

ARE³



**Augmented Reality Education,
Entertainment, and Expression**

North Carolina State University
September 15-17, 2017

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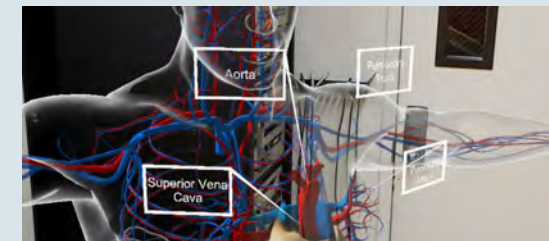
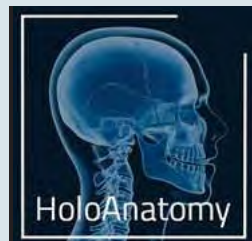
This conference is dedicated to enlightening the general public about the many types - the wide spectrum - of augmented reality. Here, we have five speakers from diverse backgrounds discuss their contributions to augmented reality for education, entertainment, and expression. Hearing these five distinguished individuals speak will inspire others to change their lifestyles and incorporate augmented reality into their own fields, for augmented reality is the future.

Moderator



Ivan Evan Sutherland (born May 16, 1938, Hastings, Neb., U.S.) is an American electrical engineer and computer scientist and winner of the 1988 A.M. Turing Award, the highest honour in computer science. Sutherland is often recognized as the father of computer graphics. In 1968, with the help of student Bob Sproull, he created the first virtual reality and augmented reality head-mounted display system, referred to as the Sword of Damocles because it was suspended from the ceiling above the user's head.

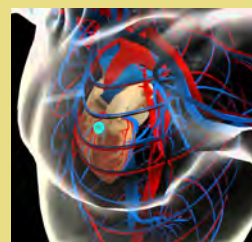
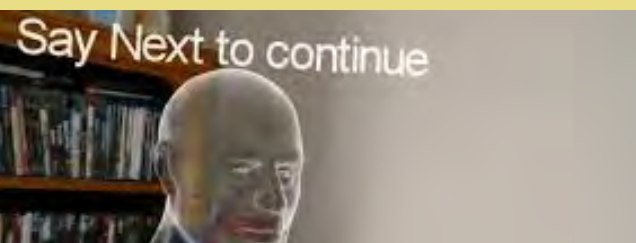




Revolutionizing how students view the human body

Medical

Mark Griswold



Transforming Medical Education with Holograms

I knew my world had changed the moment I first used a prototype of Microsoft’s HoloLens headset. Two months later, one of our university’s medical students illustrated exactly why while using HoloLens to examine a holographic heart. “There’s the aortic valve,” Satyam Ghodasara exclaimed. “Now I understand!”



HoloLens can transform learning across countless subjects, including those as complex as the human body. Let’s begin with a holographic heart. In traditional anatomy, after all, students like Ghodasara cut into cadavers to understand the body’s intricacies.

With HoloLens, you see it truly in 3D. You can take parts in and out. You can turn it around. You can see the blood pumping—the entire system. In other words, technology not only can match existing educational methods—it can actually improve upon them.

Ghodasara had already taken the traditional anatomy class at Case Western Reserve, but it wasn’t until he used the HoloLens headset

that he first visualized the aortic valve in its entirety—unobstructed by other elements of the cardiac system and undamaged by earlier dissection efforts.

