Distracted by Virtual Reality (https://www.mindmatters.ai/podcast/ep87)

Robert J. Marks:

What's happening today with virtual reality technology? That's the topic today on Mind Matters News.

Introduction:

Welcome to Mind Matters News, where artificial and natural intelligence meet head on. Here's your host, Robert J. Marks.

Robert J. Marks:

Greetings! I recently bought an Oculus Quest VR system, and it blew me away. There's only four pieces, there's a headset, two hand units, and there's also a recharger. The experience was so real, I got shaky knees just looking down into an abyss in a Star Wars game. We've been talking to Tom Furness about that, and he said that pilots that first witnessed his virtual reality had similar sort of experiences.

Robert J. Marks:

For the Ocular Quest, the rollercoaster ride that I went on was so real, I had difficult just standing still, you just want to fall over. And the boxing was so real, both my wife and future daughter-in-law could not continue with the game because the boxing opponent looked so fierce. It's real, and it's scary stuff.

Robert J. Marks:

In the beginning of virtual reality, as we've talked in previous podcasts, in the beginning of VR, was Dr. Tom Furness, and he's our guest today on Mind Matters News. Dr. Furness has been dubbed the Grandfather of Virtual Reality because of his pioneering work in the field. Dr. Furness is a professor in the Department of Industrial and Systems Engineering in Seattle, at the University of Washington.

Robert J. Marks:

Dr. Furness, welcome back.

Thomas Furness:

Thank you, Bob. It's always good to continue the journey with you.

Robert J. Marks:

Yeah. Man, I have been learning so much about the history, this has been a lot of fun.

Robert J. Marks:

One of the things you did at the University of Washington is you founded the HIT Lab. Now, lest our listeners become concerned, this is not an organization for Murder, Incorporated.

Thomas Furness:

Although, we thought about that in the past.

Robert J. Marks:

Did you? The HIT Lab stands for the Human Interface Technology Lab, and Dr. Furness also has HIT Labs at the University of Canterbury, and the University of Tasmania. He has 27 startup companies, and two of them have capitalization of over $12 billion, and two of his companies are traded on NASDAQ.

Robert J. Marks:

We wanted to talk about that today. What's the cutting edge of virtual reality technology? What are some of these things that have come out of the HIT Lab? So Dr. Furness, I'll turn it over to you, I don't know where you want to start. I have some specific questions, but tell us some of the technology which has come out in your startup companies.

Thomas Furness:

You bet. Well certainly, what we are trying to do is embrace this whole idea of the push and the pull of technology.

Thomas Furness:

I mean, for many years, virtual reality, and augmented reality were in push mode. Basically, the whole idea, if you build it, they will come, that the technology was developing. We knew from the early days, especially the military days, it was profound, in terms of the power it had. But, what could we do to get it out of the military? To where it could be used in not only vertical markets on the outside, consumer markets, and industrial markets, but how we could solve real problems with it. So, you have the push of the technology, and you have the pull of the applications. And, how do you make these work together?

Thomas Furness:

Well, in an earlier segment, actually the first segment, we talked about that actually, VR emerged, at least from my work at it, beginning in 1966, emerged as a result of trying to solve problems in the military aviation. As a result of the process of solving those problems, we invented what we know today as virtual reality. We found, over the years, what a profound impact it has on the way people think. As I transitioned from the military to a university environment, we started looking across different domains, and how this technology might be applied.

Thomas Furness:

Now, one of the beginning things that happened was that, when I showed up in 1989, very few people knew what virtual reality was, that it existed, or what it was. So, we decided, maybe we should try to introduce a device into the consumer marketplace. And working with some of my colleagues, even before arriving in Seattle, we came up with what we called a Personal Eyewear Display. This looked like ski goggles that you would wear, and what it would be is, basically, a virtual display, a head up type display, that would display, over one eye, a virtual screen that appeared three meters away, and about one meter wide. It's sort of like a home theater system that you'd wear on your head, and it would plug into this little battery pack with a television receiver hooked around your waist.

Thomas Furness:

And we started working on this, and a patent was issued in the early '90s, and we started a company called Virtual Vision, to make these. And, indeed we did, and raised a bunch of money, and started building these devices. So this was a really simple display in that we just took a liquid crystal screen, that was rear illuminated, and then we projected down to a prism that you would look through, and you'd see this virtual image. But, you'd also see the outside world around it. So it didn't replace the outside world, it was just a small piece that you saw, [inaudible 00:06:05], or again, appeared out in the outside world. So, you could sit on Waikiki Beach and watch the NFL playoffs, if you wanted to, with this device with broadcast television.

