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THE WOMEN'S MAKING



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Interview to Ross Stevens

Shujun Ban

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Abstract

Ross Stevens, architect, industrial designer of many mass-produced products – including washing machines (Fisher and Paykel), lawn mowers (Morrison), televisions (Thomson, Saba) and lots of stereos (Perreaux and Plinius) also as a co-owner of PureAudio – and professor of design is engaged to establish a globally recognized design research expertise on multi-material 3D and 4D printing, at the School of Design Innovation of the Victoria University of Wellington, New Zealand. In the MADE lab (Multi-property Additive-manufacturing Design Experiments) students enjoy being free to explore multi-material printing and experiment with new design solutions. Meeting him on the occasion of the last World Industrial Design Conference and Industrial Design World Expo (WIDC 2019 & IDWE) in China, we were fascinated by his way of promoting women's work in the area of new digital printing technology. He helped us to understand the perspective of female students to generate novel applications of the technology to form complex and highly customized multi-material structures, assemblies, and products biology-inspired that cannot be made by any other means. He draws an analogy of women weaving and 3D printing as a complex process that requires patience and sensitivities to things like color, texture, and tactile qualities of the fiber. Ross thinks those sensitivities empower women in relation to this new emerging technology.



Q: We heard about your choice to involve students in your interesting research about new digital printing technology, advanced materials, and future vision. In your lab, you have been observed women students working in this area, their ideas, way of proceeding. What specific ability do you think women have in these areas? Are there any achievements from your projects made by women? What are the more representative projects of a feminine way of thinking and/or making?

A: It is interesting to watch young women working with technology. It does seem to be slightly different to the way my male students have in the past. Probably at the moment the male students are falling behind. And the young women seem to be dominant on our program now and certainly dominate the prize giving. The technology we focus on is 3D printing, so things around how you make digital information into three dimensional objects. And I think there seems to be quite a built-up multi-generational sense of frustration that women have been pushed away from technology. There is a lot more patience with machines female students than male students. If you think of crafts like weaving and 3D printing, they are quite similar sensitivities. Even if you repeat something many times, you have to repeat it really beautifully to get a consistent piece of embroidery on fabric. It's very similar. You build one layer on top of another layer. It has to be tested. The machines can do prints and do a job gradually. I think a lot of young women seem to be very good at the same thing what the machine do. 3D printing requires two sides: a digital side, which is the file you send to the machine; the other is a physical side which is

the plastic melting and temperatures heating writers. This is lovely digital, physical and sensitivity. So physical strength doesn't play any part in it. Printing seems to be a neutral territory. You don't need to be strong to do it. It's not dangerous.

Q: Do you believe there is potential in the creative areas of female students? Are they capable of expressing a sensitivity for technology, materials or sustainability in the lab MADE? Are they proposing a different type of innovation? What are their specific manifestations? Did you realize that women's design could have something different to express on projects with sophisticated technology?

A: I think old people see technology differently to not have everyone exploring it and expressing themselves through it. It's just foolish because you get a really limited dimension of what I could do. A lot of the products are bought by women and yet they are often designed by men. But without the sensitivity of what we might want, I think it's a huge empowerment for a country that can get all of the people. The more I travel, the more I see other countries, the happier I am in New Zealand seems to be empowering young woman pretty well at technology. We expect that half of our program will be open to women. More than half the price is going to the women. I would say that 80% of the prices will be going to young woman because of their dominant international acknowledgment.

Q: We all know that you are interested in the future of design, so what role do you think women will play in the future of design?

A: Generation of campaigns, lots of good role models and discussion about women doing things, have convinced young women they can do anything they haven't traditionally done. 3D printing makes us doing things that we wouldn't have thought possible before.

Q: Do you think there is in women designer a vision that subverts a masculinist bias in technology and design? Do you think there is a difference that could emerge through an overtly feminized technology or a critique of the production models supported by technology?

A: Yeah, I do. I'd be fascinated to see while women will take technology it will be different. And I don't think we know what it is yet. But, from what I can see, when young woman comes in our program, that would be very different. We do a lot of work close to biology. And so a lot of our research is inspired by biology or trying to make dynamic creatures or plants that move like biology or acts like biology. We find a very particular sensitivity coming from young women and an interest in biology and natural world. And I think we're starting to see some projects that we wouldn't have got from a young man. The technology and biology of the two things are really pretty exciting. It's more like natural technology, but we're cutting edge mixing the two.

