

Art in Human-Robot Interaction

Transcript of the Human-Robot Interaction Podcast Episode 6. Published on 18 April 2019 by Christoph Bartneck at <https://www.human-robot-interaction.org/2019/04/18/art-in-human-robot-interaction/>

[00:00:00] **Christoph:** Many disciplines contribute to the success of human robot interaction. Computer scientists and psychologists are amongst the most frequent contributors. Teamwork is often a challenge, but collaborating across disciplines, it's a layer of complexity to the dynamics. Today, we're going to discuss what and how art can contribute to human robot interaction.

[00:00:28] This is a Human-Robot Interaction podcast. I am your host, Christoph Bartneck.

[00:00:45] Robots have been used in the theater, exhibitions, comics, and music to name just a few. Here's an example of a robot that collaborates with musicians.

[00:00:55] **Guy:** The main project was when I was a postdoc and Gil Weinberg's lab at Georgia Tech. The robot was a robotic musician that played the marimba, which is this was in xylophone, like large ones xylophone. I started there. I came from a Human Robot Cooperation lab. That's where I did my PhD in and Gil Weinberg told me can you make a musician to collaborate with a robotic musician to, to play jazz?

[00:01:20] I thought it was a really interesting problem because I used to play piano as a kid for many years, and I played jazz while. So my name is Guy Hoffman, and I'm an Assistant Professor at a Mechanical Engineering at Cornell University. And I thought that music is a really difficult challenge because generally people are quite forgiving to small errors here and there and the timing and the action of robots. And they don't expect robots to be perfect. But the music you have really know. And so I thought it would be a really interesting problem if you enrolled with operation to try to make a musician that plays jazz with you. Up until then all the, there were other people who've worked on robot music.

[00:02:02] And, but all that work was set up in this column response pattern where the human would play some music and then the robot would analyze it

and come up with a response that was somehow influenced by the humans playing. And in a way, this is also where most of HRI was at the time. So people, would you say something to the robot responds to you.

[00:02:22] And I thought that when music is really amazing is when everybody. To harmonizing together, everybody's playing their part. And it's just this ensemble that is almost like magic. And I thought that the challenge I wanted to set to myself with this project is to have the robot play with you while it's learning from you and adapting to you at the same time.

[00:02:43] So that there would be this back and forth interaction. This is what I spent almost two years on after that moment.

[00:02:50] **Christoph:** The creation process requires artistic engineering and social skills. And hence artists and engineers work together on these projects. There are two types of collaborations.

[00:03:02] **David:** My name is David. I'm currently a postdoctoral researcher at Polytechnique Memorial in Montreal, Canada. But I'll be starting as an associate professor in two months at Ecole de technologie superieure. So another University in Engineering, in Montreal, I published a couple of years ago, a paper on conference about the different types of collaboration you can have between engineers and artists.

[00:03:30] There's, let's see. Two big category, classic category that we often see either you're hired by an artist and then you're implementing the artist needs in terms of technology or you're collaborating with the artists. And then together you're creating something that serves both realms. So for a long period of my career, I was more into first part.

[00:03:51] So as a freelance, I worked with many artists developing what they needed, the technology that they needed for their artwork. And then when I came into university, I slowly decrease the amount of those contracts in my schedule to give more place to other kind of artistic collaboration that would serve also my research. So all that the current project that I'm working on also have great contribution to mechanical engineering or interaction design, but I'm still working with artists and we're collaborating with all the artists I'm working with.

[00:04:24] We're collaborating together and creating something new. So obviously when we start, there is a concept most of the time coming from the artists and there's a research interest from my part. And we're trying to merge that together and to walk together into the design and development path until we get something that satisfy us both.

[00:04:44] Obviously there's a many possible artistic project that do not require new development of technology or new design of interaction if I speak for my own field. But since a couple of years I'm referring those two colleagues that are working in that area, not researcher, engineers that are working into that area.

[00:05:04] And I'm really more focused on the project that I see contribution for HRI or robotic community in general. The two types of project do exist. It's a matter of which one you bake. There's really a lot of artists out there looking forward to collaborate with the engineers and to push the boundary of what technology is currently able to do.

[00:05:26] And so some of them, it's just a hack of what is available, but a lot of them is really to push forward to technology and something that the original designer of that particular technology, for instance, never thought of, or to create something completely new that nobody thought of because they're having a completely different perception, at least in the field of robotic.

