

# Catalyzing Computing Podcast Episode 8 - Content Generation for Workforce Training

Intro [00:00:10]

Khari: Hello, I'm your host, [Khari Douglas](#), and welcome to [Catalyzing Computing](#), the official podcast of the [Computing Community Consortium](#). The Computing Community Consortium, or CCC for short, is a programmatic committee of the [Computing Research Association](#). The mission of the CCC is to catalyze the computing research community and enable the pursuit of innovative, high-impact research.

This episode of Catalyzing Computing was recorded following the [CCC's visioning workshop on Content's Generation for Workforce Training](#). This workshop was held in Atlanta, Georgia in March 2019, to discuss and articulate research visions for authoring rich, graphical content for new workforce training. In this episode, I sit down with CCC council member and lead workshop organizer [Dr. Holly Rushmeier](#). Holly is professor in the [Yale Department of Computer Science](#). Her research interests include shape and appearance capture, applications of perception and computer graphics, modeling material appearance, and developing computational tools for cultural heritage. I also include a snippet from my upcoming interview with CCC council member, [Dr. Beth Mynatt](#), related to the goals and topics of this workshop. Enjoy.

[Interview with Holly Rushmeier 1:21]

**Khari: Hello. You're listening to Catalyzing Computing. We've just finished the Content Generation for Workforce Training Visioning Workshop, here with CCC council member Holly Rushmeier. How are you doing today?**

Holly: Great and I'm really feeling great after the workshop. It's been really inspiring.

**Khari: Could you tell me a little bit about your background? You specialize in computer graphics, right?**

Holly: That's right. My research focus is computer graphics; and in particular, the sub-area of rendering, that is taking numerically defined assets and making a picture. We can make gorgeous pictures given the right assets but the big challenge in graphics and rendering is authoring the assets in the first place.

**Khari: Okay. So what do you mean by authoring the assets?**

Holly: So say you want to model a room with tables and chairs and lighting and so forth. Somehow you have to express what shape chair? What is it made of? How does it reflect light? What's emitting the light? You have to somehow express to the computer all of that stuff. Once that's expressed, I can turn on algorithms and make a picture of that.

**Khari: So was this kind of what inspired you to propose this workshop or what was the reason for it?**

Holly: Yeah, absolutely. In graphics we're always looking for new challenges, and traditionally the driving industries in graphics have been computer games and feature film and we've had spectacular successes there. When you look at games, or when you look at feature films, you think, "well they can do everything, it's done," and we really can't. It's still hard. How can we surface the challenges and how can we take the great

things that we've done for these applications and transfer that to other needs in other parts of the economy, of the country? So that was the inspiration.

**Khari: So this workshop was focused around workforce training. Have you designed any tools specifically for workforce training before this?**

Holly: I have not done any design for training. The main application area I've worked on recently is cultural heritage and providing tools for people to document and analyze cultural heritage. The first iteration, we built some tools and really there was not much uptake. Then we realized that if you design a tool you also have to design manuals, you have to design training classes, and it begins to dawn on me that this is bigger even than just producing the softwares. It doesn't do anything until there are people who understand how to use it.

**Khari: Right. So I guess that's where the workforce training part comes in, is how do you teach people how to use these systems, in a way...**

Holly: Well, it's partly to software systems, but then also how can we build software, use computing assets, to teach people to do things that don't have anything to do with a computer necessarily, but prepare them for activities in the real world. There really is this need to train the workforce more rapidly, and that's for your first job entry...somebody said we should define the workforce, I feel like, well, that's all of us, except for a few people who may not need to work. But the workforce is all of us, and adopting the mindset that we all have to be constantly updating and learning. So that was sort of the backdrop and then looking at, well, what are the computational issues so that the industry, they know what they're doing and what they need. People who do education training, they know what they're doing; but what our job is is to provide them tools.

The big gap there's been, whether it's doing just images or whether it's doing videos or whether it's doing AR, VR, whatever it is, producing that stuff, that content is slow and it's expensive. So understanding what do they really need and then how can we provide that. And that also goes back to my past interest in photo realistic rendering. We've always said, well, that's because people can use it in design and learning how to maneuver in virtual space as well. This is where that really happens and that was another inspiration for the workshop.

**Khari: Okay. So can you talk about some of the specific use cases that people discussed in the workshop that you thought were...seemed promising or interesting?**

Holly: Oh, yeah. It was really a revelation. There's one whole area that I hadn't thought of, but it jumps out at you as soon as somebody mentions it, and that is training inspectors, training safety inspectors. They have to know, be trained where to look for certain kinds of things and how do you expose them to the problem. You can't just take them out in the field and hope that the accidents are out there waiting to happen and you can point it out to them. You have to somehow instruct them and get them into that.