Q: We have observed some 3D and 4D printing works designed by your students, which have bionic and organic forms, soft and delicate perception, close to nature, and material humanization, and so on. These characteristics

are more feminine or not? What outstanding characteristics do women display in design?

A: The materials become softer, more pliable and more precise. The printer that we use is a very precise printer putting down extremely small droplets. And one model can have a billion drops of reason that can be programmed. To do that, you really need a lot of sensitivity to tell it what to be. You have a lot of decisions to make. But as I say, if you're weaving something and weaving is a complex thing as well, and if you look at traditional woman and weaving, (there's a reason women have dominated weaving for a long time), it does require patience, sensitivities about things like color, texture and tactile qualities of the fiber. Maybe cooking is a little bit the same, too. But that's a complex thing where you bring a lot of subtle emotions into it. And it's really four dimensional, ingredients come from how you prepare them, to how you heat them and how you proceed them. I think those sensitivities empowering them. That's empowering hard and really cutting edge technology on top of those sensitivities.

Q: Which is the consideration about the role of women in design in your country?

A: We have a female prime minister who is in charge. She's a quite young mother. I think that helps to tell other people and other women that they can be what they wish to be. We're a pretty young country, so our rules are not particularly rigid. That's why amazing technology suits us quite well, apparently quite a pioneering. We're not very good at doing traditional

things competitively. Other countries get more history of mankind, so they tend to be better at traditional ways of making. And we have to be quite fast with change, this also inspires technology, art and design. It is interesting how many young women are studying industrial design in our programs: about 50%. 30 years ago, that would have been closer to 2% or 3%.

Q: There are topics in research field in your country that are preferred or dominated by women? Are there any specific topics approached only by women designers? Why?

A: We're starting to see a lot of women and things like the creative fields like design and architecture – and our faculty too – are now dominated by women. It's extremely competitive to get into the architecture. It's very very difficult. Higher education has been dominated by women. It's quite a profound shift to more women studying in university, winning more of the prizes, with more ambitious. This generation has been told they can do anything, whether they believe it or not.

Q: Is there any lack of technical ability of female designers in actual design projects? For example, how well do they master advanced materials or digital 3-4D printing?

A: Not really. I think in a creative project, the technical competence is part of it. I think it'll be one of my complaints of a masculine way of doing technology. We're not finding a young woman in any way technically inferior. Basically they will learn as well as the young men. So no, we're not seeing women behind. Maybe in one area, and that's coding. I'm

not sure why the computer coding is still dominated by men. It seems to be one of the last bastions of victim traditional masculine gigs. It requires a very particular kind of person. We struggle to get design students to study coding. It's somehow the creative process and mathematics. I think to learn the programs basically require tenacity and effect. It's said the women know what they're trying to make and they will put the time to learn and make sure they have the knowledge. So now we're not seeing a big difference.



Q: What's your plan with your research in the future?

A: I'm working on a game that's 3D printing, so everything I explore is emerging technologies that effect New Zealand industry. The research I'm doing is a multi-material printing.

It's very precise, multiple colors, multiple partners. And at the moment I'm trying to display inside prints so that once it is printed, I can still change things like color by keeping things locked up. When it's printed, it can still be reprogrammed.

I'm really interested in a lot of things such as where they come from, how they are used, where they go. Once you finish with them, you have a feedback into the system. Creating the material first and even at the end of its life history, absorbing it and making it into something else. Technically, we need to understand how to do that. That's one of the reasons I really like printing. It gets me pretty close to biology. I can't print a tree, but you know we're getting closer.

