# "Why Did I Say, 'Yes' to Writing This Bimonthly Column?"

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*The "Games" column is a new bimonthly column in* Computer. *The focus of this column is on new technology in and around the development of games.*

**W**elcome to the "Games" column, a bimonthly column about topics in the games industry. Now I am primarily a tech person. I like the new electronics, new software, and new ideas that get us technology for the games of the future, so this column is going to be about that. We're going to try and get it written every other month to meet the publishing schedule of *Computer*.

I have a couple of ideas planned for this column and will let you know what I'm thinking about with respect to the future of games technology. If you have anything to say about these issues or the topics I'm planning to cover, send me an email or contact me on Facebook or LinkedIn. It's okay to tell me "Here's something you don't know about," because the world is big, the games industry is huge, and all the technology ideas people are thinking about in their basements and in their labs are perhaps secret, but maybe they want to give us a hint at what the future holds.

## TOPICS

The first topic that comes to mind is where does R&D for the games industry happen? In the games industry, game studios do the big "D" for development, but they do not do much in the way of "R" for research. Research tends to come from what's done inside universities, and what's done inside those university walls is stove-piped and guarded like Fort Knox, meaning that individual departments, for the most part, stick to what they know and rarely step into the realm of cross disciplinary. Once you get past all those

walls, what does get built in a university is a prototype, usually a prototype without an attached business plan or plan for scaling, hopefully with a filed or issued patent. It is something that is far from being a delivered technology, let alone something to be deployed in a commercial game.

A middle-ground type of organization or laboratory where those ideas can be built out in a more advanced prototype is required. We need a laboratory that knows how to build games, that can take these new developed technologies and put them into play in an online game. What I have in mind is something kind of like Google Research (Kernel) for the games technology industry.

Currently, there are no labs focused on the totality of the future of technology for games, meaning *the building out games to test/try out new technologies.* There ought to be a university that has a big program for this, that has donations from every major game company in the world to build and test out the research for the future of games. Right now, there is not.

Right now, our research model in the United States is distributed and it tends to be small projects. So the way I always think about this is, the computer science field itself was originally founded on a lot of DARPA money and DARPA would say, "We want to know something about distributed computing," and they would give US$5 million a year to several universities and say, "Just go do some research in this area, graduate some Ph.D.s, and tell us what the topics and solutions are for distributed computing." That proposal would be roughly one-page long. In around 1994, the U.S. Congress passed legislation that changed DARPA so that it had to build equipment that would have a direct impact for the warfighter. The consequence of this was that most of the

basic research in computing stopped getting funded in favor of very short-term developments, which could be examined every 90 days and shipped to the warfighter in the field.

If we look at the list of interesting research areas DARPA has funded that have had longevity, like the Internet or VLSI design, all those types of grand things are no longer being funded because DARPA basically funds defense contractors to build small pieces of software based on already-existing work, and they want some twists and changes on it but there's no big new area in the R&D column.

So my thought is that universities ought to have a games research institute somewhere, with its focus not just on design but on technologies that could change the way we do game design and development. So in future "Games" columns, we'll talk more about this, but this is one area that I think a whole lot about.

Another area that I very much love is what I would call *will I see biometric sensor-based gaming happening any time before I die*? And that might be the title I use, and it would be really nice if I could.

Previously, I worked for seven years as an advisor at a brain-sensor company, EmSense. Our goal was to make a hybrid electroencephalography sensor device that could measure the physical and emotional state of a human so that we could then build games that take that information, put it into an artificial intelligence (AI) character that understands, has a good model of emotions and a physical model of what the AI character can do, and then comes back and interacts with the human in a way such that the game can make the human cry. This is a reference to the ad campaign Electronic Arts used in their early years (circa 1982). The idea being that we'd like to have games

that are like film. Film gets very deep into the story and presses against our emotions, and we form attachments to characters and to what happens as the film progresses. We don't really do that much in games with emotion. In games, we push a button and fire a weapon, or we swing a sword, run, or pick up supplies. We don't necessarily do things that are emotion driven. We want to be able to have natural language processing going, and everything that will work with the use of biometric sensors to figure out what is the state of the human that is playing against this AI character, which also has a virtual physicality and emotional state. I'm very interested in biometric sensors that are integrated with games where the AI characters have this virtual physicality and emotional state.