So the whole area of inspection. Then also a really interesting thing is people started thinking of VR as wearing goggles and being by yourself, but a lot of the training scenarios is training people to work in groups such as in a hospital emergency room, so you're not just teaching somebody how to put one thing into another, it's how to deal with other individuals, with unexpected situations, including things like...so you have some computer simulation, but you also have human in the loop.

So it's both computer simulation and a trainer working through that to guide a trainee. I knew historically that people had used them in industries for training — in manufacturing — but a lot of this sort of social and out in the field inspection kind of things were new things to me that I learned about at the workshop.

**Khari: Yeah, I did think that the CAVE thing that was presented... I forget what her name was.**

Holly: Carolina.

**Khari: Yes. It was really interesting, especially how she showed that in the '80s there was the big goggle movement and now it's sort of comeback...but the need for systems that groups of people can use at once to interact and learn together.**

Holly: Yes. [Carolina Cruz-Neira](#) is one of the inventors of the original [CAVE](#). She showed how much it has been used in industry, and there is a lot of work they've done we can learn from. But suddenly when cardboard VR came out, suddenly we all jumped back to thinking that we had to put something on our heads and she did a tremendous job illustrating that. Particularly the picture of a classroom full of children looking into goggles, it was a very compelling image. Like, no, this is not what we want education to look like. We want people to know how to interact with people. And modalities like the CAVE, allow you to have both the virtual and still have the people being able to interact with each other.

**Khari: Yeah, I think I heard several people describe it as sort of the [Wall-E](#) effect where everyone's focused on their own...**

Holly: Yeah, so I think a theme of the workshop was the overall context, not just focusing on the little technical details, but what is the big picture of what we're trying to achieve here. And we're looking at society and social interactions and people making their way in a society.

**Khari: Which is big. What do you think the big research or policy or economic challenges are that we still need to overcome to institute these systems?**

Holly: We have many layers. We know how to acquire data, but from a wide range of things, there's sort of a jumble. We need sort of coherent ways to acquire data from multiple different sources and then make sense of that data in terms of tasks that people are using. We haven't really gone through that gap of, here's a bunch of data and now how do we interpret this as tasks that we can then act upon to understand how people are doing things.

There was a great slide about when we have all these VR assets that, you know, they look wonderful but the price tag on creating these things right now is enormous, so no wonder people don't use them. You know, if you've got a business of 20 people and you're going to train somebody, you are not going to invest \$200,000 in developing a scene. So we have some know-how, but we don't have it at the level where it's readily specified by somebody who's not really into spending months learning how to use a software package, and where it comes at a price that's affordable for training.

**Khari: In order to successfully design these kinds of systems, obviously, you can't just have technologists. You also need psychologists and learning specialists and domain experts in whatever field you're trying to model. So what do you think can be done to help, sort of, integrate those communities and bring them all to the table to better create systems that could be used?**

Holly: Right. Well, first of all, I mean, just making this statement to make it clear that these are team endeavors. And of course, we brought together a big team with all these different kinds of expertise at this meeting, but then I think defining classifications and high level tools for specification we can bring in the expertise of many different populations and put it into the asset collections and the software that we build. So then the individual, you know, if it is an individual at a smaller enterprise, can benefit from that whole team's worth of expertise to build effective solutions. So we want to build

systems that have embedded in them things like best practices that have been established.

**Khari: Okay. Another challenge that was brought up was making systems that aren't very specific because it seems like a lot of times people are creating scenes that are hyper specific. I think someone used the metaphor of work as a moving target. So if you create something that specific, it's difficult then when the job changes. So I guess...**

Holly: Yeah, it's going to be out of date in fifteen minutes and it costs a fortune, so this is clearly not a good way to go. So I think that's why we want to create these systems for easily authoring new experiences and then procedures that will allow people with as minimal as possible descriptions, whether it's text or sketches with minimal description, to automatically generate a lot of the detail that's needed, in a way that there's hooks in there for them to customize it to their taste. So identifying the common things that everybody's going to need to use, or at least classes of things they're going to use. And then making systems that can generate more detail with minimal input is the answer, rather than crafting from zero everytime a very specific system.

**Khari: Right. Were there any systems that weren't talked about that would be a good application of virtual reality and augmented reality?**

Holly: Well... [laughter] I think that there had to be a finite limit of what was presented. I think there may be some more in-between...I mean, you know, the extreme brand X kind of training is to use just PowerPoint and show people images and text in PowerPoint, and the other extreme end is full on 3D models, virtual reality. There's things within that spectrum that I think are worth exploring for the sake of the ease of creation and the cost of creation. So there's things that have been done about acquiring rich images that can be edited, there's some space in there I think that we could explore and see some useful modes for training.