Thomas Furness:

So we introduced this, actually the first opening of this product, we took it to the Consumer Electronics Show, and people were lined up for two hours to see this thing. They'd take a look at it ...

Robert J. Marks:

What year was this, roughly?

Thomas Furness:

This was in '94, '95 time period.

Robert J. Marks:

Okay.

Thomas Furness:

They would say, "Oh gosh, this is amazing. This is transformative, you guys are going to make a fortune." And we started saying to ourselves, "We're going to make a fortune." We started believing our press.

Robert J. Marks:

That can be very dangerous, as you know.

Thomas Furness:

It can be dangerous, that's right.

Robert J. Marks:

Yes, it can.

Thomas Furness:

We ramped up, we're producing these things, and they appeared in the marketplace. We had a big advertisement in the New York Times, and all this.

Thomas Furness:

Indeed, people would show up, and line up outside of Magnolia Hi-Fi, which was the first place where we introduced it. We had the network television people were there, and the big introduction. People would go in, put it on and say, "Wow, this is really neat, I want one of these things," and they looked at the price tag.

Robert J. Marks:

Oh.

Thomas Furness:

It was $799. That was back in '95, this was '94. That was a pretty steep bill. By the way, we weren't making any money at that price point. But, the technology was still pretty archaic, at that time.

Thomas Furness:

So what happened was that people didn't buy them. They wanted to buy them, but it would just cost too much. We were disappointed in that, but then we started seeing there was one market segment that was buying these things like crazy. We said, "Hm, what's going on here?" We tracked it down, and there were dentists, dentists were buying this Virtual Vision display. And we went and visited it dentists and saying, "What's going on?" And they showed us.

Thomas Furness:

What they were doing is they were giving these to their patients, so the patients would put them on, they would select a movie, plug it in the VCR, play this into the headset. And there they were in the dentist chair, and they were watching this video, or this movie, while the dentists were inflicting pain on them. The dentists said, "The patients love it. And we love it, because they don't complain any more, they're watching this movie, they're zoned out in their own space." They said, "However, it is creating another problem. Now, we can't get them to leave." You know, I can't leave now, this is the good part.

Robert J. Marks:

They didn't finish the movie, of course.

Thomas Furness:

That's right. But, even more remarkable than that, was the children. They would have these small kids in, and they'd hook this up to Nintendo. So, here the kids were playing Nintendo with his headset on, with a virtual headset on, and sitting in the dentist chair while the dentists were doing their thing. Usually, the kids are terrified, and they don't want to be there. So these kids loved it, and they'd go home and talk to their mothers. "Mommy, when can I go back to the dentist again, so I can see this special glasses?" So when did that ever happen, when did kids ever say they want to go back to the dentist?

Thomas Furness:

But, the dentists were saying, "You know, it seems like they don't notice the pain, when there is some, because they're distracted." We're saying, "Hm, that's interesting." Then, we contacted some of our colleagues at Seattle Children's Hospital, to see if this pain thing really was relevant, especially with leukemia patients. These little patients are really sick, and the way that you determine the efficacy of the treatment, which is basically chemotherapy, they would have to extract bone marrow, and look at what was going on with the white count in the blood marrow. This is a really painful procedure, you put a needle in the hip and extra the bone marrow, and children would just scream, it's so painful. They're so sick, you can't anesthetize them, this is what was happening.

Thomas Furness:

We went into the hospital with our equipment. Again, it was connected with Nintendo, and these kids would be going through this procedure, but they're playing Nintendo at the time. The doctor would put the needle in, and the kid would say, "Ugh," or something like that, and just continue to play the game. The nurses and doctors were looking at each other saying, "What's going on here?" It's like they didn't even notice it. That set us on a whole different track, of what we were doing with these virtual displays. We said, "Wow."

Thomas Furness:

What's happening is, in order to experience pain, you have to be conscious of pain. But, if you're doing something else that is engaging, then you don't notice it. So we went to the Harborview Burn Center, this is one of the regional burn clinics where these patients are severely burned, and they are doped up with morphine most of the time. So the morphine can control the so-called rest pain, when you're just lying in the bed in semi-agony, but the morphine can control that. But, morphine isn't good, it's toxic, it's addictive, it's pretty bad stuff.