## DEGREE PROGRAM

The brand-new Stanford Human Perception Laboratory (see Figure 1), created in the Stanford University Medical School, is taking a close look at all of these issues. In fact, it's created a new degree program, computational human perception, which is a direct descendant from the original design of the Computer Science Games program at the University of Southern California (USC). The courses in that proposed master's of science in computational human perception program include the following:

› Biosignals, Sensors and Modalities
› Interactive Experience Design
› Human Behavior Models
› Human-Intelligent AI
› Building Virtual Worlds
› Advanced Experience Projects (a two-semester-long project)
› Startup Pitches, Productization, Business Models and IP Development.
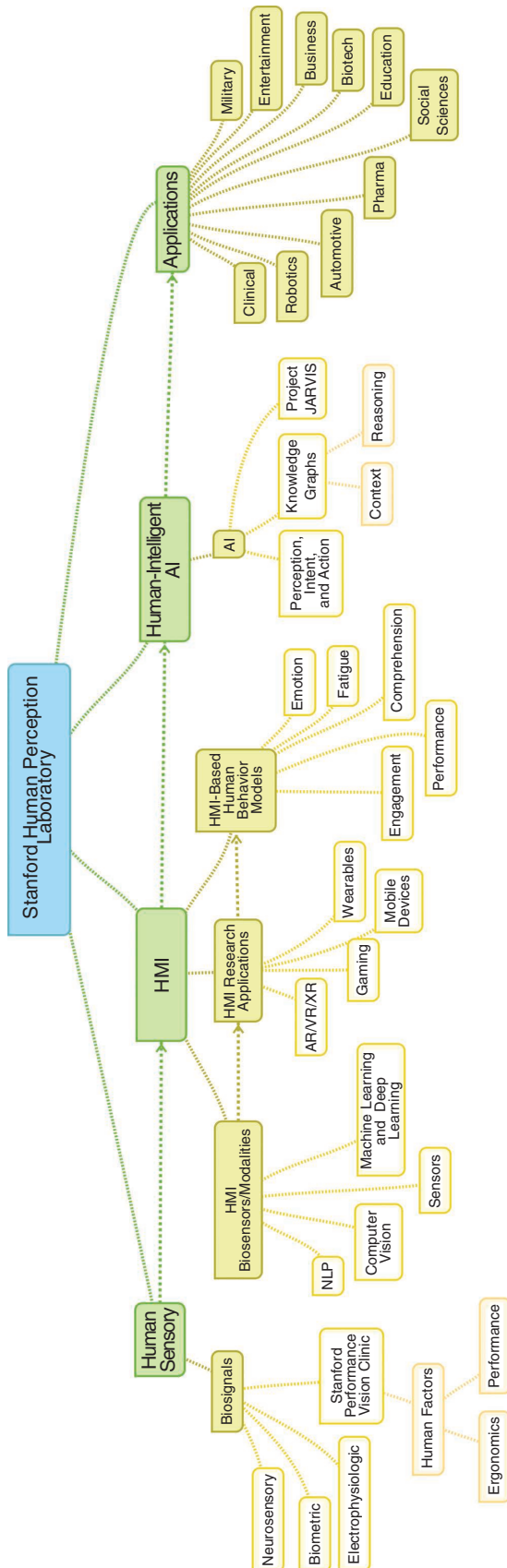
**FIGURE 1.** The proposed directions of the Stanford Human Perception Laboratory's R&D. NLP: natural language processing.

This new degree program and the associated laboratory look a lot like what I am thinking about with respect to a lab that can test out interesting future tech for games as well as other industries. The most interesting thing is how Stanford has extended the game development model of the USC program into domains beyond games.

For this column, I think this whole area of biometric sensing or sensor-based gaming is super important for the future of games, but I remember taking the EmSense sensor to the CTO for Electronic Arts and he said, "Oh, this is really neat. Why don't you come back when this sensor is shipped with all consoles that are shipped." I mean this is basically a way of saying, "Well yeah, we'd like it, we like the technology, but we don't want to jump into the pool until everybody else has already jumped in," the classic "chicken-and-the-egg" conundrum. He then continued, "Once that sensor is available everywhere, we can actually spend the money to build games that support and use the sensor." So no new tech until it makes total sense financially. No bravery or exploratory development on the horizon. We'll talk more about this in a future column.

Now remember, this column is high level. These are ideas. I believe there is a big possibility behind the utilization of biometric sensors in games, and it will change everything we do in many fields—if we have the will and the funding.

Another topic I really like is the continued enhancement of the mobile game platform. In 2006, I received a donation from Motorola to create a mobile games course at USC. At that time, I was thinking, Does anybody play anything other than Snake on phones? And is there really a business in mobile games? Well, we created that course and roughly 60–70% of my students have gone into positions in the mobile game industry. We have run that class with 100 students per semester practically every semester since fall 2006.

