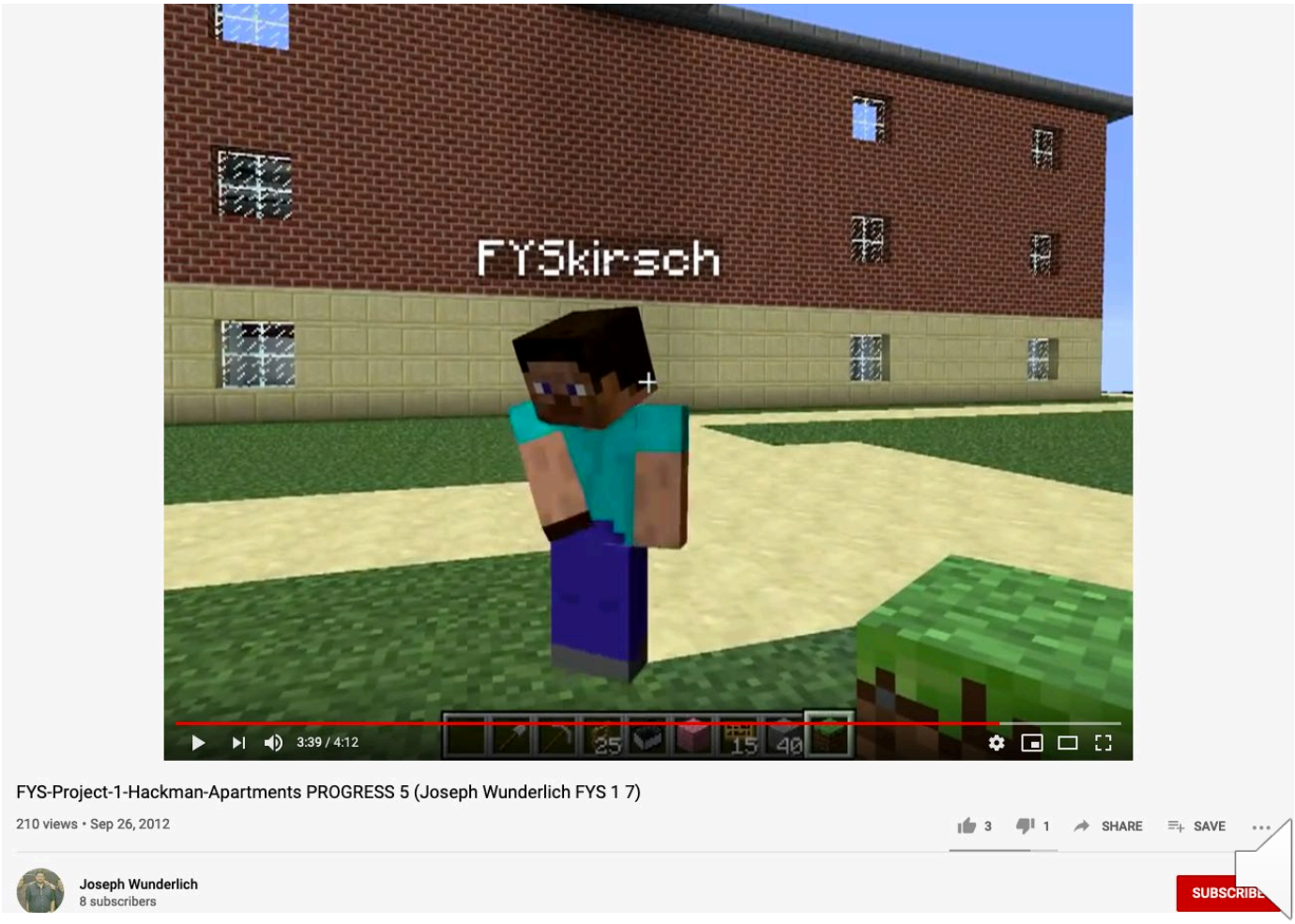
http://www.unhabitat.org/categories.asp?catid=9
http://informedinfrastructure.com/1775/un-habitat-taps-minecraft-for-urban-development/
http://www.learninggamesnetwork.org/mojang-un-block-by-block/

Also see related publications:

Wunderlich, J.T. and Wunderlich, J.J. (2014). **Crowdsourced Architecture and Environmental Design.** 2nd *International Conference on Emerging Trends in Engineering and Technology (ICETET'2014*) May 30-31, **London** (United Kingdom). **TALK PAPER**

Wunderlich, J.T. and Wunderlich, J.J. (2013). **Green architecture and environmental design using rapid-prototyping social-networking sandbox tools, followed by professional architectural software.** *Asian Conference on Sustainability, Energy & the Environment* (ACSEE 2013), June 6-9, Osaka, Japan. **[1 of 3 chosen from 250 for extended 45-minute key-note talk]** TALK PAPER

And my YouTube channel:
https://www.youtube.com/channel/UC_kM_k93zreIu40CVwuHQzg?feature=watch



AND, we now have Virtual Reality in my Elizabethtown College Robotics and Machine Intelligence Lab, which is also our Architecture studio. See more HERE