

Between Engineering and Art *with Rob Gorbet*

Sarah Bonnemaision

Can you tell me a bit about your research process, what your hopes are, and what you would like to grow from your research?

Rob Gorbet

I consider myself to be first and foremost a collaborative researcher, rather than a strong, independent research leader. I help other people drive their projects. I sometimes find myself in a strange situation as a stream leader. I think there are stream leaders in LASG who have a very clear idea of where they want to go, and they're going to drive that project. My stream is specifically about education and the interdisciplinary work. It is more of a meta stream than the actual making of Living Architecture. I'm very interested in the projects that can bring LASG into the mainstream in terms of language and understanding and awareness,

and bringing it into the educational domain mainly as a way of helping people think differently about creativity and problem solving.

One of my main collaborations through LASG has been with Lucinda Presley, who is an educational designer and consultant from the United States. One of the big things in STEAM, K12 education and 21st century competencies is teaching creative thinking and problem solving. We know that it helps to have a context in which the answers are unknown; the more our context is understood by the students, the more they fall back on prescribed answers to problems. The definition of creative thinking is to be able to be in a familiar context and yet think about different things. That can be difficult for student novices.

The advantage of the work that we're doing at LASG is that it's multidisciplinary. Not only can we provide a context for students to exercise their imaginations in ways that they haven't really thought about before, but we can also tailor the workshop in a particular classroom to whatever standards for art and sciences the teachers are trying to target. For example, we can talk about electricity and actuators and electronics and movement; or we can talk about biology and mechanisms or chemistry. The fact that we can tailor a presentation to the specific learning the teacher needs in that classroom makes it a very powerful tool.

We've also incorporated a number of other partners including TDI - the Toolbox Dialogue Initiative - who are interested in the sort of overarching dialogue on how disparate groups work together.

Do you ever go into art classes?

We haven't been specifically in art classes. But we did a school in Waterloo where the art and science teachers came together into the science class, and we worked with both curriculum standards.

Lucinda has an Art History background and teaches Art History in Texas. One of our goals is to incorporate the idea of form, space, line and balance and some basic art concepts to say that art doesn't have to be a painting. Art can have electronics in it, and it can be interactive. So that project appeals to me on many different levels.

That's very appealing. This might be good time for you to share how you fell in love with interactive arts.

I come from an engineering background. I am an electrical engineer. I studied in electrical and computer engineering at Waterloo University. I did my Masters and PhD at Waterloo as well; and then I did a post-doctoral fellowship at the University of Toronto.

I got hired at Waterloo in 2000 as an Engineering faculty member. Along the way I had some small experiences and connections with art and culture.

From the age of 12 to 14, I lived in Paris. My family drove me around and we saw lots of museums, churches, and other cultural things. I think that appreciation for culture and even diversity was probably a dormant influence. I studied four different languages when I was there. In addition to French, I also studied German in Grade Six, Seven and Eight. In Grade Seven they added a dead language, so I started taking Latin. Then in Grade Eight, I started taking Russian. So by the time I was 14, I was an Anglophone bilingual in French, studying in French, studying through my third year of German, my second year of Latin, and my first year in Russian.

But all this to say, when you were young, you were already able to think in different modes.

That's right. In hindsight I think it had a bigger influence than I knew at the time. Others might think differently, but as an academic I don't think I fit the traditional model. I am much more interested in teaching than research. I don't drive my own research agenda; and that would be how I first got introduced to the art world as a contributor.

In 2000, Ernest Daetwyler, a Swiss artist living in Kitchener, was trying to design a sculpture for a festival in Switzerland. The sculpture consisted of two big satellite dishes that would rotate and communicate across a canal by blowing soap bubbles at each other. Daetwyler had taken off the receiver part of the satellite dish and built this extension with a half-moon shaped dish and a disc that rotated through the soap, and fans that would blow soap bubbles. But his motors kept burning out and he needed help. He exhausted all of his personal connections before he called the University and somehow ended up at the Dean's office. The Dean said, "Oh we've got this new guy Gorbet. Let's ask him if he would help!"