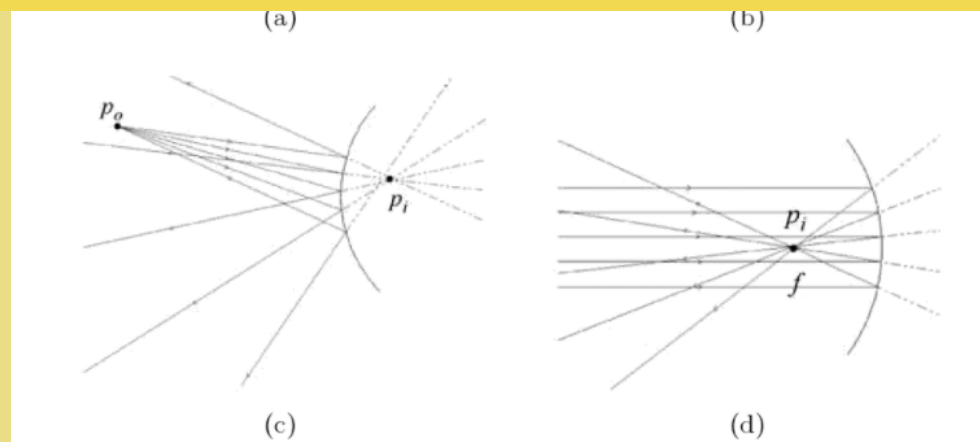
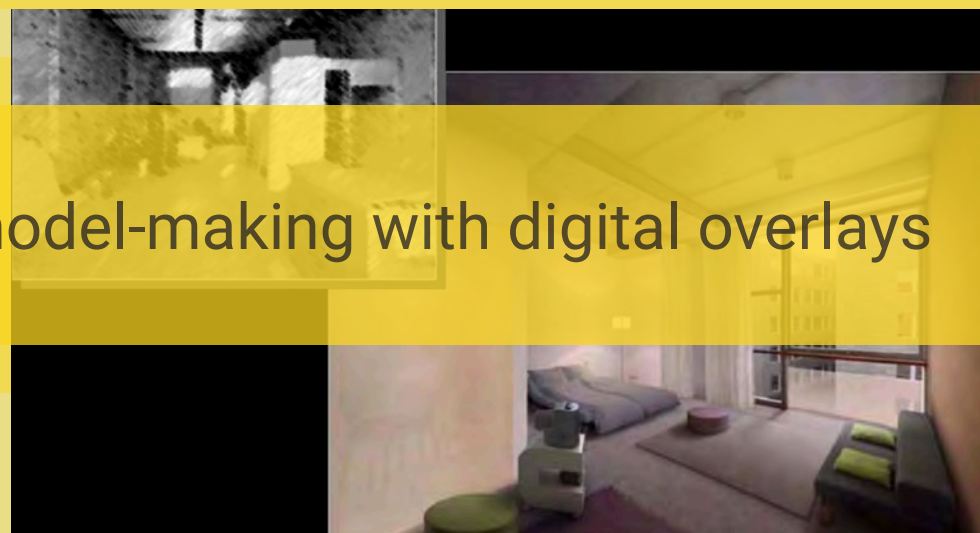
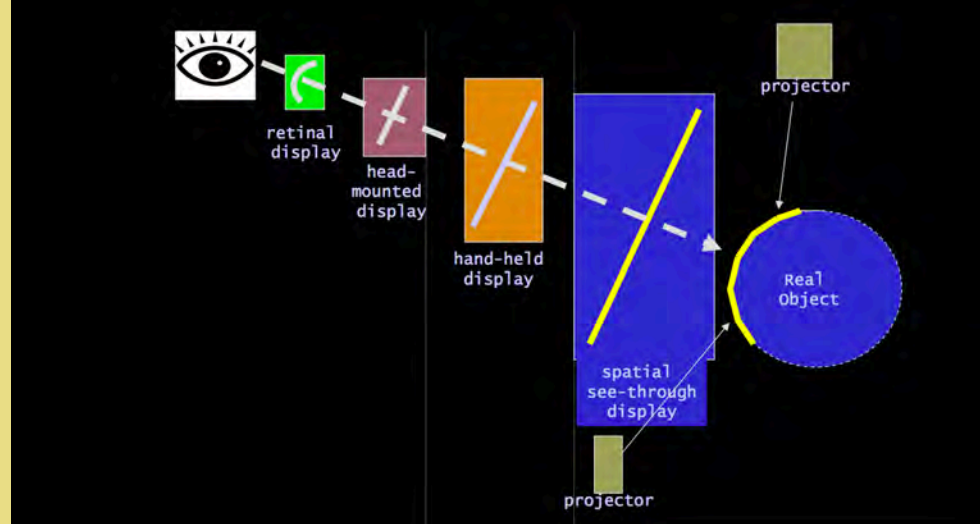
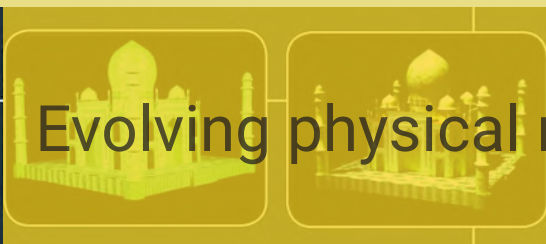
Because the technology is relatively easy to use, students will be able to build, operate and analyze all manner of devices and systems. It would also encourage experimentation, leading to deeper understanding and improved product design.