Thomas Furness:

When they went in for wound care, to remove staples from skin grafts, or to do physical therapy, or they would soak the patients in these tubs of water and then slough off the dead skin, any time that happened, the pain would shoot through the roof. You couldn't dose them with enough morphine because it's what's called breakthrough pain, it would break right through that. So, we started introducing VR to the burn clinic.

Thomas Furness:

The patients, again, would put on a headset, and we built a virtual world where they would be flying, basically, in snow. They would be in this snow canyon, and there'd be snowmen throwing snowballs at them, when they're flying through this canyon, and they would throw snowballs back at the snowmen. This was all going on, during the time that they were receiving this treatment. Then, we'd ask them for a pain index. Often, what would happen is the patient would say, "Well, when are you going to start?"

Robert J. Marks:

Really?

Thomas Furness:

When, in fact, you'd finished the procedure.

Robert J. Marks:

What is the pain index, is that where they ask you, tell me on a scale of one to 10, what the pain's like?

Thomas Furness:

Yes.

Robert J. Marks:

I see, okay.

Thomas Furness:

This is a well-established pain scale, and they talk about what do you feel, when you're at this particular number. Usually, with breakthrough pain, it's just off the scale. Rest pain is maybe two or three. But then, when they're in VR, the pain went from 10 to zero. Then we ask them the unpleasantness of the pain, the feeling of presence in it, all these kinds of things. We thought, this is amazing, but it'll only work once. You know, you put them in this world, after they get used to it, it's not going to work. We were wrong, exactly the opposite. It gets better with time, as they get it.

Thomas Furness:

Furthermore, they remember being in that world. We're now finding out that's a big factor in chronic pain. These other things were acute pain, during wound care. But in chronic pain, rheumatoid arthritis, things like that, it even works there because of the model that people build in their head. So what this did, this early work, is it set us off on an altogether different track of an application for VR.

Thomas Furness:

Now, VR is being used worldwide in hospitals, not only for treating things like burn pain, or acute pain, but also in pediatric clinics. We're actually using it, we have a project with the Make A Wish Foundation, where we're actually making wishes for these kids who are terminally ill, to help them with giving them something to do in VR. So, the impact on medicine, just from the pain standpoint, is huge. Not to mention the diagnostics, the simulator training, and things like that.

Thomas Furness:

So in my HIT Lab, we had a major project going on in looking at medical applications of VR, including the pain work. Also, for surgery simulation, to train surgeons. Amazing what happens there, in a case of, for example, urology, where there is going to be a procedure called the transurethral re-sectioning of the prostate. That's when you go in and carve away part of the prostate that's restricting the urine flow, and urethra.

Robert J. Marks:

Ah.

Thomas Furness:

This is a painful process, it can be a painful process, and you don't want to mess it up because that can change your will to live, you know what I mean.

Thomas Furness:

What would happen is the doctors that are learning, the residents, they only have a limited amount of time to practice this procedure. Over a period of a three year residency, they can only maybe do a total of maybe 30 or 40 procedures, on real patients. Of course, most of these patients are going to be normal, nothing unusual happens. But, with our simulator that we built, in conjunction with UW Medical Center, University of Washington Medical Center, these residents can do 50 procedures a day. And, with all kinds of variations.

Robert J. Marks:

Wow.

Thomas Furness:

With things that would happen, with bleeders, and things like that. What it is is flight simulating, it's like the pilots train, we've having the surgeons train the same way. This has been done sinus surgery simulation, with suturing simulation, training medical students, so this is a boon for training, especially medical training. So, here again, as we have an application pull that's come from this.

Robert J. Marks:

Well, you can see from your illustration the need for this cross curricular sort of approach to things.

Thomas Furness:

Yes.

Robert J. Marks:

You need the psychology, the medicine, you need the art, you need cultural anthropology, you need all of these different disciplines because they all contribute.

Thomas Furness:

That's right. You know, no single discipline owns virtual reality because it cuts across. It is, basically, it's all aspects of building tools for humans to work in the world, just like everybody uses wheels.

Robert J. Marks:

Yeah.

Thomas Furness:

It's that kind of thing, it's a ubiquitous kind of technology.

