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Spatial Computing

By Mark Costlow

Last year Apple announced they would enter the market for Virtual Reality (VR) headsets with the Apple Vision Pro (AVP). The announcement included a sleek video showing off the features of their stylish device, with an eye-watering price tag of \$3,499. After taxes and accessories the real cost is over \$4,000.

Earlier this year the device began shipping, along with a promotional blitz. Early reviews are in and one might expect we would understand what the device is and whether it will succeed. But if we looked into our VR crystal ball right now, the answer would probably be, "Reply hazy, try again". Basic questions are not even fully understood yet, such as what the device really is, and what it might be good for.

VR Or AR?

The **first hint of the idea for VR** came with the discovery and understanding of Stereopsis, the way our brains combine two images into a single 3-dimensional image, in the 19th century. By the 1930s the idea was taking hold in Science Fiction in stories like **Pygmalion's Spectacles**. The first **VR Head Mounted Displays were built in the 1960s**, immersing users in a world of primitive line drawings. They did provide stereo vision of a synthetic world which moved and reacted to the user, but they were bulky and tethered to the large experimental computers of the time.

Public interest in VR ramped up in the 1990s, alongside advances in 3D computer graphics. By 2000, small cheap computers could render 3D models in real-time. In 2016 the **Oculus Rift CV1 was the first VR headset** mass-produced for consumers. The primary uses are immersive VR games and social gatherings. Facebook purchased Oculus in 2014 and has invested heavily in the idea of a shared VR environment they call the Metaverse.

Augmented Reality (AR) shares features with VR, and the terms are sometimes used interchangeably. The main difference is that VR is 100% immersive. You see the environment the glasses and headphones present, and nothing

from the outside world. By contrast, AR is an overlay which enhances and adds to your environment. Examples include the heads-up-display in a fighter jet, the speedometer reading projected on your windshield, or the **Night Sky** and **Sky Map** apps which overlay the names of stars, planets, and constellations when you point your phone camera at the sky.

Apple says the Vision Pro is not VR, and not AR. It is **Spatial Computing**.



Spatial Computing

The AVP works at the intersection of VR and AR. Unlike VR headsets that immerse users in entirely virtual environments, the AVP integrates AR, letting users interact with virtual elements superimposed on their real-world surroundings.

Rather than navigate a computer-generated virtual world, you move through the real world with digital elements added to your perception. The AVP is packed with cameras and sensors, looking forward, up and down. What you see on the two 4K displays (one for each eye) is a camera image of your surroundings. To pull off the illusion that you are looking at the real world (without causing motion sickness) requires extremely fast video processing, made possible by a new **Apple chip called the R1**. Even small delays could result in people tripping or falling down stairs. But people have shown that they can navigate the world, **even ski slopes**, without falling over.

Inside this new environment, you have the equivalent of a Macbook Pro to run apps of your choosing. You can display a virtual computer screen, which positions itself as if it were a huge flat-screen display located a few feet in front of you. You can move it around and resize it by making hand gestures. The AVP sensors watch your hands and eyeball movements to assist in these illusions.

The Killer Apps

The criticism Apple gets is that there really isn't a killer app for the the AVP in particular, and Spatial Computing in general. However,

people have discovered some things which may at least raise your eyebrows and make you wonder if there is possibly something to this.

Cooking - In [Joana Stearn's review](#) she cooked dinner while wearing the AVP. She found three things of note:

1. She could have a window open with the recipe available in her field of vision any time.

2. Kitchen timers appear as little tags you "physically" place on objects. Put one on the pasta, another on the mushrooms, and see at a glance how much time is left on each.

3. Since the AVP goggles completely cover the eyes, she was able to slice onions without crying for the first time.

Privacy in a crowd - have you ever tried to do private work or watch a movie on an airplane, and been self-conscious about your shoulder-surfing neighbors? Watching an R-rated movie seems rude, not to mention exposing people to spoilers. With AVP you can do all of that, with the equivalent of a huge-screen TV, without bothering anyone around you.

The Problems

Apple is convinced (or at least trying to convince us) that Spatial Computing is the future.

To become ubiquitous, the AVP and devices like it have to be commonplace. Right now, it is highly personalized. Owners must endure a calibration process after unboxing. It scans their face and eyes to make a digital avatar to show other people in virtual video calls. Those who wear glasses will want to take advantage of the prescription lens feature so the displays are corrected for their particular eyesight.

One reviewer noted that the first thing he wanted to do when he wore it in a meeting was [share a document with someone else](#). But he was in his own private world, and since the headset is customized he couldn't just hand someone else the goggles. Simply pointing and saying, "check this out" will require a sea change in human society. Most people will have to be wearing AR/VR headsets most of the time. It sounds far fetched right now, but how many people were carrying smartphones in 2005 compared to now?

Which brings us to the price. When you see the cutting-edge hardware and innovations in the AVP, it's clear why the price is so high. But, consumers don't care what it costs to make, only what it costs to buy. If it's too much, it's too much, and won't take off.

And then there are the physical limitations. The supplied battery is only good for 2 hours, so extended untethered use requires spare battery packs and planning. It is fairly heavy, so it can get uncomfortable after a while. There are mitigating factors, like a version of the head strap

which goes over the top of the head to provide better support, and some early users report that the extra weight becomes un-noticed after a couple weeks of use.

Will It Succeed?

Reading and watching the early reviews, it's easy to conclude the AVP is a solution looking for a problem. A very well-made useless device.

Apple must be convinced that Spatial Computing truly is the future. It's hard to agree, given the tech and infrastructure that is available right now. But the same could be said about the smartphone when the iPhone was introduced in 2007. It laid the groundwork for what followed, but the list of things that first iPhone **could not do** is interesting: No GPS, no selfie camera, no video, no 3rd-party apps. And yet, a few years later, an entirely new ecosystem of smartphone apps was powering furious innovation. Now [4 out of 5 Americans](#) carry these devices at all times.

If Spatial Computing is going to take over, it will take several years, and much more innovation. Apple has done a lot of the heavy lifting to provide the basic substrate, and now it is up to app developers to make the must-have apps that will make people want one.

Contrast the AVP rollout with Google Glass in the early 2010's, an AR headset that looked like a standard pair of glasses. It was released to developers but never declared to be out of Beta Testing or offered to the public. The AVP release is similar, in that most of the interested customers at this time (and price point) **are developers**, and Apple is courting them vigorously. But Apple is not calling this a beta device. They are treating it like an established product with a long future. That sends a signal that it is worth developers' time and effort to adopt the platform.

Another recent event sheds light on how Apple is thinking about this. They just **shut down their Apple Car project** after investing 10 years and \$10 Billion. This shows that Apple is not susceptible to the **Sunk Cost Fallacy**. They are willing to cancel a project they have invested enormous resources into if they don't think it will pay off big. The fact that they released AVP with fanfare but no killer app, instead of cancelling it, says they really believe they can reshape the world to make the AVP make sense.

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