In truth, HoloLens ultimately could have applications for dozens of Case Western Reserve’s academic programs. NASA’s Jet Propulsion Laboratory already has worked with Microsoft to develop software that will allow Earth-based scientists to work on Mars with a specially designed rover vehicle. A similar collaboration could enable students here to take part in archeological digs around the world. Or astronomy students could stand in the midst of colliding galaxies, securing a front-row view of the unfolding chaos. Art history professors could present masterpieces in their original settings—a centuries-old castle, or even the Sistine Chapel. Holograms can be incorporated into any discipline. The whole campus has the potential to use this.

Evidently, our ability to use this for education is almost limitless. For now, however, the top priority is creating a full digital anatomy curriculum, a process launched with the advent of the Health Education Campus, and now experiencing even greater momentum. This will combine a cutting-edge structure, technology, and teaching techniques, providing students with the innovative education required to lead in this new era. For more than a century, our medical school has been renowned for inventing and reinventing approaches to teaching and learning that take root nationwide. Now, we must create a rich environment to explore the educational potential of the Hololens.



Mark Griswold, PhD, is a professor in the Department of Radiology at Case Western Reserve University. He also leads the Interactive Commons at the university and led the development of HoloAnatomy, an app allowing medical students to learn with holographic body parts.



Spatial

Ramesh Raskar

Bringing Physical Models to Life with Projected Imagery

Spatially Augmented Reality (SAR) is the notion of augmenting physical objects with images that are integrated directly in the user’s environment, not simply in their visual field. For example, images can be projected onto real objects using light projectors, or embedded directly in the environment with flat panel displays. This would promise very compelling hybrid visualizations with benefits previously exclusive to either physical or graphics models.



Despite the availability of high-quality computer graphics systems, architects and designers still frequently build scaled physical models of buildings or products. Physical models provide a depiction of the object that is high resolution, can be viewed in 3D from all around, by multiple people, without tracked head-mounted display systems or stereo glasses, and can be physically manipulated. However, such physical models are static in structure and surface characteristics; they are essentially lifeless. On the other hand, high-quality graphics systems are of course tremendously flexible, allowing the viewers to see alternative structures, textures, cut-away views, and even dynamic effects such as changing lighting, moving automobiles, people, setting, etc.

I believe that SAR offers an interesting new method to realizing compelling high-fidelity illusions of virtual objects and surface characteristics coexisting with the real world.

Two example applications are augmented visualization of table-top architectural models of buildings and augmented visualization of bench-top parts and procedures for assembly line workers or repair technicians.

In the first example, an architect could provide clients with a compelling form of walk-around scaled model of the real (proposed) buildings or complex. At a minimum, SAR could be used to “paint” different colors and textures onto the surfaces of the physical model. She could, in addition, show the clients the building as it would appear under varying lighting conditions, including night time with building lights on, daylight with the sun in varying positions, and both over varying seasons. Finally, she could show the clients parts of the internal structure of the building, including pipes, electrical wiring, etc.

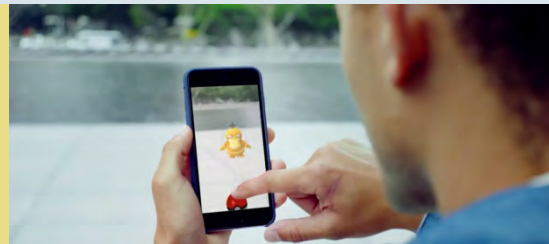
In the second example, an assembly line worker could be guided through the assembly process via spatially-augmented information. Head-mounted display AR has been used for this application at the Boeing Corporation. Using the aforementioned techniques, one could achieve the same effects without the need of a head-mounted display, using inward-

pointing projectors to render instructional text or images on a white work surface. This hybrid Spatially-Augmented Reality approach can offer some of the advantages of each of the two situations (purely physical models and purely digital models), when a physical model is either readily available or obtainable. The combination has significant potential. Even simple static demonstrations will be extremely compelling, bright, clear, and easy to look at.

The basic idea is to aim multiple ceiling-mounted light projectors inward to illuminate and graphically augment table-top scaled physical models of buildings or products. The approach promises to provide very compelling hybrid visualizations that afford the benefits of both traditional physical models, and modern computer graphics, effectively “bringing to life” table-top physical models.