So I did! I sat down with Ernest and in a half a day I did the calculations and found some motors with the right gear ratios and voltages. That was where I first

got this feeling that what for me was an average problem to solve, was magic for him. It allowed him to bring his creation to life.

After that my brother, Matt Gorbet and sister-in-law, Susan moved back from California to Toronto to have a family in 2001. They came out to visit me here during CAFKA (the Contemporary Art Forum Kitchener and Area). The idea of CAFKA is bringing art outside of the rarified space of the gallery into the street and public spaces. We went to visit CAFKA over at the Kitchener City Hall.

In 2002, they had a call for proposals on the theme of “Power to the People.” Matt, Susan and I put in a proposal called *P2P*. The piece was about questioning the role of central oversight in communications and the extent to which that was important in a society. It was during the rise of Napster and file sharing, and the accepted practice was centralized.

But were you questioning the practice?

Yes. But I think the practice was centralized simply because of mass communication networks. This was the beginnings of the Internet. Mass communication in the way that we know it now didn't yet exist. The proposal was grids of light bulbs and switches that looked like a marquee, which is a canonical icon of communication. And you could put whatever message you wanted up.

P2P literally means “bringing electrical power to the people” but also kind of this power of communication and those questions of centralized oversight. The jury loved the piece, but they didn't want it to be indoors, which the original design was. They wanted to be outdoors and to be twice as big. That meant it had to be waterproof without changing the way that it looked. We wanted to use standard household switches that would be inviting to people.

Would you say that the piece was the first one where you really tangoed with the interactive part?

Yes.

So in a way, that was sort of your first kiss.

Certainly! It was the first work that I was directly involved in the creative side, and the creation. It also exposed me to another part of interactive art. My experience

with Daetwyler taught me how amazing it was to collaborate with somebody and contribute to the project something that no one else could bring. *P2P* taught me how impactful a well-designed interactive art experience can be on the visitor.

Interactive art doesn't really exist unless somebody is using it. We would stand across the street from where the piece was installed and just watch people use it. We talked about people as the medium. In the same way that a sculptor understands clay or a painter understands paint, an interactive art designer needs to understand people.

Over the last decade we've learned about making interactive art, and things that psychologically and socially empower people to use the piece without instruction. The piece was up for ten days; and there were people who fell in love with the piece. They brought people to it and also protected it from being tagged. One night there was a group of punks hanging around the piece. Matt and I crossed the street and started engaging them. They all said we basically gave them what they wanted - an opportunity for them to express themselves. So why would they tag it when they could put the tag up on City Hall? *P2P* was where I first saw the impact on the individual.

Fast forward a couple of years. In 2005 Matt, Susan and I got a commission for piece called *Solar Collector*. It is an architectural scale interactive outdoor sculpture. That's how Phillip found me - from an article about the commission. At the time, I was doing research on shape memory alloys: novel engineering materials that the automotive industry was interested in harnessing. I was literally making better door locks for cars by figuring out how to make more them behave more predictably when it's very cold out. I had a big grant from General Motors and five grad students in a lab. On the one hand, there I was making better door locks; on the other hand, there I was making interactive art.

You can tell which one shifted the balance. So I spent a lot of time working with Phillip. The first piece that we did together was *Implant Matrix*, predating the Hylozoic Series. The first Hylozoic piece was *Hylozoic Soil* at the Montreal Museum of Fine Arts in 2006. That was the first big piece that I did all the hardware design for.

So we understand now some of the roots of my interest in interactive art. In 2004 *P2P* got an award. I was at the Award reception with Matt and Susan when Bruce Taylor, the Chair of Fine Arts at Waterloo approached me and said we should

really do a course together. So we designed this course, and he went to my Chair to get me permission to start this tech art course. We put ten upper year engineering students and ten upper year sculpture students in a class together. Bruce, who is a sculptor, co-taught the class with me. We were both at every lecture. Some of the most interesting content in the course was unscripted dialogue between Bruce and me at the front of the room.

