

Edit IV

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Welcome to MIT'S Computer Science and Artificial Intelligence Labs Alliance's podcast series. My name is Steve Lewis. I'm 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. Today, we're here with Professor Fox Harrell. Harrell is a professor of Digital Media and Artificial Intelligence in the Comparative Media Studies program and Computer Science in Artificial Intelligence Lab at MIT.

He is a director of MIT's Center for Advanced Virtuality. His research explores the relationship between imagination and computation and involves inventing new forms of VR, computational narrative, video gaming for social impact, and related digital media forms. The National Science Foundation has recognized Harrell with an NSF Career Award for his project, computing for advanced identity representation.

Dr. Harrell holds a PhD in computer science and cognitive science from the University of California at San Diego. His other degrees include a Master's degree in Interactive Telecommunications from New York University's Tisch School of Arts and a BS in Logic and Computation and a BFA in Art, Electronic and Time-based Media from Carnegie Mellon University, each with highest honors.

He has worked as an interactive television producer and as a game designer. His book, *Phantasmal Media: an Approach to Imagination, Computation, and Expression* was published by the MIT Press in 2013. Dr. Harrell, thanks for joining us today.

Thank you very much for having me.

Can you tell our listeners a little bit about the area of focus of your research and maybe some of your bold aspirations?

Sure. I'd be happy to. One of the major endeavors I've been working on these days has been founding the MIT Center for Advanced Virtuality. So this is a center that's incubated under Open Learning here at MIT. It encompasses a range of professionals, as well as my CSAIL PhD students as research assistants and other graduate students from across campus affiliates and more.

And we have an advisory board that connects us to industries in terms of media, gaming, and many more areas for impact. The key aim of the MIT Center for Advanced Virtuality is to pioneer innovative experiences using computing technologies that paint a layer of imagination atop the physical world. And so what I mean by that certainly includes virtual reality, mixed reality, augmented reality, but more than that, we're looking at other media forms, such as synthetic media-- that is generating content using AI based techniques and other forms of interactive narrative technologies that are supported by AI.

And then, finally, we also, besides producing immersive technologies, do work to analyze these technologies. And crucial to all of the work that we do within the center is engineering-- technical components of these kinds of systems, design, to create systems that are expressive or innovative in novel ways, and then also considering their social and cultural ethical impacts as we engineer and design these systems.

That's fascinating. You've coined the term phantasmal media. Can you explain what that means?

It comes from my book at Phantasmal Media, an Approach to Imagination, Computation, and Expression. And core to this is this idea that we implement all sets of values in our computing systems, oftentimes inadvertently. So you may have heard about these kind of issues such as algorithmic bias or bias within AI systems. Phantasmal media gives language to how those biases emerge, how they're built into computational ontologies and other knowledge representation systems, how we can design systems to respond to the needs of diverse stakeholders and diverse cultures, and how we can make sure that our systems support social and ethical needs, even as we design them to support the rigorous areas of application.

I see. This might be a loaded question, but why do you believe there is an engineering bias in computer systems and applications in social media?

Well, I think that-- I would rephrase the question such as, what are the issues at stake when it comes to bias in the computing systems? And the answer to that kind of question is when we design our technologies, oftentimes they're not properly designed with broad groups of stakeholders in mind. And so for instance, one of the projects we had within CSAIL was looking at how social media technologies and related technologies in gaming and similar areas may not be designed always with the cultural values and needs of different international settings in mind.

So what we did there was use machine learning and other statistical methods to find, what are the patterns of use that exist in different global settings? And from those patterns, we would work-- and then based on those patterns, we would work with a social scientist to help us better understand, what are the social and cultural meanings of those patterns? How people are negotiating the use of those technologies in their regions, and then produce principles for design that support different regions internationally, as well as new implementation strategies that can better support these different regions.

And we even applied our principles for the design of our own custom software for teaching computer science in different international regions. We have used the software we've built, both in public schools here in Massachusetts, but we also designed it for use in the Middle East, based upon those principles. So that's just one example where we can use analysis driven by AI to make our works better serve the needs of diverse user groups, diverse customer groups, and so on.

So that's how you're using it to help developers build better narratives and applications?