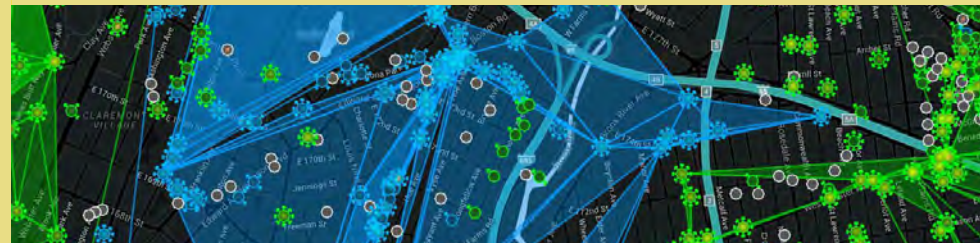
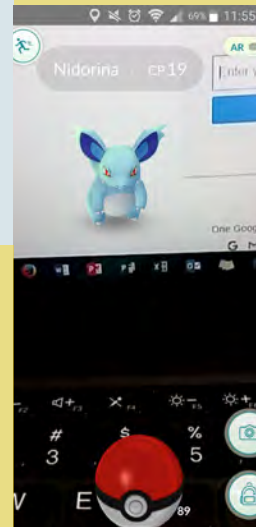
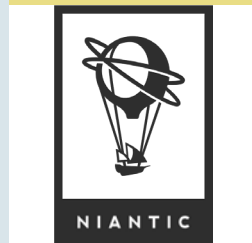
Ramesh Raskar, PhD, is a member of the MIT Media Lab and inventor of various technologies, including Netra, a low-cost eye care device, and Bokode, a long-distance barcode. While finishing his PhD at UNC Chapel Hill, he introduced Spatially Augmented Reality to the university.



Changing socialization and exploration through mobile games

Gaming

John Hanke



The Accidental History of Pokemon Go

I've always found games and computers fascinating because a lot of technology and products exist out of contact with the people around us. Through that, I learned that I wanted to build applications that would deepen people's appreciation or involvement in their town or community, encouraging people to actually meet up in the real world.

I was lucky. I helped start a company called Keyhole that Google bought in 2004. We worked on the project that eventually became Google Earth. I worked on Maps and Earth and those related projects for about six years as part of Google.

But I wanted to do something a bit more entrepreneurial. I had been at several startups before coming to Google. We were thinking about how we'd built this map of the world. We'd helped bring maps to the Android and iPhone, GPS. I grew up as a gamer. People seemed to like to do social things with games. It seemed to me that there was something interesting at the intersection of maps and mobile phones and gaming.

We formed this little group with permission from the higher-ups at Google to give it a shot. We started trying to create something interesting in that area. First, we did Field Trip, which is about discovering information about historical sites and cultural things in your immediate vicinity. Then, as that product was launching, we started working on Ingress, the precursor to Pokémon Go. We incorporated some concepts around location and multiplayer and discovery of local places, and put that out there.

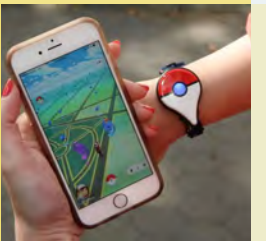
Then in 2014, Google did an April Fool's joke. The Maps team did this mash-up with Pokémon - a video that got 18 million views. At Niantic, we saw how that took off virally. We reached out to the Pokémon Company at that point and said, "This joke did really well. Let's build a real game around on that concept."

Pokémon Go proves that you can do a fun AR experience with just a phone. However, we'll definitely take advantage of other kinds of AR devices as they become prevalent out in the market. I'm excited about investing in that area, about building prototypes and bringing our gaming products to that hardware as it comes to market. I'm looking forward to the

Pokémon Go Plus launch, because that's going to give people a way to play the game and not look at their phone all the time. They can look around them and see the cool places that we're trying to help people discover.