And that's a creative part, isn't it?

Yes. The way my perspective as an engineer/artist and his perspective as an artist came together was fantastic!

The course also gave me a whole lot of tech art projects to work on. They weren't mine, but I could help debug and help them come to life. In the process I started to get fascinated by the dynamic between the artist and the engineer. I started doing research on Billy Klüver, who in the 1960s was an engineer at Bell Labs. He knew people like Andy Warhol and Robert Rauschenberg. He started EAT, Engineering Art Technology, which was like a matchmaking service for artists and engineers in New York City. They had culminated in this show called 9 Evenings at the Armory where they brought together artists and technology people to create these interactive experiences. It was an enormous critical failure because it was like nothing that anybody had ever seen before. People were playing tennis and sound was moving around the room, but they were inventing the systems for doing distributed sound in space. So many of the things that we know now were invented as ways of helping artists achieve their visions that didn't exist.

Why was EAT a critical failure?

I just think the majority of people didn't get it; they thought they were doing really weird stuff. "This isn't art." "What is this stuff?" But it's like when the Impressionists started out. The critics said, "Well, that's not art!" because it didn't follow the rules.

I started reading about Billy Klüver and we started teaching the history of technology and art in the course. That was when we wrote a paper asking, "What can we do as academics when we're trying to build educational contexts to bridge across really disparate disciplines?"

A lot of people will argue that art and engineering are not that far apart; and in some ways they're not. They're both very creative acts with creativity at the core. However the context in which you're doing it can be very different. We talked explicitly in the course about navigating the stake and the expectations of the participants. For the engineers this was just another project course. But for the artists, they were building a piece that could be the most important work in their portfolio. They needed it to work, to look good, and to last beyond the collaboration.

It's very interesting. I had asked you earlier what inspired you the most. It sounds to me that Klüver might have been your model.

He was sort of a pioneer. I never really thought about him as an inspiration but more like a reference. There are other people too, but Billy Klüver is probably the closest. For example, I'm fascinated by Sol LeWitt's *Wall Drawings*.

If you don't know that series, the idea is that Sol LeWitt never actually executed any of these drawings. They're more like instructions on a one foot grid: "Put dots at the corners and draw blue lines, half of them wavy half of them straight." When different people execute, it's a different vision. The idea is of disconnecting the creation from the execution, and in the process of doing that allowing other people into the process. If you're going to sell a Sol LeWitt, what are you selling? Is it the execution? Or is it the instruction? What's valuable about a Sol LeWitt? Is it the napkin on which he wrote the instruction? I find that fascinating.

How does that connect with your interest in people participating and engaging with the work?

It's a different kind of participation. These instructions come from the artist, but there is a group of people executing. I wonder whether in history there is an example of mass public execution of one of these *Wall Drawings*. Or whether it's always the gallery that gets a gallery guest or some volunteers to do it.

In pictures I've seen, it looks like there were a number of people.

It's often a number of people but usually it's in a gallery. I don't think it's the general public. I wonder whether any of his pieces have ever been executed *en masse* as a general public thing.

Did he say it should only be executed in galleries? Was that one of his instructions?

I don't think so. Not that I know of.

It questions authorship, doesn't it?

Yes. For example, Bill Reid, who was a great Canadian sculptor, had Parkinson's at the end of his life and couldn't carve. He had an army of apprentices to make Bill Reid sculptures and the artists were never credited. There's a long history and lots of examples of this sort of apprenticeship model. LeWitt is a little bit different in that it's different people executing every time. It's not like he's cranking it out in a studio. It's not really the apprenticeship model because you don't have the same person learning and building a craft. I think this apprenticeship model and craft is seen a lot in architecture as well.

That's what I was going to say too. You cannot possibly be an artist in architecture because you need all those people to do the studio work.

That's right. This is where I think that Philip is not an artist, he's an architect! I've seen it most concretely in my work with Philip when we visit any city in the world and we can drum up an army of 15 to 20 volunteers to help us with installation. I think that is owed to this culture of apprenticeship putting in time and working with the master.

