Co-creation and Risk-Taking—In Pursuit of New Technology for Human Augmentation

An Interview with Pranav Mistry

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Marc Langheinrich and Nigel Davies interview Pranav Mistry, Global Senior Vice President of Research at Samsung, about his views on the field of human augmentation.

Creating new technology for augmenting humans represents a major challenge to both industry and academia. To explore how the field has developed over recent years, as well as discuss future trends, we sat down with Pranav Mistry, Global Senior Vice President of Research at Samsung and director of its "Think Tank Team," an interdisciplinary group that aims to create Samsung's "products of tomorrow." Examples of Pranav's work include visionary contributions such as the SixthSense device—a wearable gesture interface that is the subject of one of the most watched TED talks of all time—as well as commercial successes such as Samsung's smartwatch, the Samsung Gear. The idea of augmenting humans has been at the center of Pranav's work for many years, so we were excited when we got the chance to interview him for this special issue.

Looking back to 2008 when you started to work on SixthSense, how do you think the field of "augmenting humans" has changed?

A couple of things have changed since the early days of research into human augmentation.

First, at that time, academia and industry had very different ideas. In academia, many of us were thinking about the idea of augmenting humans, while in industry this wasn't much of a topic at all. When I look at the field today, industry and academia are moving in the same direction, looking at the same problems—both are thinking much more about bringing human augmentation to the mass market.

The second thing that has happened since 2008 is that, because of the new form factors of computing, everyday users have started accepting the possibility of human augmentation. Of course, for many years, maybe even several hundred years, we've been "augmenting" ourselves with simple things, like reading glasses or a watch. I remember that during my school years I used to wear a Casio watch that allowed me to store my phone numbers on my wrist. Nowadays, not only geeks like me and you do this. "Regular" people also think that in the future "I might live like that" or "I might wear that kind of device," or even "I might directly connect to computers using my brain."

This new trend of accepting human augmentation isn't actually coming from either academia or industry; it's coming from the media, from science fiction movies and stories. And that's helpful for all of us, because unless some people accept the fact that it's okay to add something to their bodies, to their cognition, there won't be support for computers augmenting our memories, or our intelligence, or our reasoning.

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Back in 2008, several companies and small startups were doing something similar to what we're doing right now—creating this world of augmented reality (AR) and virtual reality (VR), and new kinds of augmentation technologies. But the investment industry wasn't taking them seriously at all. Now, the situation is flipped upside-down—if someone comes up with a completely different augmentation technology, even if it has nothing to do with currently accepted technology, investors will support it, thinking there might be a market for it in the future. From a technologist's perspective, acceptance of novel augmentation technology as a potential big thing is a huge and positive change.

Google Glass attracted quite a lot of negative press in the past. Do you think this was because of something inherent in the technology or would the reaction be different today?

I would say that a fair debate is needed, at the individual as well as the societal level, on what's right or wrong with any new technology. This debate is probably going to emerge as a result of trial and error. I don't think a social scientist or psychologist can simply declare that people should or not should not accept the technology. Take, for example, self-driving cars: it seems that, perhaps due to their depiction in sci-fi movies, people already accept this technology. But is the technology safe? Is it for everyone? You can't have an informed debate until there are enough self-driving cars on the road.

I wouldn't say Google Glass was a failed technology; it was a necessary intermediate step that allowed the public to understand how such technology works and could fit into their lives. People often react negatively to a new technology but slowly come to accept it as they see its benefits. When we started research on Samsung VR and told users to insert their phone into the headset and put it in front of their eyes, their initial reaction was "Are you crazy? What are you talking about?" In time, people recognized its value for entertainment and other kinds of applications. And, of course, how a technology will play out in the market isn't exactly what industry expects. VR is becoming less of a virtual reality experience and more of an "other reality" experience in which people want to be transported to another place, such as the other side of the world. Technology changes the perspective of both the user and the maker, and a period is needed to assess those changes.

Has technology in the human augmentation space evolved as you foresaw when you were doing your PhD?

Some aspects of technology have seen much faster progress than I expected, while others have been much slower. In particular, I thought software development would be well behind hardware development, but it has been the other way around because today there are a lot more experts on machine learning, AI, and computer vision algorithms. With respect to hardware miniaturization, there isn't much difference between what we used nine years ago and what we're using today. The Galaxy phone I have now is similar in size to the one I had in 2008. Hardware hasn't changed as drastically as I anticipated.

