

MIT CSAIL Alliances | Karl Sims Podcast Export 1

Welcome to MIT'S *ComputerScienceandArtificialIntelligenceLab'sAlliances* podcast series. My name is Steve Lewis. I am the assistant director of Global Strategic Alliances for CSAIL at MIT. In this podcast series, I will interview principal researchers at CSAIL to discover what they're working on and how it will impact society.

Karl Sims is a digital media artist and visual effects software developer. His interactive works have been exhibited worldwide at such places as the Pompidou Centre, ICC Museum, the Museum of Science in Boston, and at MIT. In 1996, he founded GenArts, a visual effects software company whose special effects have been used in many blockbuster movies including *X-Men*, *The Lord of the Rings*, several *Star Wars* movies, and *The Matrix* trilogy.

Karl studied computer graphics at the MIT Media Lab and life sciences as an undergraduate. He is the recipient of various awards including two Ars Electronica Golden Nica awards, MacArthur Fellowship award, and in 2019, an Emmy award for Outstanding Achievement in Engineering Development. Karl, thanks for your time today. Appreciate you joining us on the *CSAIL Alliances* podcast.

Right outside our offices at the Stata Center at MIT, you have a piece called "Flow." It's a really cool interactive display. Can you tell us a little bit about the inspiration behind the piece and maybe some of its technical details?

Sure. Yes, so the folks at CSAIL were interested in having something in the lobby that showed off some technology to go along with what the lab does a little bit but also was just simply fun for all audiences. They wanted kids, anybody coming by to be able to interact with it and appreciate it.

So we came up with this interactive sort of an augmented reality exhibit where you see yourself on the screen and then there's special effects and simulations going on that you're essentially inside of. So it's a little bit like an augmented reality situation but no headset. You simply see yourself in the screen as if it's a mirror plus the effects.

And then there's many different things that happen over time, and every effect lasts for about a minute. And you can interact with it, experiment with it, and then it will cycle to the next effect. So there's different things that happen over the course of the day. It's about a 10-minute cycle.

But then the following day, there's a different set-- mostly different. There's a little bit of overlap. That way people who are regular visitors to that lobby will see something different the next day. So there's an odd-day group of effects and then even-day group of effects. And the common theme is flow-- fluid flow simulation, physics simulation, where you're playing around in this virtual world of physics and interacting and creating in this world.

So your motions are detected by a camera, a Kinect depth camera, and it uses your motions to generate forces, so to speak, in this virtual simulation. So you are swirling things around, creating things, interacting with other people that are using it at the same time as well. So it's a multi-user kind of thing.

Now, I think it's really cool this way. I learned something new because I didn't know it alternated every other day. So every day we see people standing out in front of that and interacting with it. So next time I go into the office, I'm going to have to check it out and see what various effects that are part of that display. But it's really cool.

Let's talk about some of your work in the past. You talked a lot about artificial life and virtual creatures and simulated physics and simulated evolution. What is your interest in this as an artist and a researcher?

So, yes, I'm definitely interested in emergent behaviors and emergent properties of algorithms that can create complexity and life maybe. Biology is even an example of that in some ways. Anything that where you apply a bunch of rules to a lot of cells in space or whatever and see what emerges, see what happens. And oftentimes, fairly simple rules will give you quite complex patterns and behaviors and results.

So that's fascinating to me because it does relate to the origin of life, potentially. So that whole connection is interesting to me. But I've applied it in a lot of different ways on a lot of different levels of abstraction in different pieces over the years.

Is there any sort of artificial intelligence built into this?

I don't call it that, no. Usually, these days when people think of AI, they think of the deep learning neural net type of setup. And I have not used that.

So you've given a framework of how these things can evolve, and it's up to them, the creatures, to decide which paths to go and how they evolve?

So you're talking about the virtual creature simulation project?

Yes.

Which was a simulation where these creatures made of blocks could behave in a physics simulation and they were run in a Darwinian simulation essentially where they would try to perform a task. And the most successful would survive, and their genetic information, which is the code that grew them, would then be replicated to make a new population, and then they would be retested.

And so it was this simulated evolution of a very abstract world of creatures with genes and bodies and different things. I could select for different things, like how fast they could swim or how fast they could walk or how well they could compete with each other for something and so forth. And some pretty interesting behaviors came up on its own.

So it was a Darwinian evolution simulation to create complexity. That was the method that I used. This is in 1994, by the way, so before people were even talking about deep neural nets.

Yes. I was researching and saw some videos on YouTube. You had an interview. And actually there is the virtual creatures demo, if you will, on YouTube. I encourage people to check that out. Just search on Karl Sims. It's not readily apparent to people the overlap between art and science. Can you explain how they overlap in your work?

I would say there's a few ways they overlap using similar tools in some cases. So a simulation of physics, for example, can be quite useful for science, but I also use it for art type purposes. And some things are potentially interesting from a scientific perspective, but then the results are potentially considered artistic. Sure, you can mix and match these things. It's hard to generalize about how, but I think it's easily doable.

Are you an artist?

Sure. I wear an artist hat sometimes. I often spend a lot of time developing tools, whether I use them myself or someone else uses them, and so the art part is maybe not a large percentage of what I'm doing with my time. I'm often developing tools that then I will often use myself for some particular projects-- particular art exhibit type project.

I see. And as I had mentioned in your bio, many of your work, your art, is exhibited in museums around the globe, particularly in Boston in the Museum of Science and as well as MIT. I would encourage people to check those out.

Let's talk about your company GenArts that you founded in 1996. Can you talk about the journey of that company? As I mentioned, the effects have been used in blockbuster movies plugins. Can you talk a little bit about that?

Yes. So there was a package of several hundred different effects plugins of software that could generate images and process images in a lot of different ways. And I developed a language for image processing that turned out to be quite useful for generating plug-ins efficiently. And so we kept just making more and more of them.