Thomas Furness:

Now, to jump around a little bit, certainly we were working on these applications, but again, we had to get the technology to keep up with the need. Up to this point in time, we were building displays that started off with some kind of image plane, or what we call an object plane. Where an image was formed, and then we relayed that image to the eye, some way. But, you had to start off with this object plane, so it was a little screen, in case of, for example, the Virtual Vision display I just mentioned, a very small screen. Then, you magnify, and you project it so it appears to be a big screen.

Thomas Furness:

But, the problem is you're really limited in how many picture elements you can put in that small screen.

Robert J. Marks:

Yes.

Thomas Furness:

And, especially at high luminance. So there had to be a change in the way we did it, so this is where we got into this whole idea of why are we having to start off with an object plan to begin with. Why don't we scan the image directly on the retina of the eye?

Thomas Furness:

So we started working on this concept of a virtual retinal display, where you start off with a coherent beam of light from a micro laser, very low energy laser. And then, you scan it such that the screen is the retina of the eye, that's the only place where an image exists, is by scanning the photons across the surface of the retina. Very low energy, as a matter of fact, it's lower energy than what you get outside, than when you walk out in daylight. What you now see is an image that doesn't exist, and is very high resolution, very wide field of view, high luminous. As a matter of fact, as high luminous as you want it to be. And, you could probably run the thing with a hearing aid battery. So this direct retinal projection was transformative.

Robert J. Marks:

You know, the biggest objection I hear today about virtual reality is the clunky headsets. This is an answer to that, isn't it?

Thomas Furness:

It is. It is, indeed.

Thomas Furness:

So what we did with this, at the time we patented this, and we had several patents. We had a company that wanted to license it, and that company was MicroVision. And MicroVision licenses it from the university. At the time, it was largest license deal the University of Washington had ever done. It was a huge license, I think it was $5.133 million, a 9% equity in the company, 2.5% royalty stream, with a minimum that was promised. MicroVision started making these things, and then they went public, and turned the university stock into something that was really worth a lot.

Thomas Furness:

Now, they still exist, and they're one of the companies traded on NASDAQ.

Robert J. Marks:

I see. Where can I get one of these? I want to get rid of my clunky headset.

Thomas Furness:

Well, that's the thing. Right now, you can't get it, because it's not being used ... It was being used by the military for a while, and now that engine is being used for head up displays in cars because it can have such high luminance. But, it is certainly the wave of the future.

Thomas Furness:

Now, the company Magic Leap started out using this concept, the technology. Actually, a variation of it was done by the Google Glass. So it will come again, into the world, because it's got to be the way to go in terms of getting rid of the clunky headset.

Robert J. Marks:

Well, let me ask you about Google Glass. I think that they went away, I don't hear much about them anymore. But, they probably had something to do with your ski goggles, and your virtual retinal display. Or, did they?

Thomas Furness:

Well, they were related, and it was very small field of view. Of course, the problem with the Google Glass was the technology worked. It worked, and it worked pretty well. The problem was the social aspect of it, no one really realized what that was going to do. When you're talking to a person and they have this Google Glass on, you don't know if they're paying attention to you, or they're paying attention to what's being displayed in the Google Glass. People started, "Are you taking pictures of me? Are you taking images of me?" Which it could do, by the way. So that was something they never really did get into, at the time.

Thomas Furness:

Now, Google Glass has a resurgence, and again, better designs. But it's now being used in vertical markets. These are where people absolutely have to have this, in order to do their job, so that's different. That's an all different marketplace than where Google originally introduced this.

Robert J. Marks:

I see.

Thomas Furness:

So there is a big deal about, now that you're wearing these glasses, and these glasses display information, and you're now interacting with another human being, and they know that you're wearing these glasses, but they don't know what you're seeing. Are they somehow psychoanalyzing you, while they're looking at you? You just don't know.

Robert J. Marks:

You know, I feel that way, Tom, when I talk to a psychologist. No, a professor in psychology, I talk to him and I think, is he analyzing me? Same thing, I guess.

Thomas Furness:

Yeah. Well, I get that with my wife, any time I talk to her.

Robert J. Marks:

Yeah, ditto. Yeah, ditto. Yeah, yeah.

Thomas Furness:

Anyhow, the virtual retinal display became one of our mainstream devices that we were working on in the lab, developing the technology. We had this big project, funded by MicroVision. But, here's what happened.

Thomas Furness:

We had one of our lab units, bench top units, optical bench unit, where we were displaying this image that's on your retina. So we'd have people who'd come in could see it, and see how it works. There's one guy that came in, a gentleman who was actually on the board of directors of the Washington Technology Center. He said, "I've been hearing about this virtual retinal display. What I'd like to do is see it operating." We said, "Okay. Come down to the lab, and we'll do that."