I think there are a couple of reasons for this. One is that, when thinking about future hardware, we quickly forget about the fundamental limits of physics, which play a crucial role in the hardware field. Another is that the emergence of the cloud has enabled software development to accelerate. Although we didn't know it a decade ago, the infrastructure needed for future applications was being prepared.

Right now, if you wanted to make a memory or visual augmentation system, hardware is the limiting factor. We can explore different software solutions—a better UX or maybe a contextual interface—but physical silicon is harder to change. You can't do trial and error with hardware as much as you can with software.

Would it be fair to say that it's been a long time since we've seen hardware in the human augmentation space that's really been transformative?

Yes, I think so. It takes time to develop hardware—there are many steps—but the good news is that pipelines are in place from the labs to end users. While hardware is still the limiting factor, we can bring innovations to the market today much faster than we would have been able to, say, five years ago. Industry has accepted the first step in this pipeline—that this technology has mass market potential—so we can now develop a market strategy much more quickly. Also, it's not just about the computing or electronics industries anymore; the automotive industry is talking about more cameras and sensors, the fashion industry is exploring new kinds of smart accessories and smart garments, and so on. And that's what's so exciting: the everyday world is starting to get augmented.

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So while the hardware side will continue to innovate, the rate of progress will be somewhat bounded compared to the software side?

Yes, definitely. Even now, software improvements are defining what new hardware improvements are needed because the software side is much further advanced. For example, Apple, Google, Microsoft, and the like are building chips just for machine learning or computer vision; that wasn't the case several years ago. The big industry players have already started thinking about the coming new world of human and digital augmentation and they want to be prepared. In the early years of computing, hardware defined the software, which in turn defined the user experience. Today, popular culture like sci-fi movies and games is defining new user experiences, which we're implementing in software; we then create custom hardware to enable this software-defined vision.

Earlier you mentioned application areas for augmenting humans, such as memory or vision augmentation. Do you see a "killer app" in this space?

My thinking is that, as been the case with many new things, consumers will readily accept augmentation applications in a noncritical area like gaming. Industry, on the other hand, is always a bit more skeptical about new technology, and hence about which particular area to explore. For example, Microsoft's HoloLens or Google Glass are finding a home in niche B2B industry applications because it's a much more controlled environment. Even at the device level, we can see

this exploration at work. For example, my Galaxy phone has Bixby Voice and Bixby Vision, but my primary method of communicating with my phone is still the touchscreen because it understands what I want 100 percent of the time. Soon, however, I might not need to tap on the screen anymore, and that's awesome. I believe this will happen with augmentation technology as well: new technology will coexist with traditional technology until users feel comfortable with it, and then they'll make the switch.

So I believe the proving grounds for human augmentation technology will be either noncritical areas such as entertainment or very controlled environments in critical areas such as business, where the technology does limited things but does them perfectly. Enterprise applications are especially promising for exploring augmentation technology because this world isn't fully open. At the consumer level, the technology initially will mostly be for fun. Take AR: most people use it to augment photos on sites like Facebook to, say, put a cat on their head or to add virtual sunglasses or a smiley face.

So if we start out with "fun" things first, what do you think this will morph into?

When we started working on Gear VR, we thought it was all going to be about *virtual* experiences such as immersive gaming or exploring imaginary worlds. We didn't know which particular aspect of the technology was going to be most important to users. We found out that what people wanted more than anything else was to use the device to "teleport" to another part of the *real* world. For us that revelation opened up an entire ecosystem of new devices and 360-degree cameras to explore, and new research goals like the network capabilities to support streaming high-definition live video. Now when we introduce a technology we tell users that it can do this, this, and this, but we leave it up to them to decide what they would like to do the most and then follow their lead.

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Let me tell you an interesting story. A couple of years ago, I was in a restaurant and at a table next to me was a group of young teenagers all using their smartphones' heart rate monitor. Such an app is targeted at older users, so out of curiosity I asked what they were doing, and they said they were playing a game in which the person with the highest heart rate had to pay the bill. These teens had thus taken something created for a serious use case and repurposed it for something fun instead, and in so doing were extending the application spectrum of this kind of technology. As this story shows, it's impossible to guess all the uses people will make of the things we create.