[00:05:47] Again, they're adding a completely different perception and angle on the use and the relevance of what we're doing. And also anthropomorphic attribute and form and shape. And the aesthetic in any case, that's a kind of perception that we don't have as engineer. Classic engineer, let's say we don't have, at least that is clearly not part of our courses academic curriculum.

[00:06:10] Just having this perception. Most of the time makes them see things in the current technology. That seems for many people obvious, but were actually never thought of. In terms of application usage, but implementation also. So anyway, all that to say that there's different kinds of artistic projects and are in collaborations, some of which will lead to contribution in our field.

[00:06:35] Some other that will not lead to contribution to our field, but just to the art realm. So it's basically to select which one you as an engineer or researcher one to participate with. I'm still doing a couple of project that do

not have direct contribution in research, but I just find them really interesting, really intriguing.

[00:06:55] I think that by doing those other projects that I'm not seeing as a potential contribution or publication or worth of publication in our field, I think that they still inspire me some ideas for my other project. It's always a win-win situation.

[00:07:12] **Christoph:** I'm not sure if it is always a win-win situation, the collaboration can be challenging because of the world views of engineers and artists can be different.

[00:07:23] **Guy:** Computer scientists and artists think very differently about the world. Computer scientists, they love things that are separable into modules, discrete, and they love the divide and conquer approach. I think it's because computer science comes from a history of mathematics. And there's a saying that mathematician thinks about a problem and in terms of some problems that can be solved and then they stack together.

[00:07:48] And the same thing with computer scientists is it's often thought that you try to formulise problems as discrete problems that can be separated into different components and that have some kind of a step by step fashion to that. And any computer science students will learn very early on that you have a program.

[00:08:08] Counter or program pointer that moves step by step through the algorithm. And I think instead musicians and other artists, they have a much more, a bigger appreciation for holistic views of problems where you are. You understand that you can't separate things from each other. You can't say, okay, this is, you can solve this and solve this.

[00:08:28] And then just solve the combination of the two. The combination of the two is in itself, the biggest problem, and this is one thing. The second thing is that the computer scientists, as many engineers, they like to model a problem into an abstract formulation of that problem, and then solve that abstract formulation.

[00:08:46] And then take this, the conclusion out, back into the real world, whereas artists, they like to explore and tinker and experience the problem and solve it through their actual interaction with the problem and not

abstracting it away. And I think this is exactly where these two kind of clash and where you have to be very cognizant and what I try to do with this project and other projects.

[00:09:09] And I think this, I think you can learn a lot too. Also beyond music is to try to bring this idea of real time experience and of holistic, tangible solution to a problem to, basically an engineering problem.

[00:09:25] **David:** HRI and Robotic Engineering, you're having a manual that describes you exactly what to expect from this and exactly how it is supposed to work and how to use it; while in art, it's the exact opposite. You have to find your way into interacting. If it's an interactive artwork with it and interpret what is going on.

[00:09:45] Based on your own experience based on your own feelings, based on what you're seeing, who you are. So that's completely different from what were used.

[00:09:53] **Christoph:** At times HRI researchers have both artistic and engineering skills and therefore do not rely on others to realize their work.

[00:10:02] **Guy:** If I can, I would like to say something about how I approached this particular project. And the first few weeks I was stuck. I read about machine learning and AI. And I try to think what should be the best algorithm and nothing came out. I was weeks of no ideas. And then I talked to a friend of mine who was an opera singer actually.

[00:10:21] And she said, why don't you just play with a problem? And I say, what does that even mean? I have a performance in six weeks and I have to write code. So I can't play with a problem, I said, I don't know. She said, I don't know what this means. I'm not a programmer, but try to think that you're four years old.

[00:10:35] And you just got tasked with writing code for an imposition of robot. And she said, and if it doesn't work out, just don't go. I said, interesting. So I went into this improvisational mindset and I started, so I was writing these like very small loops of behaviors and stacking them together. And I started playing around with actual behaviors of the robot by making these like one hour projects. I'm like, what if I can, not like, how fast can I make this robotic arm move? And what what does it sound like? Let's keep this element and say,

okay, what if I just try to see if I take all the notes from this particular key and use their ASCII code as I just started playing around with it and then this is what eventually, it brought me to a lot of, I threw away, 80% of what I did, which is also what artists are very good at doing, and scientists are not good at doing. And I ended up with some four ideas that ended up in the performance, which were all the four of the 80 ideas I have that I programmed in a very quick amount of time.

[00:11:35] So in a way that improvisational mindset enabled me to also do this project.

