

The Intersection Between Computer Science and Digital Media: An Interview with D. Fox Harrell, Ph.D.

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D. Fox Harrell, currently a tenured associate professor of Digital Media at MIT, earned his B.S. in Logic & Computation and B.F.A. in Art at Carnegie Mellon University in 1998, both with University and College Honors. In addition to his work in television production and game design, Harrell earned a M.P.S. in Interactive Telecommunications from the Tisch School of the Arts at New York University in 2000. He then gained a Ph.D. in Computer Science and Cognitive Science from University of California, San Diego in 2007. In 2013, he published a book through the MIT Press entitled *Phantasmal Media: An Approach to Imagination, Computation, and Expression*, which focuses on the expressive potential of computational media, particularly concerning how this type of media portrays ‘cultural ideas and sensory imagination.’ Currently, he is serving out a fellowship at Stanford University’s Center for Advanced Study in the Behavioral Sciences.

Among his recent work, discussed in the conversation below, is a platform called Chimeria, a system that models the dynamics of group membership and individual identity. Demos of the platform include *Gatekeeper* (<http://groups.csail.mit.edu/icelab/chimeria-gatekeeper/conv.html>) and the *Chimeria Music Simulator*. (<http://groups.csail.mit.edu/icelab/chimeria/>)

JN: One of your primary focuses in research is on the various methods in which people represent themselves in online environments. What led you to this kind of work? Is there a particular part of your work that sparks your interest?

DFH: Researching how people construct their identities is one aspect of our work, but more broadly my work is about how cultural ideas can be programmed into computing systems. So, to help illuminate this broader point, I’ll first give you a little background about what I do and the lab that I direct.

My lab is called the Imagination Computation and Expression Laboratory (ICE Lab) and we have a broader focus on building artificial intelligence and cognitive science based systems for creative expression,

cultural analysis, and social change. We produce interactive computational storytelling systems, social media systems, games, and other exciting new forms of computational media

In my own work, early on I focused on computational narrative because I saw it as one of the key areas for computational expression: it's relevant for virtual reality and gaming and for so many different modes through which someone could express themselves through programming. Yet, I found that unlike some others in the area, I was less interested in creating a kind-of virtual reality playground than in answering certain questions. Can you create stories where you can keep the plot fixed, but change cultural points of view based on what users do? What about change the themes and metaphors used in a story? Can interactive stories help us to better understand ourselves and each other? In order to implement interactive stories that address these questions, you need to be able to represent underlying meanings within the story. It's not just a matter of innovating at the interface level.

This meant that while working on my Ph.D. in Computer Science and Engineering, I engaged in cognitive science research both on how people construct meanings and metaphors and how people blend different concepts. In this strand of cognitive science, there's also work on how people categorize different things in the world. This work on cognitive categorization formed the underpinnings for how I moved into researching identity representation. If you can better understand how people cognitively categorize the world, you can apply that to social identity categorization. I had the insight that the way people categorize in software systems is quite different from how people categorize cognitively. First of all, you can directly look at data structures and algorithms in order to see how social categories are formed in software. For example, in social media you can see if people are "friends" because the software has implemented a link between them. Becoming a friend is as simple as issuing a command. Secondly, categorization is much more limited on the software side. Usually, you're in a category because you opted into it by clicking a button or if you fulfill some pre-determined criteria. For example, consider a music recommendation system that categorizes people as music fans of specific genres. It's all very top-down, predetermined, and completely specified.

The way humans actually operate is quite different. People move between categories, sometimes fluidly, sometimes with more difficulty. We can implement systems with a lot more of this flexibility and nuance that people have in the real world. I thought that if we could improve the way that categories are implemented on the computational side by using more advanced cognitive models, a host of new software possibilities open up as systems gain a more human fluidity. Our research in this area has led to new AI methods to analyze social categorization phenomena such as social status or stereotyping. It has also led to new ways to model social

phenomena in games and social media, using an engine for modeling social identity dynamics that we have implemented.

JN: Where do you think research of this kind is heading in the future?

DFH: I think that online our online identity representations are increasingly interrelated. People have multiple selves both in the real world and online. Online, for example, you might have an avatar for some applications, you have a different profile for others. What's happening now is that increasingly these identities are interoperating at the software level. For example, you might log in to the commenting section of a sports website using your social networking account and all of your posts end up with your profile picture next to them. On one hand, those are different selves, but on the other hand, these two different platforms of self-expression are interrelated in interesting ways. This is an emergent phenomenon that I have been working hard to better understand. For example, we use machine-learning models to learn...that people that operate this way on a social network (lots of friends and posts) prefer 'high-status' avatars in a specific game (customized with very expensive and rare items). I think the different identities that someone expresses online are interrelated and future designs for these personalities to interoperate is one trend I'm really excited about. In particular, I am especially interested in educational and gaming applications just now.