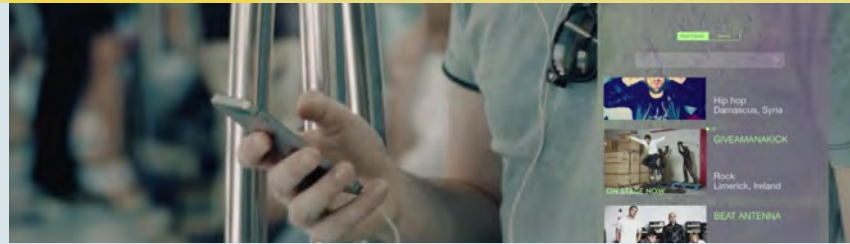
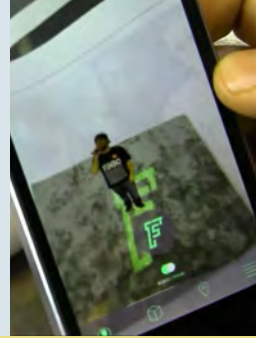
Regarding the future of AR, I personally see an evolution of things like watches towards glasses. It's a really exciting time for anyone making games, anticipating the kinds of experiences we'll be able to create as those devices transform people's experience out in the real world.

With AR, you can embed interesting hidden things out in the world. They can have all kinds of different behaviors. You can find them by yourself, interact with them, interact with other people. We've only just scratched the surface. I hope other people in the industry jump in and create fun games that I can go out and play.



John Hanke is the CEO of Niantic, a software company best known for developing the mobile games *Ingress* and *Pokemon Go*. He also founded the startup that developed what eventually became Google Earth and helped develop the first commercial MMORPG, *Meridian 59*.

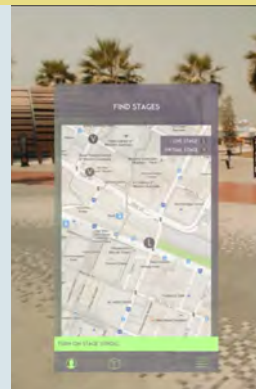
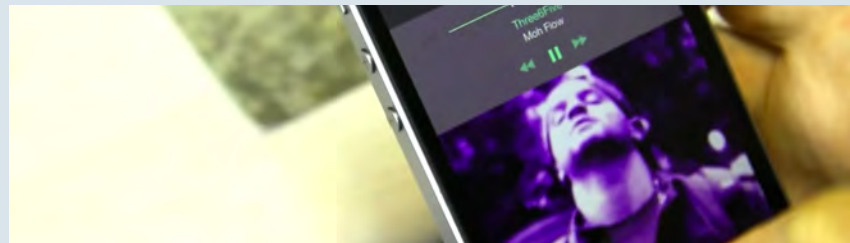




Altering how artists and audiences reach each other

Live Events

Keith Lawler



Bringing Live Events to You

The idea for Firststage – a self-funded venture using AR to create a “virtual stage” on anything from a tabletop to a street corner – first came to Neil and I when we were both living in Dubai and working for advertising agency Saatchi & Saatchi.

Then we started thinking about it and thought ‘Wouldn’t it be great if an Irish band could play in Dubai? Or an American band could play in China, or wherever?’ Emerging bands (without the money to tour worldwide) can now do that through a virtual stage. You can get loads of exposure, use the power of playing gigs and connect with people who really want to discover great music.

With Firststage, fans can buy the exclusive Firststage track that the artists have recorded, or simply act as patrons of sorts by donating a few quid if they like what they hear. All of the money will go directly to the artists and there’s an incentive for fans to be generous, too; as they donate, they will be rewarded with Fan Points, which will allow them to buy music, get onto guestlists and other similar rewards.

People have asked us, “Why are you spending so much money recording these artists – can’t you use a YouTube video or something?” But