[00:11:39] **Christoph:** Daniel Kahneman in his book, "Thinking, Fast and Slow" introduced two modes of thinking that he labeled system one and two. This labeling is as non-expressive as it could be. But what he refers to with system one is the fast, intuitive thinking. While system two is the slow logical thinking. Does this dual processing theory explain the difference between artists and engineers?

[00:12:05] **Guy:** I think that they both have to be at play. You have to go back and forth. In the end. I had to get a robot on stage. And there has to be something that detects whether I'm starting to play or not. But I'm a big believer in multi-disciplinary education. And I think the, one of the reasons is that you need to practice both types of thinking.

[00:12:25] When you see artists trying to move into more engineering related art projects, and there's a lot of examples for this and you feel they don't get what a robot is. They stay in this. It's very small achievements in many cases. So I believe system one and system two serves us very well together.

[00:12:42] We are not just reactive creatures that just experience the world and play with it. But you're also, I don't think we can get very far, but just trying to decompose every problem into an abstract model, and then solving.

[00:12:56] **Christoph:** The robots need to be programmed to do anything, really. So what use is an intuitive, artistic understanding, if in the end you must program the robot using rational and formal programming languages?

[00:13:11] **Guy:** So I, I have this recurring argument with my colleague and Chris, cause it was in my department and I kept saying, The beautiful thing about the, one of the four modules of the improvisation robots was that it

wasn't planning. It was just trying to put itself into opportune situations from which it could then react well.

[00:13:31] And she said, that's planning. And I was like, no, that's not planning. This is the opposite of planning. And we keep saying she says, it is planning. It's planning at a different timescale. And I said, no, this is not what planning is. In the end, everything is code and you have to model it at some level.

[00:13:45] **Christoph:** One of the problems with robots is that they have no system one, no intuition, no feeling. Hence they cannot improvise and jam with a musician, but could you code some sort of intuition?

[00:14:00] **Guy:** What I am always trying to do is to try to model, I want to say pretends to be, but something that is inspired by what happens when you're using intuition? I don't think we know enough about how intuition works for humans. I definitely am not an expert on this, but I also think that we don't have a good model of what makes an intuitive person intuitively good at things.

[00:14:19] Just as we're saying. Okay, we're modeling, reinforcement learning as this temporal difference learning, update function, and this is not reinforcement learning. When you teach your dog to sit or some command, it's not the same, but it's inspired by. So I would say if I could do something that's inspired by intuition.

[00:14:36] This is good enough. This is interesting enough.

[00:14:39] **Christoph:** But what makes the collaborations across disciplines so difficult?

[00:14:44] **Guy:** I think collaborations are really important here. You and I have been around enough different academic structures. The collaborations are they run into. Some of the same problems often. And then part of it is that people are very afraid to listen to other people. People are used to, especially academic researchers and artists are used to being on stage and being the people who speak and not the people who listen.

[00:15:05] **David:** To be a bit famous or to have to be in front of the public to defend your own work after a while some people get arrogant out of it. I don't know, but it's clearly not only artists that take that path.

[00:15:18] **Christoph:** Could partners not learn from each other by listening?

[00:15:21] **Guy:** Many artists feel that they could never understand the principles behind AI or behind engineering or behind electric engineering or robotics. And I think that's not correct. And people in engineering and science often feel like art is not serious in some way. It's not precise. It's not something that's.

[00:15:38] So that's a lot of actually psychological barriers more than they are real barriers.

[00:15:43] **Christoph:** The Christchurch Art Gallery recently revealed its latest acquisition. A sculpture by Ron Mueck. It shows an old man in his underpants sitting at a table. He stares at a chicken on top of the table and that chicken stares back. Officials were quick to point out that no public funding was used for the purchase. While the sculpture does not fail to bring a smile to my face, I cannot avoid thinking if the \$1 million spend could not have been used better, helping solving some more important issues. Christchurch does not fall short on critical social problems. The earthquakes and terrorist attack left our community bruised and the mental health facilities are severely underfunded.

[00:16:30] At times, art can indeed be perceived as being less useful or less serious.

[00:16:37] **Mari:** That's why you have to be extremely structural. And I know people think that some sort of this art and design fluffy lovely thing, but which unfortunately it's not, I would love it to be, you have to be methodological. You have to have methodology like the spiral methodology of testing, developing when you put the system, artistic or not, creative or not, into the public domain and you invite, you open up to the public to interact with it.

[00:17:02] It has to be Bulletproof. Otherwise it's a disaster. It's the end of your career. It's going to be another side case of the technology failed. And I remember all these exhibitions in the night, I'm going to ask Electronica from, since I was a student, how many years. Fish-Bird was there for their 25th anniversary.