**Khari: I did think, one of the interesting things that I had never seen was in [Eakta Jain](#)'s presentation, the [cinemagraph](#) thing where it's basically a still picture, but some aspect of it is moving to reveal information to you.**

Holly: Yeah, that's exactly in that space where it's not just an image you're showing somebody, but it's not a full on model with a lot of investment. It's something that's readily captured, that with some effort we can develop methods that can be easily edited that serve the purpose. In that case, training inspectors to notice particular kinds of things. So that was interesting both from that ease of authoring perspective and then also how do we author experiences where we get people to notice. How do we draw people's attention in a way that they're not going to rely on that drawing of attention when they go out after their training and work in the real world. So that presented some really interesting challenges.

**Khari: Yeah. People were talking a lot, I guess, in that context, about gamification. Like when you play a video game the treasure chest will be lit up differently so that you notice it.**

Holly: Yeah, so in games you can play games like that.

[Laughter]

But this is where we need to collaborate with both the learning science, psychology people, and human computer interaction people, and other technologies for like what alterations can we do. Is it going to train people to be dependent on something that we don't want them dependent on? Or can we build an experience that eventually they're no longer relying on the artificial highlighting?



**Khari: Yeah, it seems like there's a lot of focus around manufacturing specifically. I guess in some ways it has obvious applications. Like you saw on a video where, you line up a pipe, you measure it, and then you bend it.**

Holly: Yeah, the thing about manufacturing is it's gotten more sophisticated. You need more training, you need more education to work in that sector. So that's why this training is really needed. Also creating manufacturing jobs — there are 3X, some number like that, of additional jobs that are created when you create a manufacturing job. So that's one reason then for focusing on manufacturing, and of course in graphics I'm concerned with modelling objects and stuff and manufacturing is all about making stuff, objects. But certainly in healthcare and hospitals, I mean the requirements are tremendous, so that's also another active area. And we also saw a demonstration of a simulator for teachers so that they can get some experience teaching in virtual reality rather than unleashing them on live groups of children from the start.

[Laughter]

**Khari: Yeah, that's probably a good idea. I think it was in the same presentation, I forget whose presentation that was, but he had the...what do you call them?**

Holly: The mannequins.

**Khari: Yeah, the [mannequins](#) that were more realistic than your classical mannequin for medical uses.**

Holly: Yeah, that was [Greg Welch](#)'s. And that also brings up the interesting issue of blending with and transitioning between the virtual and the physical, that there's parts of these trainings that you should have either the real physical stuff or in this case the mannequins, the stand-ins do. So it's not just about building software, it's also about building the physical systems for training.

**Khari: Did you go on the field trip to the [lab at Georgia Tech](#)?**

Holly: Yes.

**Khari: I thought that was pretty cool. Did you do the thing...they had this one system that was designed to detect your emotional response to a VR system. So it's like a wood circle and in the middle is a green screen and you put on this headset and then it looks like you're standing over this pit. And the goal is to like throw stuff into the pit or whatever.**

Holly: Yeah, if you've been in graphics, you've probably been to a lot of those. Those classic kinds of VR. I mean, that does elicit quite the response to it. You know that there's just a floor there, but it's really hard to get over that feeling that it's a pit.

**Khari: Yeah. So any other interesting things that you saw during the field trip?**

Holly: Well, I think an area that concerns me is the so-called [aging in place](#). [Editor's note: read the CCC workshop report on computing technology for aging in place [here](#)] On one hand, you don't want to interfere with privacy, you want things reliable, but when you look at the cost of going into even modest assisted living and living in your own home, the costs are enormous, let alone the emotional. So the development of relatively simple things that can make people's life in the home possible, so that they don't have to take this step up to another kind of...I found that really interesting.

**Khari: Yeah, I think that's called the [Aware Home Project](#). In terms of logistics, what was a process that you went through to put together this organizing committee?**

Holly: Oh, okay. So for the organizing committee, we, of course, drew on the CCC counsel and fellow council member [Beth Mynatt](#), who's done a lot of work in HCI (human computer interaction), and then we engaged with [Jessica Hodgins](#), who through many roles, including being president of [ACM SIGGRAPH](#), has a lot of interest in this. Then [Blair MacIntyre](#), because of his speciality in virtual reality and then [Kapil Madathil](#), because he's been very active in the efforts at Clemson and workforce training and particularly with AR/VR. We also had help from [Tony DeRose](#) from Pixar, who had been involved in the [Pixar in a Box](#) materials in Khan Academy, just as more input about...

**Khari: What is Pixar in a Box?**

Holly: It's part of the Khan Academy where it's combinations of videos and quizzes and information about the fundamentals of computer graphics that are used to make the Pixar movie magic.