I think that whole thing about people's involvement and what they contribute could be really interesting to tease out more. It is like being behind the scenes and it's really fascinating.

I think that there's a balance to hit. It has to come together as a unit, and the design needs to be flexible enough to accommodate the different ways that people are putting things together, so that people don't get frustrated by the rigidity of things. Instead of having to be there for days and become an expert, multiple people can contribute for brief periods of time.

The learning curve has to be short.

In order for that to happen, the whole that comes together from the collective needs to accommodate variability.

You know I'm really interested in organicism. The philosophy has two elements that I think are relevant. The first one is that you create something that has unity. It's not about doing networks that are spreading or reproducing throughout the world. It's about creating a thing at the end of the day.

The second one is learning from nature. Different systems work at different levels of complexity and they're all interdependent. Each one is embedded one into the other. Because the organicism is a way of inventing and creating it, it's not about interpreting what exists but about creating something new.

Your contribution to Philip's work is to create clarity on how those different networks work. Maybe some of them are friendlier to have people come in and do things, while others are to be left alone. Some of them have to be preconceived, so that unity can happen.

I get excited about people collaborating and making a thing together. Often large collaborative works get pieced together from bits, like a community mosaic. And it's wonderful that people have come together and they've created something; but it doesn't have integrity.

Yes, it doesn't have unity.

I definitely think that integrity or unity is important. It's what is going to distinguish and allow the message to rise.

Yes, when the viewer interacts with the piece, the unity will help them get it. If not, then all they get is a mirror of that community, which is fine. The community expresses itself. But if we want another message or something that connects to art, it is a bigger task.

This idea of layers is very interesting. Earlier I was talking about the importance of interface design in interactivity. Too often you see particularly with interactive art, the experience for the visitor is that they come into the gallery or the museum or the space, they push some buttons and some stuff happens; or they wave their hands and stuff happens. The goal becomes for them to try to figure out how to play the piece. And they figure it out and then they move on. They never make it to the point that the artist was trying to make. So I think of it in layers. The artist has this conceptual layer: a message that they want to send, or an experience, or an emotion they want to transmit. But then there are other layers: the

technology layer and the interface layer. And those can be too thick, making the conceptual layer, the whole point of the piece, inaccessible to the vision.

I've had people in the technology art world, artists, come to me and ask, "Is it possible to make good technology art?" Because they've seen these pieces that are all about pushing the button and learning how to play the piece. And I think, "Absolutely, it is!" But it takes good careful interface design.

It's the hardest task because you're inventing and creating something new. It's not like you know if people are interacting with something they already know. Part of it is going to be new and that's the excitement. But the question is, how fast can you bring them to that new part so that they can really groove on the higher level?

I guess that's one way to think about it. But a really well thought out design, unless it was absolutely not possible based on what you wanted to do, will actually have people interact with it in ways that they already understand in order for the interaction to not be the focus. *P2P* is a great example. When we had to move the piece outside, the easy thing would have been to move to waterproof switches. But waterproof switches are very industrial and they're not inviting; they're intimidating. People would be looking at this big thing and asking, "Am I allowed to touch it?" So it absolutely had to be the normal everyday wall switch, which is not waterproof. That meant that I had to redesign the entire electronics so that it wasn't high voltage, because they could electrocute themselves if it rained. It was critical that the interface be simple and obvious. By knowing the psychology, how do people interact and affordances... you know the term "affordances"?

Not really...

It comes from a designer Donald Norman. He wrote a book called *The Design of Everyday Things* where he talks about several different dimensions that are characteristics of good design; one of them is affordances. The idea is that the thing should communicate to you how you're supposed to use it without instructions. If you have to put a sign on it then it's failed.

Do you feel like you're contributing that to Philip's work?

I don't think so. We have never really talked about the physical design on that level. Right now the kinds of interaction that people have with our sculptures is just that they walk around. Hence, the question becomes, you know, the

placement of the sensors in order for them to have an experience that makes sense to them. Also in our work, we're trying also to accomplish this sense of mystery. We don't want people to understand how it works.