[00:17:19] And that was in 2003. We have this pressure. That's a very different, that's why for me I don't think to be honest with you, and this is with the deepest respect, that how for experimental arts and amazing paintings culture,

it's a very different the parameters for us to exist, even before I moved to robot, because I spent 11 years of the study center to fulfillment robotics.

[00:17:42] Postdocs in a robotics environment, I can call, I can design. I can do mechatronic design, but the scientific approach is much more different than that. I still have the skill, the tool sets to have enough mechanical drawings. So someone who is expert in the field can understand and do a perfect version.

[00:17:59] But the pressure for us was always, that's what it makes us a different, not better. Not worse, but different. It has to work. And even for the concept to function, even to test the concept that technology has to work.

[00:18:15] **Guy:** I see a lot when I'm in the science engineering environment is that they look at the humanities and the arts as something that is not as serious as science and engineering, whereas having been back and forth between these two worlds, I would say that there's, you can't make this distinction at all.

[00:18:31] Whenever I see somebody who is an engineer and says, okay, I'm just gonna add this like artistic side to my work. They know that there's been 2000 years of history and culture and people are very serious and smart people have thought about these questions long before this particular graduate came along. And I think having respect for the traditions of other fields while also believing that you can actually understand these things.

[00:18:56] I think this is the key. I do believe that anybody can understand in depth, the basic principles of thought in different fields.

[00:19:10] **Mari:** In my talk today, there was a talk, it was about sociorobotics being in multidisciplinary a new area in robotics that it needs everyone, but that doesn't mean that everyone can be a pseudo something else. So I work with fantastic cognitive scientists. I work with fantastic neuroscientists. I'm so excited and inspired by them.

[00:19:28] I work with incredible AI experts, but I know who I am. And my contribution is not in that. For example, Katsumi Watanabi when we were doing the questioning for new robot, it was my version and his version, he especially was so much better. He's an expert. He's been doing that for so many years.

[00:19:45] So I think it's different. I wouldn't have the confidence that shouldn't be communicated, that someone built electronic systems and responsive installations, move through robotics and start analyzing data. That's a very dangerous territory.

[00:19:58] **David:** I was working on voice control flying robots. And we had a lot of issue with surrounding noise. Obviously with the motors and there was a huge crowd around. So the understanding of what the performer was saying was really difficult to parse and to interpret. Showing the result or like the state of the system to a choreographer.

[00:20:20] And he told me why do we need the performer to speak? And I was like that's voice control. So we need the performer to speak and send commands and interpret the commands. And he just told me why don't we as a performer to sing? And that completely changed the challenge. It was way easier to detect the singing because then that was completely different to a lot of background noise.

[00:20:43] It's simplified a lot of the problem. And then, obviously it was something completely different at the time. No one has ever used singing to control a robotic system. Voice, sure, and it's close to voice, but then everybody understand that it's completely different than just speaking. And so we designed a system specifically made to parse the singing for a couple of different performers so that they would control the robotic system with that.

[00:21:08] And it worked really well in many different venue, with huge crowds around in a lot of noise, even bad signals on the microphones and everything. So what I mean by at each step, it's interesting to have their input to try to, get around your problem, get another perspective and try something else. That may be as interesting.

[00:21:26] **Christoph:** Do the reviewers appreciate multidisciplinary work?

[00:21:29] **Guy:** The sad reality is that it's hard to get interdisciplinary work accepted to any conference or to any new journal. There are some journals that are more open to these ideas. I've had the experience that the most interesting cross boundary work that I've done has been rejected several times before it got accepted.

[00:21:48] Finally, my skin is thicker these days, and I know that it's, I see it more as a barrier of openness on the reviewer side than a problem with my own work, which is what I did when I was a student or postdoc. And I think, I always talk to the students. I tell them, if you're being rejected, it's, it can be that maybe your idea just doesn't fit into somebody's specific mindset.

[00:22:13] It doesn't mean that the idea is wrong and this, cross-disciplinary projects take a long time to publish. My experience, and now I can look back at 15 years of experience. I can say they take the longest to publish, but they have the largest impact on the long-term. And I've been trying to continue to work on the improvisation work and I've been denied grants on it every year for a decade because people for say, it's nothing different than dynamic planning, or it's not different than this or that.

[00:22:44] And I think this kind of misses, but something you just learn to accept.

[00:22:48] **Christoph:** Is the review process in art different from that in science?