Now what's happening is that mobile devices are getting faster in terms of clock rate for CPU and graphics, and some mobile devices are now starting to have machine learning chips on board. Machine learning chips on board is an exciting development for anything requiring machine learning and natural language processing. With this package, mobile devices will soon be more capable than the game consoles that are out there. When the consoles come out, they're out for five years and their hardware doesn't change and at the third through fifth year of the console being released, it is slower and less capable than many mobile devices and PCs. So in the not-too-distant future, mobile devices will replace game consoles. We will talk about that more in a future column.

The next game tech topic I want to talk about is 5G. Everyone has talked about 5G since 4G and about how 5G would magically make things better. I know when we went from 3G to 4G LTE, people were very excited, except for those using Los Angeles International Airport, where there is barely cell phone service at all. Now where I live in Los Angeles, I can see a 5G tower outside the window in Skid Row, so I have a really good signal here, and in Monterey, there's a really good 5G signal. With respect to games, the real question becomes will the shape of games change as 5G is on all our mobile devices?

This basically assumes that all the 4G LTE devices will get thrown away and everyone buys the latest iPhone or the latest Pixel phone and says, "We're going for 5G, we're diving into the deep end." We are also hoping that 5G will allow us to stream games to mobile devices nearly instantly and sufficiently fast enough that the failure of Google Stadia can be forgiven, forgotten, and replaced with something better technically.

Maybe some new technologies can be developed that will deliver games and slices of games nearly instantly. We're going to talk about these topics because I think everyone is absolutely going to want to know how this will change games.

Another area that I absolutely love is machine learning for games. I teach a course, CSCI-527 Applied Machine Learning for Games, at USC. Most of

the ongoing machine learning work for games is being conducted by people at Google Research and in labs in universities, and most of the people who are using games or doing things with machine learning for games are sort of dabbling in games—they're not really people who know how to build games. They do, however, have better access to machine learning hardware than most of us.

One of the things that I believe will change games in a significant way with machine learning is that we can basically watch a master player play a game and grab screen images of what the player is doing. And we can put those into a machine learning system such that we can build a non-player character (NPC) who can approximate the game-play ability of that master player. I think we're real close to that right now, but it's expensive computationally. As we get machine learning chips inside our phones, consoles, and PCs, all kinds of things change. All of a sudden, we have NPCs that are built by machine learning systems, and eventually, they can play in a fashion similar to the master players who were used to build the NPC.

When we have machine learning chips in our mobile devices and in a 5G network, we're going to have more engaging mobile games. With that 5G network, we will be able to reach out to a warehouse full of NVIDIA machines, and we're going to do gameplay and interactions with characters like we've never done before. We're going to talk about that, what it all means, how we learn how to author games like that, and so on. We are going to discuss where the research institutes are that focus on that.

Another topic we're going to cover is the venture capitalists who funded the development of more than 75 different augmented reality (AR) and virtual reality (VR) headsets; however, there was absolutely no funding for the development of interesting game content or user-interface standards to make the development of such games easy and routine. The consequence of this was that everyone basically looked at the content that was out there and they played game one on their Oculus headset, and game number one was interesting and you learned how to play it, and you got to game number two and it had a completely different user interface. Then you got to game number three, and you know, there wasn't a lot of things for you to choose from in this space because venture capitalists didn't fund it and hardly anybody, just tiny studios, focused on AR and VR development. So the real question is, How do we recover, such that we can have a thriving AR/VR games marketplace in the future? So I think we're going to have a topic on that, and if you have something to say about that, you might say, "Oh no, it's already happening," and "There's lots of AR/VR game development money." I don't know. Convince me otherwise, please.