JN: You have a diverse professional background, having been involved in both television production and game design. How has this interdisciplinary approach impacted your work, and can you think of any fields that could benefit from greater collaboration where little currently exists?

DFH: Interdisciplinarity is core to the work that I do. As an undergrad, I earned my B.S. in Logic & Computation (akin to Symbolic Systems here at Stanford), my B.F.A. in Art with a Digital Media focus, and went further in depth in AI and machine learning with a minor in Computer Science. From there I went on to earn a "terminal master's degree" on the Digital Media Arts side, although it wasn't really terminal, because I went on after that to a Computer Science & Engineering program for my Ph.D. The core is interdisciplinary, but I've always pursued a complete education, with disciplinary depth on either side. We need those multiple perspectives to build the kind of systems I do because we need to attend to aesthetic and social concerns while constructing the underlying implementation. Rigorous cognitive science underpinnings are required for the knowledge representations in these systems. I think a lot of interdisciplinary work is like that. First, you have a big question that you're trying to answer, in my case (as I put it in my book *Phantasmal Media: An Approach to Imagination, Computation, and Expression*) it is: How can one better understand and design computing systems that

effectively prompt human imagination in the forms of narrative imagining and poetic thought (e.g., metaphor, theme, emotional tone, narrative, social categories, and imaginative worlds)? Then you realize that only way you can pursue that question is by bringing in multiple fields and modes of thinking.

JN: What projects are you currently working on now? What projects in your field are you excited by?

DFH: We do work on both the design/development side and the analysis side. On the development side, I'm very excited about a platform called *Chimeria*. This is what I described earlier: an engine for modeling how people move between social categories, within categories, and how your social interactions result in categorical change over time. You might imagine somebody, for example, who starts off as a computer science student who begins to learn a lot about algorithms and data structures and starts to form an identity as a programmer, but then takes a break and focuses on dancing. Next, she begins doing computer programming to control the staging for dance performances and sees herself as both a dancer and programmer. Finally, this same person decides goes back to school and takes on a hard-core software engineering program, where she is recruited for a large-scale project at NASA—she sees herself as purely a computer programmer again. That person is focused on different identities at different times. On a smaller scale, imagine a player who starts a role-playing game as a knight, dabbling in magic during the middle of the game, then going back to being a knight towards the end. In both of these scenarios, as different as they are, the trajectory is comparable. Each one also includes features such as being in multiple categories or being more or less central to a category. *Chimeria* can model these kinds of trajectories of identity regardless of whether it's in, say, a social media system for music or a game where you're going between different clans. I'm enthusiastic about it because of the sheer number of applications it has. As a demo, we've constructed a game from this system, called *Gatekeeper* in which a player has to talk her way into a castle by getting the guard to see her in a certain light. The game forces people to think about what it means to pass as a group that you may not consider yourself a part of. We've also built a social-media music conversation system that could be used for recommending music using the same technology.

On the analysis side, I'll also briefly mention that we've been finding a lot of advances in the telemetric analysis of public user data, such as modeling users and players. Here, we can describe social issues such as whether users are being stereotyped or stereotyping each other, how they view themselves and each other online, and so forth. We can analyze empirically, using A.I. and machine learning techniques, phenomena that were once considered to be mostly subjective and social.

JN: What do you anticipate is the future of computer science, cognitive science, and digital media, both individually & together?

DPH: In computer science, there are areas such as human-computer interaction, which are major areas of research. Some places use the term 'human-centered' computing, but I think the idea of being human-centered can go even further by computationally engaging issues that are typically deemed to be subjective areas best studied by the social sciences or humanities. I think you can make complimentary inroads into these areas using engineering techniques. You can start to think of different users not just as "demographics," but in terms of individual taste, personality and preferences that model aspects of identity that aren't considered in such a 'top-down' approach. Taking those concerns and bringing them into the core of computer science research is an important next step.

On the other sides, there are fields like software studies and platform studies in media scholarship where media and communication scholars are beginning to look at actual code and system functions. There's a generation of scholars emerging and establishing a scene where it's natural to know how to code and develop software systems and also be deeply read on social issues. I think that's an important new direction.

In terms of new forms of expression, my response is similar. Computational media are being seen as media in their own right. Processing data algorithmically, interacting with interfaces, and varying the ways in which knowledge is represented through data structures can all be seen as artistic building blocks just how filmmaking techniques like montage can be seen as the fundamental artistic building blocks of cinema.

Increasingly, I think the language of computation will be seen as not only in terms of instrumental and utilitarian ends, but also as a starting point for creative cultural expression.