And we packaged them up as plug-ins for Adobe, Avid, Autodesk, Apple and sold them as a package that you could connect into an existing system so it's easy for people using one of these products to then have access to our effects. It was called Sapphire plugins. And yes, that was-- and I ran the company for a dozen years or so and got to meet a lot of interesting, creative people all over the world that do special effects for a living. So it was fun.

Did you start that company while you were at the Media Lab?

No. No, it was Media Lab, and then for a while I was at Thinking Machines Corporation, and then I went back to the Media Lab, and then I started that company afterwards.

I see. Can you tell us about some of the work you did at Thinking Machines Corporation? And for those who are listening, the company was eventually acquired by Sun Microsystems, I believe. What did you do at Thinking Machines Corporation?

So Thinking Machines made a massively parallel computer called the Connection Machine. And I like to think of it as a refrigerator-sized GPU. It's ahead of its time. It was a little bit tricky to program because people weren't used to that kind of way of thinking with parallel processing.

But I was essentially an artist in residence. That was my official title. And my job was to test out all this new software and make animation that was a visible way to show off the computing power of the machine.

And so I made a few pieces. I made a piece called Particle Dreams. That was actually while I was at a customer of Thinking Machines called Optimistic. And then I made a piece called "Panspermia" while I was at Thinking Machines. And then the Virtual Creatures Project was actually done at Thinking Machines as well.

How about that. And can you tell us how advances in either programming languages or computer hardware has changed since you were doing this at Thinking Machines?

Yes. It's changed a lot. So, of course, everything gets faster and faster and more practical and cheaper. So back at Thinking Machines, I was using a million-dollar computer to do something that I would have to render overnight to create frames of an animation.

And these days you can buy a GPU that does the same thing in real time. So 1/16 of a second can render a fairly complex frame, which allows interactive, real-time special effects rather than slow-computed, little-by-little special effects. So it's changed things a lot in terms of what I can do.

And certainly, the cost of a GPU these days or a card is significantly less. So, eventually, GenArts was sold in 2016 to Boris FX?

Yes. I first sold it to a private equity firm called Insight Venture Partners, and then they ran it for a handful of years. And then they sold it to Boris, yes.

I see. And are they still using your Sapphire plug-ins?

Yes. It's still out there, yes. It's still out there getting used. And we won an Emmy award for it a few years ago as well.

Yes. I mentioned that in the bio and certainly the movies that your effects have been used in, like the *Star Wars* movies, *The Matrix* trilogy, *X-Men*. How does that feel when a tool that you're using is used in these million-dollar movies?

Yes. It's fun. It's great to know that the software you wrote is out there getting used by creative people to do things that then other people see. So I can refer to *The Lord of the Rings* movie and a particular effect in there, and people go, oh, yeah, I saw that. I know that. So it's a very tangible result, which is nice.

But can you-- I'm a *Lord of the Rings* fan myself. Can you recall the scene?

Well, there's quite a few. But one is when there's Orcs nearby and Frodo pulls his sword out and it glows blue. That was our glow.

How about that.

Frodo made the sword glow, yes. And then in Sauron's eye, there's lightning in there. That was our lightning. There's quite a few different examples. Sometimes it's subtle and not obvious. In other times, it's more obvious. But those are a couple that people will recognize.

Very cool. So AI art has been discussed a lot lately, especially with DALL-E 2, and others have opened their betas to the public. What do you think of AI art?

Well, I think it's fascinating, and I think it is significant. It represents a real shift in what's possible in a new way. I haven't quite wrapped my head around how it's going to change things and how different it is and how creative it really is. It's leveraging on past people's creativity, even the 5 billion images that they use to train the system.

Is it going to limit new, crazy stuff because it's only using existing examples, or is it going to allow anyone to experimenting and extrapolating and go beyond what's currently there. I mean, there's a lot of questions that I don't have answers to, but I think it's totally fascinating.

What are you up to these days? And are you still continuing developing tools or where your interests lie and what projects are you working on? Can you tell our listeners?

Yes. So I'm still developing some tools, and I did one experiment, which was a web application. So it's a tool that's a lot easier to distribute to the world rather than having an exhibit at a museum where people have to physically go to that museum to try something. It's a web page you can go to and try and experiment right on the web page.

Is that available to the public? Do you have the URL?

It is. It's karlsims.com/rdtool. And it's a reaction-diffusion simulation with controls and parameters so you can mess around and create your own reaction-diffusion simulation patterns.

So this runs as a browser plug-in or just HTML5?

It's WebGL plus HTML5 plus JavaScript. Yes. So, yes, you want a computer with a GPU if you can. It's not great on your phone. In fact, there's some bugs on the iPhone, which I still haven't figured out.

Interesting. And any other projects you like to tell our listeners about?

I'm working on a couple more web applications. I think I probably shouldn't go into the statistics. I never know which ones I'll really finish.

[CHUCKLE]

But that's the direction that I've been going lately.

And is there plans to commercialize any of this?

No, I haven't really thought about that part of it. Just getting stuff out into the world at this point.

Interesting. I'll definitely check that out. And where can people go to find out more about your projects? Is it just at your home page karlsims.com?

Yes. Yes, that works.

Great. And is there anything else that you'd like to tell our listeners at CSAIL about maybe your experience at MIT, in the Media Lab, or in general working as a student?

Yes. MIT is a great place. I enjoyed my time there a lot and made a lot of friends that I'm still in touch with. And make the most of it, do good things for the world, and keep up the great work. There's a lot of amazing people there.

Indeed. Well, Karl, we thank you very much for your time today. It was a fascinating discussion.

Thank you very much. Thanks for having me.

Our pleasure.

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