Thomas Furness:

So at the time, we were using acoustical optical modulators in order to do scanning, and this was a monochrome display. Monocular display, but the image was painted with high resolution on your retina. And, it was remarkable. But, it was just one eye.

Robert J. Marks:

Oh.

Thomas Furness:

So, we invited him down the lab, we were just using one eye at the time, this was a monocular system and optical bench. He came down to the lab, and he sat down in front of the optical bench, and looked into our objective lens of this. And, sure enough, saw this virtual image. He said, "Wow, this is really amazing, and really high resolution, high luminance." We said, "Yeah, well take off your spectacles." He took off his spectacles, and he said, "Well, I can see it just as clearly without my spectacles." We said, "Yeah, we're not really using the optical power of your glasses, or the lens of your eye. Basically, we're writing almost directly on the retina."

Robert J. Marks:

Wow. But, wouldn't you still have to take into account whether the person was nearsighted or farsighted?

Thomas Furness:

No.

Robert J. Marks:

That doesn't ... Wow, okay.

Thomas Furness:

It doesn't matter, it doesn't matter. So, it's clear, the image is just as clear because you basically have a beam, a non-diverging beam of light that's collimated, and it goes right to the retina.

Thomas Furness:

So he was seeing this, clearly, as we do, all the other people that have been working with the virtual retinal display. But then, he did something else. He then switched to his left eye, and started looking with his left eye into this, just on his own. And his mouth dropped open, and he said, "Wait a minute, what are you doing here?" We said, "Well, what do you mean?" He says, "I can see this with my blind eye." We said, "What?"

Thomas Furness:

He says, "I'm blind in my left eye, and I can see that image." We said, "What?" He said, "Yeah, I've been in an automobile accident, and it blinded my eye because there was all the scar tissue in my eye. And, I'm seeing this image." We said, "Oh yeah?"

Thomas Furness:

After that, we went to the Department of Ophthalmology at the University, in the medical school and said, "This is what happened." They started sending us patients. Sure enough, these patients that especially had optical problems in their eyes, were able to see with the virtual retinal display. Then, we started finding out that people even with degenerative diseases of the retina were able to see better, with age related macular degeneration. And even when they thought the receptors were dead, we were getting light into those receptors.

Robert J. Marks:

Oh my goodness.

Thomas Furness:

Then we found out later, is the fact that we're using coherent light, the receptors act like waveguides. The coupling efficiency of our coherent light, which is much greater than what you could get from broadband light, non-coherent light, so they were actually seeing.

Thomas Furness:

What this did, again by accident, just like the dentists, it just took us off in another direction where we started work on low vision, and low vision aids. We wrote up a proposal, and got some money from the National Science Foundation, to work on this.

Thomas Furness:

So it's one of these journeys I've taken, and this has been true all the way through, where you stumble over something. That you were going in another direction, but you stumble on something, and that became more interesting than the direction you were taking initially.

Robert J. Marks:

Well, that is amazing and exciting stuff. I can actually see how coherent light could actually go down the waveguides that you mentioned, whereas broadband light wouldn't be able to do that, so that's what happened. Yeah, how about that?

Robert J. Marks:

Well Tom, I want to have you back for one more podcast, we want to talk about things like the RAT Lab, and its relationship to skunkworks.

Thomas Furness:

Right.

Robert J. Marks:

Because they're both about deplorable animals ... no, the RAT Lab means Rocket and Thinking.

Thomas Furness:

That's right.

Robert J. Marks:

It's one of Dr. Furness' incubators for virtual reality business, talk about the Virtual World Society, the AAR Toolworks, Incorporated. I want to talk about your other NASDAQ company, and then see what you have in mind for the future of VR.

Thomas Furness:

Okay.

Robert J. Marks:

So we'll do that next, on Mind Matters News. We've been talking to Dr. Tom Furness at the University of Washington, the Grandfather of Virtual Reality, who continues to be an innovator in the field of virtual reality, as we've heard today.

Robert J. Marks:

So until next time, be of good cheer.

Conclusion:

This has been Mind Matters News, with your host, Robert J. Marks. Explore more at mindmatters.ai. That's mindmatters.ai. Mind Matters News is directed and edited by Austin Egbert.