Right. That's one of the ways. One way is that we can analyze the systems to see, are they supporting the needs of their user base? For instance, we were able to show that one best selling

video game, actually, if you played in any of the three major play patterns, you are not going to be optimized if you play as a female character. So these are the sort of things that developers might want to look out for, but may not have automated tools to find these kind of phenomena.

The other thing that we can do with these kind of approaches is design experiences that better support diverse user groups. So for instance, we work with museums to make displays and kiosks and other forms of immersive interaction one, more conversational and accessible by diverse users. We wanted to also make the experiences more personalized, and not just personalized in a generic sense-- we'll find the latest social science model in that domain to do fine grained personalization.

So if it's a music museum, we did some work with Universal Hip Hop Museum, we found a model that's on musical identity and created a system that, whether you listen to country and Western, or you listen to rock or hip hop, or you're interested in issues of women representation in hip hop or representation of issues like violence in hip hop, you will get a narrative that has a soundtrack with your musical preferences, as well as the topic that you're interested in.

So that's just an example there. Another example has been used in workplace training. So for instance, we built a system that addresses workplace training, that addresses sexism in the workplace. And in this case, we measure not only like, a lot of systems, did people complete this, but did people reflect, have their perspectives transformed? We want to make sure that the system will have longer lasting impact.

And so that's just another domain where we took a social science model that's-- where we took a social science model of sexism in the workplace, we translate it into a simulation, implemented that simulation in an engaging accessible way informed by gaming and interactive narrative, and then do the scientific work to make sure that people are learning, reflect and transform their perspectives.

So you developed tools that can actually find this implicit bias in social media, in gaming, in a HR application?

Our work falls into two strands, design and analysis. In terms of design, we build systems that simulate social phenomena, learning phenomena, and so on in ways that are engaging, dynamic, personalized, and where we can ensure that our objective takes place, whether that is learning, whether that's perspective transformation, or whatever the particular aim of the software is. So that's designing systems, interactive narrative systems, gaming technologies, immersive media, VR, AR, MR that will have social impact on critical issues, like learning bias, workplace training, sociability, 21st century skills, and more.

The other aspect of our work is analysis. So that's where we reverse the lens. We build analytical tools, using AI and other statistical mathematical approaches, where we can, for instance, identify, what are the kind of trends? What are the kind of biases? What are the kind of diverse user needs? And so forth. And then convey the social reason for these and develop new principles for design that people in industry, people in academia, and so forth can take up and apply to their work.

And then finally we also build our own systems, as well, to address these kind of issues that are based on those analytical principles that we elicit.

With so much learning being done virtually now, how can you work help the experience for everyone trying to adapt to this new reality?

It's a great question because, in some sense, we've all become virtual now in the face of the pandemic. And then, also just general changes related to work style in many of the computing disciplines-- so some of the work that we do, one, is inventing the kinds of technologies that people would use for virtual engagement. That is, whether it's in virtual reality or augmented reality or mixed reality, identifying the appropriate tools and then, within those tools, thinking about what are the different needs that people would have for various applications?

In some settings, you might need to make sure that people are serving the particular roles that they have on projects in terms of development. In other cases, say in ideation and brainstorming, maybe you want to reduce the hierarchy so that you get input from various people on the team. These are the kind of learnings that will come from the research that we do in this area.

Also again workplace learning, workplace training, K-12, higher education, and much more-- these are other areas of application for our work. And then, finally, making this kind of applications more engaging-- that is can we leverage technology such as gaming or virtual reality for social impact? And that's another place where we're doing this kind of work, where we both have the design and implementation chops.

We have the technical research that makes it more adaptive, engaging, and more-- and then we also have the scientific approach that makes sure that these systems are going to actually be effective for their aims.

Very interesting. What artists inspire you? What inspires you in general to do this research?

In terms of what artists inspire me, I would say a lot of my approach to conceptualizing computational work and simulation could be thought of as inspired by jazz composition. Because there you often have some type of structure in which there's also room for improvisation. And I look at that as a metaphor for designing some kind of computational system in which you're going to have users engage the system, where you don't always know what they're going to do.