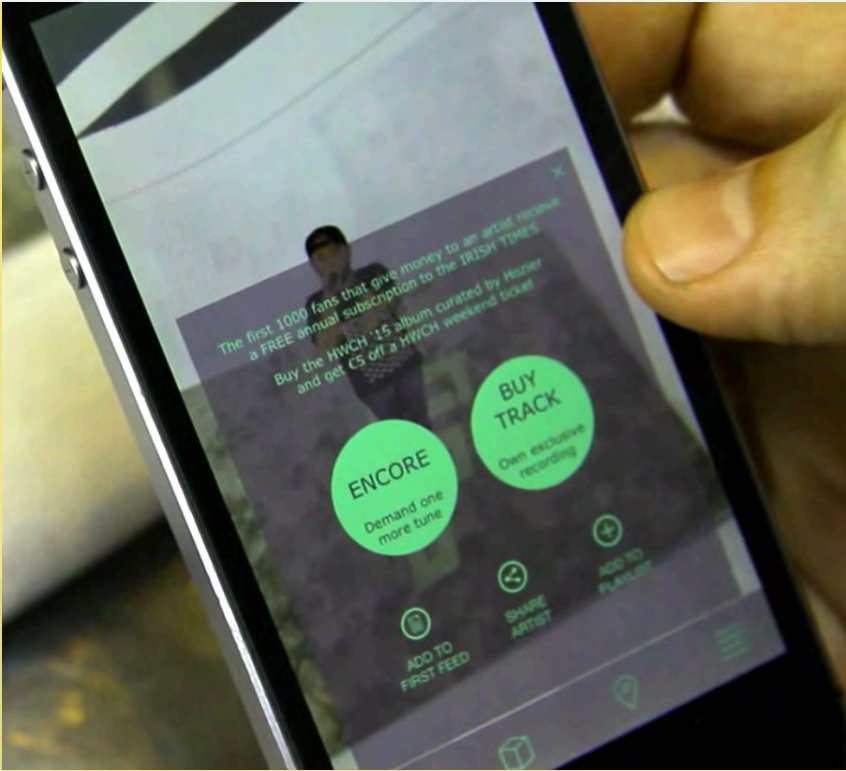
that’s not what it’s about. It’s about giving artists an opportunity to show how talented they are, and fans an opportunity to see exclusive content.

We wanted to make sure that it’s not just a track going up there, that it’s a performance. It makes the content that’s on Firststage exclusive; you won’t be able to hear those versions of the song anywhere else. It should feel like a gig that you’re looking at. It shouldn’t feel like you’re watching a YouTube video that you can watch on your laptop. Once you’ve got the buzz of a live gig, you can maximise that with extra content. We’re looking at using gig posters or flyers as a portal, where people can scan the logo and watch extra performances. We’re still in the early stages; until we work with artists and find out how they want to use it, it’s wide open.

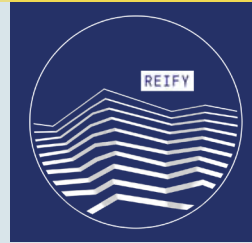
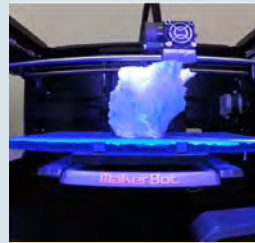
Currently, we want to expand Firststage to cities around the world, allowing people to see performances by emerging Irish bands on virtual stages in Australia, or emerging German bands in Los Angeles, or emerging British bands in Brazil; you get the picture. There is scope for corporate branding, too. A beer brand could do a festival on their

beer bottle. It’s a really good way to sponsor emerging talent and get involved. Once that takes off, we want to roll out the second stage of the app, Firststage Live, which will be used with actual live performances by artists.

You have to question yourself; go, “Are people just going to see it as a fad?” but you’re always brought back to the point of it, which is that we’re doing it for the artist, so how can we make it work for them? If it’s just about a piece of tech, people will get bored of it. That’s what’s great about the content. You’re normally wowed by a bit of technology, but then you’re going “Who is this? What song is this?” That’s exactly what we want.



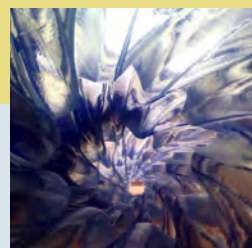
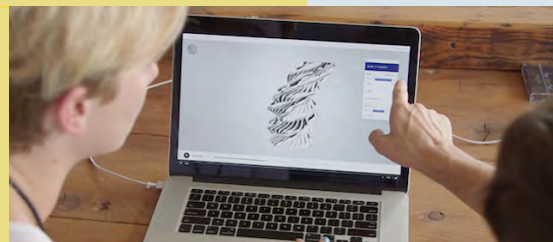
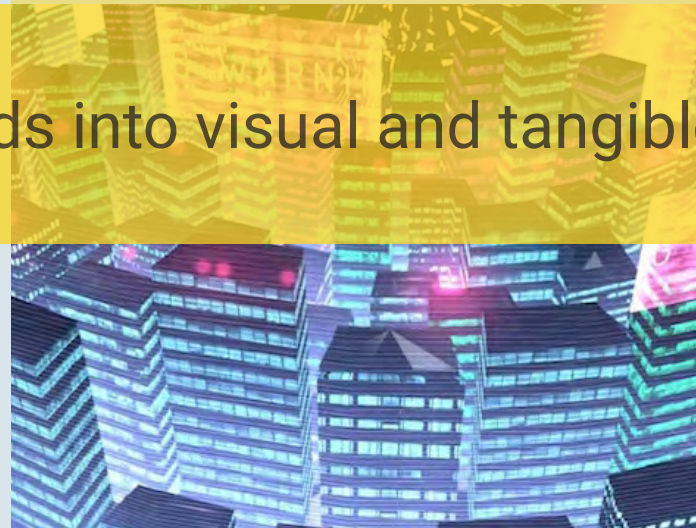
Keith Lawler is a former drummer of the band Giveamanakick and co-founder of Firststage, an app that connects musicians with real music fans by bringing live recorded performances to mobile devices and amplifying the artists across thousands of virtual stages.