**Khari: So where do you see the future of this work going? Both specifically in terms of like this workshop and this community, but more broadly.**

Holly: Where I want to see this go is, for my own field in graphics, to grow a new application area that helps drive our efforts. Both in the sense that we can do more good and also I think it will get people to think in new ways about addressing the problems we've been addressing. And I'm hoping that for sort of the other fundamental areas of computer science, it will do the same thing. Because there's these connections between human computer interface graphics and computer networks.

Finally, all these people in computer science are talking to each other and, you know, can inform new ways of looking at problems that we've looked at for a long way in the past. So that's one thing I hope coming out of here, and I hope we have started to build some connections so that there are people here who are on the ground working with

small manufacturing companies, getting training out to them. I hope we can maintain all these connections to form projects in the future.

**Khari: So if anyone listens to this and wants to get involved in some way, what should they do?**

Holly: They can write to us. We'll be producing a report from the workshop [[available here](#)] and I think that will give them...I mean the whole point of that is to give them a good roadmap about what needs to be done, how people can get involved.

**Khari: Right. Yeah, so stay tuned for the report. And thanks for sitting down with me.**

Holly: Thank you.

[Transition 21:30]

**Khari: The following snippet comes from my [interview with CCC councilmember Dr. Beth Mynatt](#). Beth is the executive director of Georgia Tech's Institute for People and Technology. This interview was recorded prior to the Content Generation for Workforce Training Workshop, sort of related.**

[Interview with Beth Myantt 21:48]

**Khari: Obviously, the Content Generation for Workforce Training Workshop hasn't happened yet, so you might have a better answer after this, but you mentioned the difficulty in terms of getting participants in the studies who are able to use technology.**

**There's obviously a barrier. I was reading an article somewhere, maybe The Washington Post or something, about the struggles one particular city was having getting people to retrain when they were laid off from a factory. There was an example where this guy quit the program, the retraining program, basically because all the information was in PDFs and he couldn't figure out how to put it onto a flash drive.**

Beth: Mmm, yep.

**Khari: To me, that seems like an easy problem to solve, but that's obviously because I've grown up...**

Beth: You do that everyday.

**Khari: Right, I do that everyday. That's a difficult problem for someone who's 55 and has never had to do it before. So what sort of strategies have you used or do you think would be effective to help combat those kinds of problems?**

Beth: Yeah, it's interesting. As you said, we had this workshop that is the CCC convening power. We're going to have people who do advance content creation, so we're talking the best of the graphics community and the special effects community. People who, you know, are also winning Oscars for special effects for great films, the best of the best. And then we're going to have learning scientists, people that understand training and learning, and then we're going to have folks that represent those communities and those folks that you're talking about. Where you're looking at individuals who have not grown up using these kinds of technologies and then suddenly that's being foisted upon them for job security or new avenues. And it is a wickedly difficult problem to figure out what those onramps look like and to understand how you create technologies that don't just put someone in that consumer/user perspective, but put them in a producer perspective.

**Khari: How do you...What's the distinction?**

Beth: So a distinction is...a lot of this shows up in educational technologies as a whole. There is the question of, you know, do you learn something by being talked at and then tested on, and kind of you're just the consumer of the technology vs. do you say, well, what's the most important thing you would want to do.

So let's say you're going to change how line work is done on this assembly, what's the first thing you would want to do? Well, you've had safety concerns about such and such. Alright, let's teach you how to do the simplest thing to help do a checklist or monitor for those safety concerns. And it's not that the technology got any easier but when you connect with someone about a goal that they fundamentally have suddenly, maybe that motivation to overcome that little barrier, it happens, and then they move to the next stage and to the next stage.

So too often we have this “these people create and those people consume” as opposed to “these people create tools or platforms and then these people do great and interesting things with it that are locally meaningful to their community, to their factory, to their job.” This is why if you go back in history lessons like the spreadsheet was so powerful, right, because everyone picked it up and started doing hundreds of different things with it. And now it's way more complicated than it was back then, but it was a tool that enabled people to pick it up and do something they thought was meaningful and we lose that sometimes. So when we're looking at these hard questions of bringing new populations into computing technologies, we have to actually say, “how do we make them powerful with what we can hand them as opposed to how do we make them do things differently?”

**Khari: Right, hmm.**

Beth: It sounds harder, and maybe it is, but that becomes way more powerful.

**Outro [00:26:04]**

**Khari: That's it for this episode of Catalyzing Computing. To learn more about the CCC's work with content generation for workforce training head over to our website <https://cra.org/ccc/>. From there, click on the [visioning tab](#) to see all of our recent visioning workshops, learn more about the organizers and participants, and find workshop slides and other materials. The podcast will be back soon with my [full interview with Dr. Beth Mynatt](#). Don't forget to like and subscribe. Until next time. Peace.**