I am really interested in gender. You don't have to break down the barriers because they're not there. And as an example of how striking it is, we have a traditional workshop at the university and it's been so frustrating trying to give young woman students to go and work down there. But eventually we just bypassed. We set up clear time for the studios primarily, so the students wouldn't have to go and ask what the male team had to do something. And so that's one of the really big strategies. For years, we tried to break down the gender bias. We gave up because we couldn't change that. The culture was too loud and too old, too rigid, too harking back to the good old days of the past, so we literally bought a huge number of 3D printers and put them up in the studio. And now the students don't need to talk to people anymore, and they use the printers. They used to talk to their colleagues or other students. We give some demonstrators at the begging of how they work. So the students don't have to ask them for permission to use them or how to use them, what you have is a dialogue between the person and

the machine. And we find that much more equal. A woman is just as capable as men. And, the machine doesn't care watching the people who seems in the power, if it's not set up well. So that's one way we found really benefit to cut off the historical culture. I feel like they're equal to students. So, pretty lots of young women would go to the workshop. And the project would be pretty much made from them.

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Women Sensibility Applied to New Materials and Technologies Processes / 2

Interview to Nicole Hone

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Abstract

Nicole Hone is a young designer who completed her master's degree in Design Innovation with professor Ross Stevens as the supervisor, at Victoria University of Wellington, New Zealand, in 2018. Her master thesis is focused on the design of organic performance and the choreographed movement with emerging technologies. Her project Hydrophytes shows the feminine perspective on digital fabrication for designing alive physical objects inspired by research into the biology and synthetic biology to imagine solutions to the climate change problems of the ocean and marine species. Her futuristic creatures are made of multi-material 3D/4D printing and create immersive physical-based experiences through the video recording of their movements. The futuristic function of Hydrophytes encourages thought about the health of our future climate and the role of design in connecting man and nature. During the early stages of his project, experimenting with multi-materials 3D printing, Nicole found that the materials perform smoother and more organically in water as fragile parts are better supported. Having known that there were plans to redesign the National Aquarium of New Zealand, Nicole proposed to have a future-focused exhibition with moving aquatic creatures models that visitors could interact with. This idea, combined with her personal be fascinated with nature, lead to the concept of the futuristic aquatic plants, that include arrow pods, feather nurses, nomadic cleaners, haven flowers. Nicole chose to use PolyJet technology as it is excellent for printing small objects with fragile parts and complex organic forms with internal structures. We interviewed Nicole with questions focusing on her project and women's sensibilities in design and technology.



Figure 1. Nicole Hone and her biological creature sketches. Courtesy of Nicole Hone.

Q: What are the motivations of this project? What did they inspire you? Why did you want to create aquatic plants with multi-material 3D printing? Why were aquatic plants? What is the meaning you want to transmit with the new forms of life of your creations?

A:

- *Futuristic Aquatic Plants*

I have always been fascinated with nature; it inspires my design ideas and aesthetic. For this project, I became particularly interested in botany and marine life. I was amazed by the way sea creatures and corals moved and wanted to reflect similar qualities in my designs. During the early stages of test prints, I found that the materials performed smoother and more organically in water as fragile parts were supported better. At the beginning of my master's project, I also discovered that there were plans to redesign the National Aquarium of New Zealand. I thought “wouldn't it be really cool to have a future-focused exhibition with moving models that visitors could interact with?”. This idea, combined with my personal

interests and discoveries from the testing phase lead to the concept of futuristic aquatic plants.

- *Hydrophytes. Research for the Film and Exhibition Industry*

The *Hydrophytes* were created as part of a research project for a Master of Design Innovation degree at Victoria University of Wellington, New Zealand. My thesis focused on how to design and choreograph movement with multi-material 3D/4D printing. I was also looking at how this technology could be applied within the field of entertainment/education. I found that immersive experiences are becoming a growing trend in the film and exhibition and industries. Contemporary museums are becoming more *visitor-centered* and offering content that encourages us to think about the future and challenging issues. Filmmic worlds are expanding into theme parks to provide multi-sensory visitor experiences. With the alluring visual effects seen in movies, there is also a desire to reach out and touch the objects behind the screen. Within these contexts, I noticed that digital-based experiences were thriving but physical-based ones perhaps seemed less exciting and showed slow progress with the integration of new technology. My research proposed that physical objects, created with multi-material 3D/4D printing, have value in creating immersive physical-based experiences.