At Samsung, we always say that we listen to our customers—we listen to what they want, we create a new technology, we listen to the response and change the technology, and so on until we get it right. This is essentially a customized process for designing the future. When Ford launched the Model T, there was one model and it was only available in black—everyone had the same car. That doesn't work anymore: today people want devices that adapt to *their* needs. And that's how it should be, since our needs are different. My father is an architect; his memory or visual augmentation needs are completely different from mine. Even if everyone eventually uses augmentation technologies like they use smartphones today, it's unlikely they'll be "augmented" the same way.

I thus see a future with a proliferation of customized augmentation technologies. One person might have an app to help remember names or phone numbers, while another might use one to help translate Chinese to Japanese during trips to Japan. At the same time, creating a technology that can satisfy the diverse needs of millions of customers at an efficient production scale of billions of units is a huge challenge.

I should mention that a friend of mine in academia is interested in personalized artificial intelligence. His idea of AI isn't a single "Watson" that serves everyone equally. Instead, your personal assistant grows with you, has the same social and cultural experiences, and shapes itself in line with your personality. I believe the same "one size doesn't fit all" notion equally applies to human augmentation. It also has interesting implications: virtual agents with their own personality might have problems communicating with each other or different users, leading to all sorts of misunderstandings!

Could you talk a little bit about your own current research, and that of Samsung as well, in trying to realize this vision?

Samsung, at its core, used to be a hardware-heavy company: we understand silicon much better than anyone else in the world. And as I mentioned before, it takes time to grow silicon—it's like a tree; it doesn't grow overnight. It takes a lot more time to develop a chip than to convert an algorithm into running software. If software doesn't behave properly, you can change some lines of the code, but if hardware has an issue, you have to rebuild it. And then there are the physical limits of the atoms compared to the bits. Samsung's research focus is "being ready for the future." It sounds simple, but it's hard because no one knows where we're heading and so we have to make some big bets in the R&D area. Some of my work focuses on thinking about the future and what its silicon requirements might be so that we don't lag behind the software industry and what consumers want.

Earlier in this interview I talked about how, as a first step, we have to "test the waters" in the real world—you can't just skip straight to wide-scale deployment of augmentation technology. That step one is also my focus: to see if and how society accepts a new technology like Google Glass and what kinds of problems they have with it in terms of privacy, security, or just how it looks or feels. So, personally, my research extends across the entire development spectrum because we have to take risks in this industry to move forward. We're like a startup: notice that Samsung is among the first to try out new technologies on the market, from curved screens to VR to 360-degree cameras.

Throughout our discussion has been this thread that software is moving very quickly—much more quickly than any of us predicted. Hardware moves more slowly, and because of that, and because you want the silicon to be in place to support new software, you must maintain a long-term perspective. As part of that process, you've got to put stuff out there and see what sticks. Is that a fair summary?

In one way, yes. However, the last point is really is about co-creating the future with our users; it's not just a matter of putting something on the market and seeing how it goes. No matter how good an initial product is, it isn't perfect; it's not "tomorrow" yet, but we're almost there—a minute to midnight. That's what drives Samsung: let's find out what works and what doesn't, and then let's make it better.

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So it's important to do co-creation and co-design early?

Absolutely.

Finally, when it comes to taking risks, what would you like to see from academia?

At the start of this interview I said that academia and industry are moving in the same direction, and this is both good and bad. On one hand, industry and academia can benefit a lot by collaborating and sharing a common perspective. On the other hand, we might overlook something interesting that might have been.

Academics have more freedom to explore; they should go wild and try out new things! We're seeing fewer contributions from academics and more from industry. There was a time when new ideas about technology mostly originated in academia, but now the situation is almost reversed, with industry saying, "We have this technology—can you academics do something with it?" I feel academia should again become a little bit more dominant in telling industry where they see the future going. The key challenges academics can focus on, which is harder in industry, are those we discussed before: testing people's experience, what works and what doesn't; seeing, even in a small way, what users like and what they don't; understanding what people expect the new world to be like.

Ultimately, industry and academia must work together to solve the bigger societal problems, not just technical issues related to software and hardware. Because the main question about augmenting humans is not about what we *can* do but what we *should* do, which will ultimately determine whether the technology succeeds or fails. It's this moral aspect in which academia needs to play a major role.

So it sounds like a call to arms for the world's philosophers and ethnographers?

I think so, because they're critical to realizing this vision.

Thanks a lot, Pranav, for taking time out of your busy schedule to speak with us.

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