Another topic we want to talk about is eSports in the Olympics. Really? eSports in the Olympics. Yay! Well, the Olympics are going to be in Los Angeles
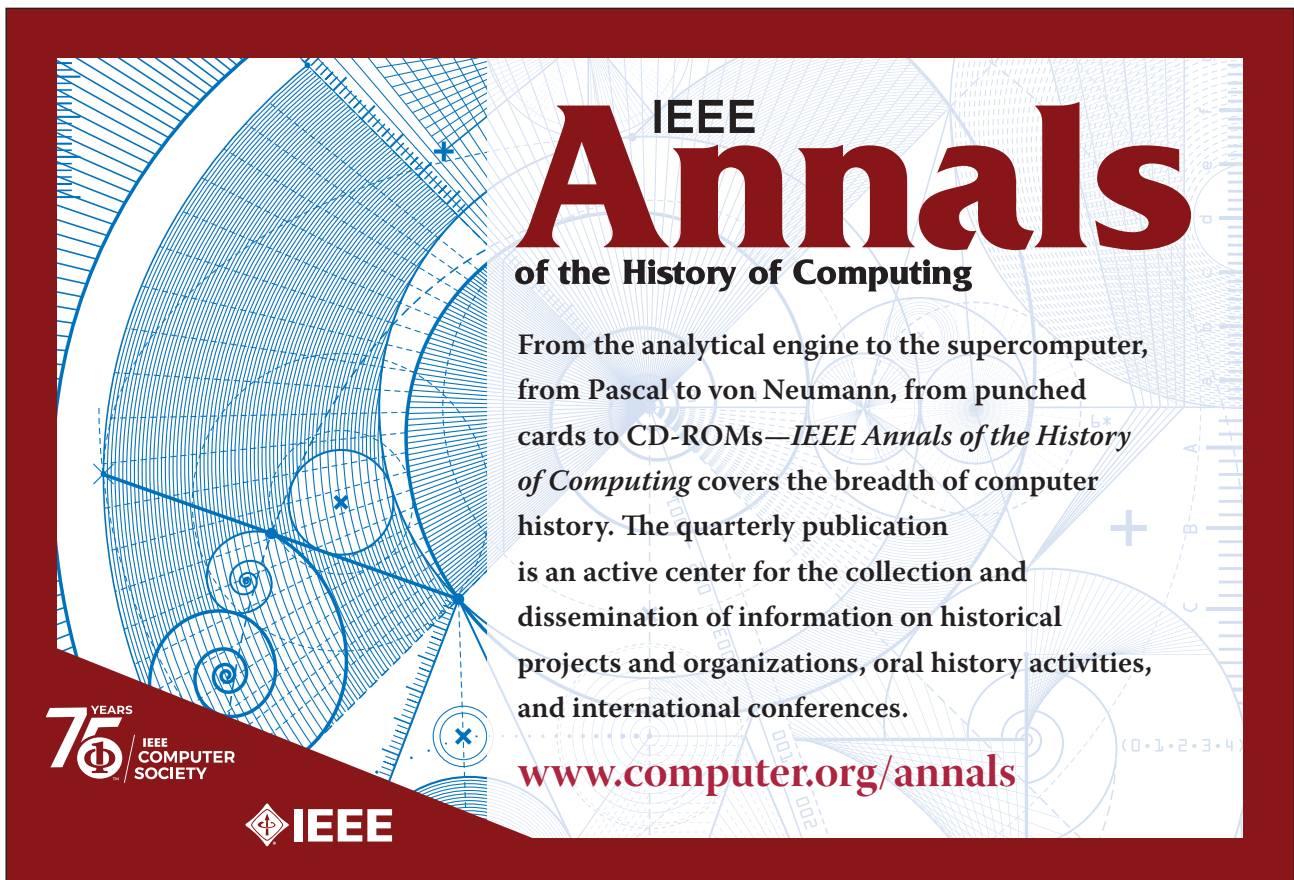
in 2028, and we don't even have an eSports center, facility, or resort anywhere in downtown Los Angeles. In downtown Los Angeles, we have lots of hotels and plenty of uncompleted hotel buildings that could be turned into eSports resorts, which we'd like to see because I think eSports in the Olympics is going to be very popular. In future columns, we'll discuss what an eSports resort would encompass because we'd like to have one built in time for the 2028 Olympics. The designs could include a theme park in a building, such as a Las Vegas-style casino, but it's also going to focus on games, health, and swimming and all kinds of food and other interesting ideas.

One topic that I believe hits all game companies and is important for all of us in games is patent litigation. I have experience working on 40–42 different cases of patent litigation against big game companies, and I've been an expert witness for some 46 game and computing companies. So I want to talk a little bit about my experience as an expert witness, what it all means, and maybe even talk about some of my ideas on patent litigation. Of course, I can't talk about any of the cases I'm working on now, but I'll try and reach back and extract some of the things that I have learned over the years, especially how to write really good patents. But with respect to what does patent litigation mean for the game industry, we need to talk about that and figure out what better things we could do. Maybe we need to build a research center that collects massive data on early games so that they can be used as prior art references to basically stop nonpracticing entities from going after people who are productively building games.

Okay, so that's what I'm thinking about doing over the next couple of columns here at *Computer*. And if you have comments about those areas or topics you'd like to respond to, I want to hear. Every time one of these columns is published, I'll point to it on my Facebook (mikezyda) or LinkedIn (mikezyda) pages so that I can receive comments from you, and maybe we'll respond to some of those comments in future columns or online to enlighten ourselves in real time. Have a wonderful day! **C**

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