But you want them to experience it. You don't want them to just walk in, take a peek, and then walk out.

That's right. But I would rather they not know where the sensors are. Otherwise it becomes a game of, "Oh, there's a sensor!"

I think it's about being clear. But again with that unity, what are the goals? Is the goal about mystery? Is it to bring people in and experience it? So that they have enough time to feel embedded in this mystery.

That's right.

Earlier you were asking what our motivations were. There was one memorable experience that launched a whole sort of range of inquiry for us. At the 2010 Venice Biennale, we exhibited a series of columns that were hooked together with the sensors at the bottom. On these columns, there were 12 fronds that would raise up in sequence as you walked past the sensor. The sensors were not really hidden, but the intent was that they'd be far enough disconnected from the movement that they weren't obvious.

I was watching this one elderly Italian gentleman. He was leaning on his cane and he was walking through this thing and he stopped. He knew that they moved and he had understood enough about it that he knew that they moved in response to people being in the space. So he was waving, clapping, trying to figure it out, but it just would not move for him. Because he wasn't triggering a sensor.

Because he wasn't moving around.

That's right. And he got frustrated. As he turned to walk away his foot brushed in front of the sensor and one little frond moved. He turned back and he wagged his finger at it. It was just like they were anthropomorphizing the sculpture - it was the coolest thing!

People talk about it as having emotion. They talk about it as being scared or angry. Dana Kulić has launched a whole thread of investigation on how people

detect and discern emotion in movement. What could we do to intentionally convey certain emotions in this sculpture? Could we do anything or is the interpretive part of that movement so varied across people that there's no way you could communicate in a uniform way?

I've been speaking with Adam Francey, an electrical engineer, who has developed sensors to pick up emotions on people's faces in a very elegant way. It doesn't go inside; it is like little things that stick on the body. I thought it would be very interesting if he would bring his gear and do some testing on people. Francey can then help us to interpret the data of what people feel and so on.

That's very interesting to me. One of the objectives of the Toolbox project is to look at the difference in people's experience of a sculpture and if they've had a dialogue about it first. Depending on how much background they've got and whether they understand the conceptual basis for it, do they experience it differently? Part of that might be how they react to it emotionally as well.

Then it would help you to get data that is raw and unfiltered, instead of a series of questions.

Maybe. But part of the goal is that we can start taking advantage of the existing test beds in Salt Lake City.

We know that sound, music and color influence emotional state. One of Colin Ellard's early studies was, "Why a walk in the woods is calming?" In his lab he got a virtual reality simulator where he designed an environment that you could walk around in. He would measure your heart rate, skin conductance and all the autonomous nervous system signals. He did a controlled experiment where he gave people the same stress test ahead of time. For example, counting backwards by seven from a thousand while listening to heavy metal music. Then he put them into the simulator and charted their relaxation curve with and without the wind turned on. With the wind turned on, they relaxed faster, statistically speaking.

So it's not windy like a storm.

No. It was just a breeze. The speculation is that visual noise such as the leaves moving and the branches moving can unwind your mental state. The same way that some people fall asleep listening to white noise on the radio. There's this visual noise in the periphery that fascinates me. So there's the idea that

movement also, and why not, can influence our emotional state.

I totally agree. But it's not just anything moving because when you're on a busy road, a movement of the car is unnerving.

That's right. But the movement of a busy car is not noise. If you think about the musical equivalence of the movement of a busy car, it's very rhythmic and it's very fast. Whereas the leaves, they are much like the static on the TV screen.

So it's a quality.

I would speculate that if we were to translate the car that is going by into musical sound, it wouldn't sound like white noise. It would sound like some kind of rhythmic something.

Yes, it feels more aggressive. Do you think the kind of movement you and Philip are trying to generate is more like the leaves moving?

It depends what we want to try to accomplish. If we want to calm people, I would argue probably that's what we should be aiming for. I'm not sure that we want to calm people. I mean I'm much more interested in trying to figure out how we could convey a range of emotions. Maybe one day we can read somebody's mood and temper or modify it.