Also when you create some kind of AI enabled system, you might want to have a designer construct the parameters of use but have it different every time, depending on the stakeholder and group. Now so that's one kind of inspiration, so I look at people such as Charles Mingus, whose work is very strong in terms of compositional structure, but then also has a lot of room for exploration within it by musicians.

And then sometimes also consider social impact because it has sociopolitical commentary built into it. And then I guess I could also just say that I'm also inspired by work that bridges between fields. So for example, you might ask questions through your research such as, how can we create new forms of interactive narratives or experience that can be told in ways that serve

diverse demographic groups? Or that can be told in ways that support diverse learners, based on the metaphors that help them to learn most effectively?

Or maybe people need different emotional tone in terms of how the material is being presented. So I'm very interested in how we can address these subjective issues, but using AI to make adaptive computational media that respond to these kind of needs. And that requires know-how, both from the engineering side but also the side that actually asks questions that relate to social and cultural issues.

That is, can we ask questions such as, why do users prefer some particular kind of interface or another one in different regions? Or why does this system seem not to appropriately support people across gender? And a lot of our work is to provide both the engineering outcome that supports those needs, but a way to ask both those social questions using engineering approaches.

I see. Very interesting analogy that you use with jazz musicians. I'm a fan of Charlie Mingus as well. I was curious if you could tell our listeners, what your vision, what do you think the future looks like for digital storytelling or virtual identities, avatars, VR, if you can look out where do you think it's going?

So in terms of storytelling technologies such as extended reality technologies or technologies in virtuality, as I refer to them, we will see increasing set of conventions of use. In cinema, we already have well-known conventions for storytelling, but VR, AR, MR exclusive conventions that involve what the user is actually attending to within the space, the way that the body is moving through the space, and that the system will respond to you and not just to passively present the work.

And not just to you in general like screen based work, but to your body and the motion of your body, we'll have those kind of conventions emerge in terms of extended reality. In terms of gaming, I think that the area that's variously called impact games or serious games, that's connected to educational and learning games will just flourish and proliferate to the point where we're not strictly distinguishing between what are commercial entertainment games and what are meant to be learning games.

That is, we can build these kind of social issues and phenomena into the most immersive, the most engaging, forms of media. Because that's what other forms such as literature already do. Most genre fiction, such as science fiction, [INAUDIBLE] meant as social commentary. It's not only meant as escapism, and I think that gaming, we can increasingly move in that kind of direction and harness those interactive and immersive technologies for social and ethical ends.

And then, as well, I think that there is just so much discussion about the values or potential biases that are built into AI technologies. One of the things that we are doing within the MIT Center for Advanced Virtuality, and I think can increasingly be done, is use AI technologies to reveal those kind of embedded values, to reveal those kind of embedded biases, and in that way our kind of work within CSAIL can be a part of the solution.

And that has direct practical benefits for our alliance members because these are crucial issues that impact user bases, customer bases, and developers, investors, and more.

I was just going to ask you how does being at CSAIL help you achieve your goals, but I think you just answered my question. And also some of the benefits of working with the CSAIL alliance program, as well as our industry partners and leaders. Do you have any examples of partnering or collaboration with the industry leaders that you could share?

Sure. I can. Just to name one example, we have had a phenomenal experience with Warner Brothers and the innovative work that they're looking to do in the space of immersive technologies. Vice President of Immersive Technologies there is on the advisory board for the Center for Advanced Virtuality. And we have also engaged with members that are in areas such as TV, and we've engaged with members such as TV and personalized experience through televisual media, and we've also engaged with members who are interested in virtual reality, extended reality technology, and other extended reality technologies such as augmented and mixed reality.

Great. Well, Professor Harrell, I thank you very much for your time today. It is very insightful. It's very exciting research that you're doing, and I look forward to reading more about your work in the future.

Thanks. The pleasure is all mine.

If you're interested in learning more about the CSAIL Alliance program and the latest research on CSAIL, please visit our website at cap.CSAIL.MIT.edu and listen to our podcast series on Spotify, App and Music, or wherever you listen to your podcasts. Tune in next month for a brand new edition of the CSAIL Alliance's podcast, and stay ahead of the curve.