[00:22:53] **Guy:** This idea of throwing away ideas, which is very much in art and design is it's a staple. That you have to throw away 80% of your ideas. And the second is this idea of critique, which I think is also very much missing in our field. And generally I think in computer science is this idea of that you brought your, bring your work out and then people just tear it to pieces, which is really part of what the hardest education is.

[00:23:18] And again, since I studied in both. I know whether difficult studies are. When you're in art school, you go in with three months of like non-stop non-sleep labor. And an artist will say, has been done a million times. You know what a waste of your time and you walk home, you pack everything up and you go home to cry.

[00:23:38] And then you start, you learn something about this idea of having your work critiques. Whereas here, you send it away. It comes back with some reviews, but this idea of critiquing, I think people can, could really benefit from it. Also outside of art and Zen, I think. This case, I think also artist are of thicker skin because of this, because they know that they have to stand up.

[00:23:56] And they have to defend, working in more of a public setting, and I think there's something about this technique that is very useful and it's not enough to use outside of arts and science and I, from my view,

[00:24:07] **Christoph:** Walking away, crying from a critique does not sound like an enjoyable experience for student.

[00:24:14] **Guy:** And it's not about being mean. It's not like about being like nasty to student. And I'm saying it's about being able to defend your work and abandon your work and have somebody tells you this is, trying to grow your young person. You're trying to become something that's greater than an incremental change.

[00:24:32] And I think this maybe the stakes are just higher.

[00:24:35] **Christoph:** What are the main contributions of art to HRI then?

[00:24:40] **David:** The art is for me brings completely a new dimension, another dimension to those kinds of development. Since I've worked a lot with them. I've start to understand a bit what the, what they can help me with in terms of ideas, in terms of, again, the perception they have on our work and the influence that our work will have on the society, but also on the aesthetic aspect of our work.

[00:25:07] By aesthetic, I really mean like the whole real mauve, the perception of the. Not just like it does it look nice, but all the aspect that a lot of researcher in HRI are digging into. So how is it perceived? Is it really interpreted the way the designer wanted and etc. All those questions in the design of an interaction or robotic system met to interact with human. All of those questions benefit from the perspective of the artist on my own point of view. So even if I was to work on a project that was not meant to be an artwork or that was not involving any artists and many time I bring artists in that, I collaborate on other project and just asking her point of view on what I'm doing.

[00:25:56] Because that triggers a lot of interesting question and that brings forward new ideas and again, new perception on all of our work.

[00:26:03] **Christoph:** But does psychology not already study how people perceive robots?

[00:26:08] **David:** Each discipline brings something. And I don't think the psychologist will bring the same thing as the artist. I think that the understanding of human perception, emotion, and interpretation of what is going on within the interaction, maybe grasp by both fields, but not the same way. Psychologists are obviously closer to science and are more using the methodology that is closer to science, obviously into our own realm. While art is our mower based on the sensibility and most of the time, the process for artists. But again, I'm not myself, an artist, but most of the time, what I understood is that artists will work by empathy.

[00:26:52] So by impersonating the interaction or the situation. And try to round to their own feeling what this triggers and what, how they can explain and explore this. So it's a completely different approach methodology to use. Let's say a more scientific term than what psychologists would do.

[00:27:13] **Christoph:** What does an artist think about the contributions of art to HRI? Here's professor Mari Velonaki from the University of New South Wales.

[00:27:23] **Mari:** Media arts in particular, have the longest recorded history when it comes to people technology and interaction. There's not other discipline that has such long history in such a wildly experimental approach, but it's about people technology and what happens engagement. So to me, the word is experiential experience, engagement, sharing spaces in the case of social robots.

[00:27:48] **Christoph:** David is organizing an art event at the ICRA Conference. But I better let him make the pitch.

[00:27:54] **David:** A huge integration of art that we're doing at ICRA. So it's really we trim the main program that we're bringing artworks and artists to participate to the conference. So it's not a side workshop or a social event it's really we tend to. There's going to be major artworks, keynotes from artists and forum, student exhibitions, all those aspect integrated within the conference at different level.

[00:28:21] So it's going to be spread out to all the venue that you can see artworks and artists going around. So we really expect that the engineers let's say too classical, densify, ICRA will be intrigued and will start discussion with those artists. And that from that will emerge new kind of collaboration and a

more open mind on our community to collaborate with artists in future work and consider those kind of collaboration as good contribution for our community.

[00:28:52] **Christoph:** If you're planning to go to ICRA in Montreal in May, have a look for the robotic art exhibition. Thank you for listening to the Human-Robot Interaction podcast.