We met some Health PhD students at the European Graduate School in Switzerland. I think they would be really interested in researching this for mental health and therapeutic potentials. Some of them could participate in those experiments then try to interpret the results. The work I've done on responsive environments is really aimed towards making more healthy environments. I had this sort of pragmatic aspect despite my love for the art. But as an architect I feel it's a possibility.

As an engineer I feel that too. I love doing the work that we do with Philip. These big pieces that ask big questions take a lot of work to put up and then watching tens of thousands of people go through.

In 2010 I left Engineering and moved to a new program called Knowledge Integration. I had some new courses to teach and I became the Chair of my program. There are a couple of different threads that we're pursuing. One is working

with TDI to test people's reactions to the sculpture, with Lucinda thinking about going into the classrooms. And it's tricky to figure out how to do it right. Because we've done a few, five or six different interventions in three or four different schools. And it's tricky to learn from the students. Because we're extensively measuring things like their ability to think creatively and solve problems - which is difficult to measure right without a very large sample population. It's hard to draw any conclusions about the impact of our work. Was it the workshop that we did? Or was this particular group of twelve kids just more creative? Was it something that the teacher did two weeks prior in class that primed them to be better at doing this? Or is it the fact that it's Waterloo Canada versus Salt Lake City versus Texas?

The way to deal with variables like that is to have very tightly controlled situations, which we can't in the schools, or to have very large sample populations where all of the variability averages out. And we don't have either of those things. For me it's very frustrating.

Do you think maybe the question needs to be refined?

I do. But I also think that no matter what you ask, it's going to be very difficult in that context to do anything more than anecdotal. You have no control group. Maybe with a better study design...

But could it be helpful to maybe have a small group and over a longer time?

It could be, and it'll tell you different things.

It seems from what you're saying that it's self-evident in a way that they are going to feel creative. That's why I am thinking a question needs to be asked there.

Yes. There's something else that I'm very excited about. Trevor Haldenby has proposed to do science fiction prototyping. He would get people to interview LASG members and write some speculative fiction about the future of architecture. It serves two purposes. One as a way to help us as a group reflect on what we're doing, so there's an internal kind of reflection that happens that is a process.

So fiction is actually writing stories?

Yes. There's a guy at Intel who started this idea of science fiction prototyping using narrative and storytelling and allowing the brain to go outside the realm of the possible to think about what could be.

It's a huge tradition in architecture - think about utopia! By definition architects draw something that will happen the future. It really started big during the French Revolution in the 18th century when they wanted to try to imagine another world. So architects and urban designers would draw up these amazing cities and buildings. And they used them as sort of motivation for what we could do. To have people dream of the future.

So, we're connecting to the origin of smart cities charettes.

I think that's one of the big things that distinguishes architects from being just builders—being able to imagine something that doesn't exist.

Yeah, that's a really interesting way of putting it. And then the other goal of that is to actually produce a story that uses the language of living architecture and might then be out in the public to help disseminate and make that connection to our work.

Formally trained as an electrical engineer, Rob Gorbet is an interdisciplinarian, a mechatronics specialist, an award-winning teacher and a technology artist. Rob's teaching has included courses on the profession of engineering, microcontrollers, robotics, control systems, technology art and museum exhibit design. His engineering research involves the design of actuators made of Shape Memory Alloys (SMA), for everything from car door locks to subtle next-generation actuation systems for responsive architectural environments.

Rob is a key member of Gorbet Design, a design firm and consultancy specializing in public interactive artwork and experiences, and also collaborates with other designers, artists and architects. As a Professional Engineer and Associate Professor, Rob Gorbet chairs an innovative integrative curriculum development and technical research program in computation and mechatronics at the Department of Knowledge Integration, University of Waterloo. An award winning teacher and artist, Gorbet's unique interdisciplinary expertise includes knowledge integration, mechatronics and complex interactive systems. Gorbet leads the Interdisciplinary Methods research stream in developing conceptual paradigms, curriculum models and design methods.