Transforming sounds into visual and tangible experiences

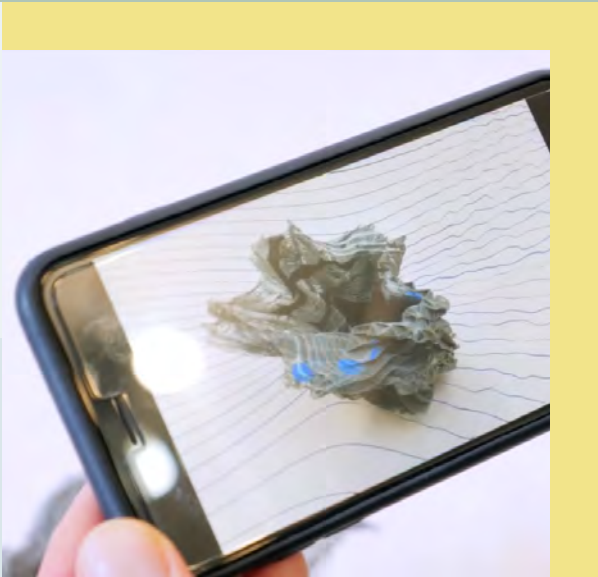
Music

Allison Wood



From Songs to Sculptures: Making Ideas Real

By definition, reify means “to make real”. And the only reason I could make this project real and become the CEO and co-founder of REIFY was because I took the idea out of my head. I talked to people about it. It’s all about taking ideas in your head, saying them out loud, and being surprised by the community around you and finding others that might also be interested in your idea.



I love the idea that there’s no such thing as a lone genius. Now, I’m certainly not calling myself a genius, but we often think it’s just one person who had this amazing idea. But to actually make something real and get it out into the world, it requires a ton of collaboration and action. Even with something that’s as complex as REIFY, we can do it because we have an awesome team of people working on it together. Together, we were able to create software that allows you to take music, run it through the program, and produce a 3D sculpture inspired by the sound. And, the great thing is, the steps you can take to get started on your own journey are simple ones:

Tell a Friend

Just put an idea out there. It can also be these crazy big dreams like “I want to be a fashion designer” or “I want to end world hunger.” Just expressing your aspirations to one other person makes you accountable. Now, that person knows something more about you,

and you’ve given them permission to say something that they want to do, encouraging more great ideas.

Find Supporters

If you’re really passionate about something, find other people that are really passionate about it, too. Once you start having that conversation, like-minded people who are ready to take action start to come together.

Ask Questions

Find people that know more than you do about the topic you’re interested in and ask questions. I’m young, but I’ve been able to build REIFY up because I surround myself with the most experienced, capable people I can and I ask a lot of questions. A huge part of making an idea real is being brave enough to say that you don’t know something and that you need help.

Ignore the Naysayers

When I first started telling people about REIFY, I definitely encountered people that told me “This doesn’t make sense” or “People don’t want this software”. But at the same time, I also found a group of passionate, incredible people that were asking the same questions

I was. You’re always going to be faced with people that don’t quite get it, but you just have to push past those people and continue on with what you believe in regardless.

One of my favorite non-profit groups, I Am That Girl, encourages young women to turn self-doubt into self-love through peer groups. One of their main messages is to tell girls, “Go be the badass that you are.” You just have to remind yourself of that. Tell yourself: “I’m a badass because I took an idea out of my head” or “I’m a badass because I asked for help.” I think it’s a really important thing to own.



Allison Wood is a co-creator and the CEO of REIFY, a software and product company that transforms sound into something people can see, sculpt, and hold, and transforms said sculptures into multi-sensory experiences with music and visuals.



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