- *Multi-Material Printing with PolyJet*

I chose to use PolyJet technology as it is excellent for printing small objects with fragile parts and complex organic forms with internal structures. One unique opportunity is the ability to simultaneously print rigid and flexible materials which is beneficial for crafting the movement of objects. Existing de-

signs have not fully utilized the flexibility offered by PolyJet technology, leaving the aesthetics and application of organic movement relatively unexplored. Designs that were dynamic tended to focus on a single or basic motion or lacked a supporting context. My research aimed to showcase the artistic potential and industry application of this new technology by exploring a range of complex movements with 4D printing. Adding the dimension of time allows the creation of 3D printed objects that can move or change their shape or appearance – 4D printing. With multi-material printing, the appearance and behavior of objects can be designed with minimal post-processing.

- Speculative Design

The futuristic function of the *Hydrophytes* was inspired by research into synthetic biology and how climate change is affecting the ocean and marine species. Contextualized within the film, the *Hydrophytes* encourage thought about the health of our future climate and the role of design in connecting man and nature.

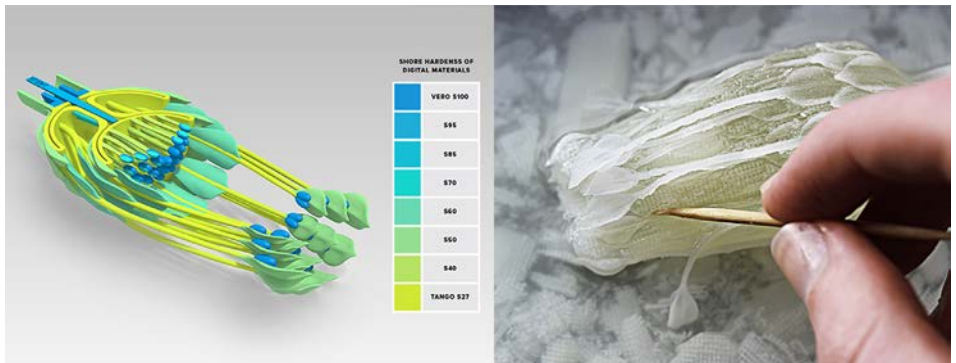


Figure 2. Nicole Hone, a digital drawing of the cross section view of the *Heaven Flower* (from *Hydrophytes* project), and Nicole carefully cleaning off the support material after 3D printing. Courtesy of Nicole Hone.

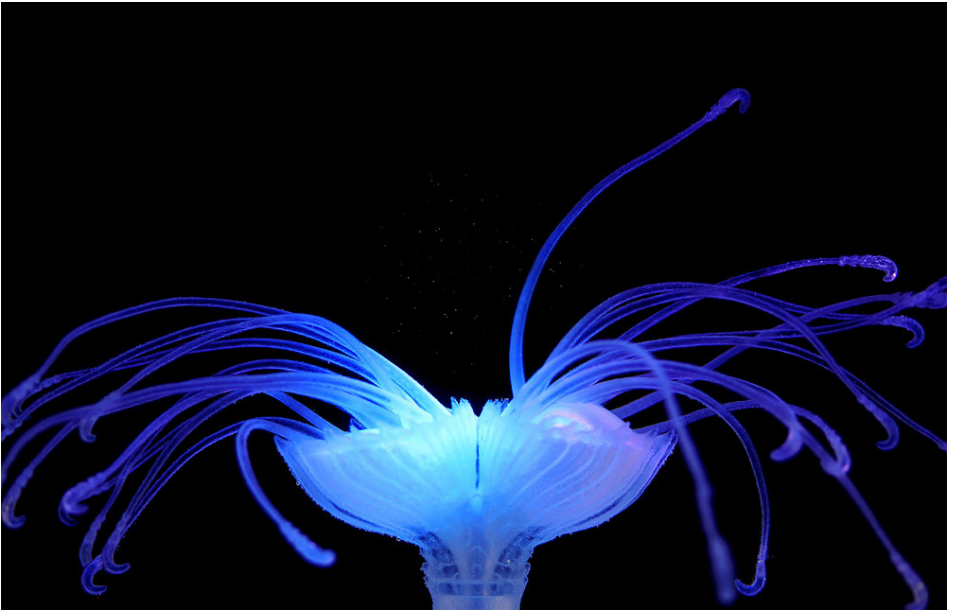


Figure 3. Nicole Hone, *Nomadic Cleaner* from *Hydrophytes* projects, a futuristic aquatic plant, 2018. Courtesy of Nicole Hone.

Q: How did you get the films of aquatic plants? They're really amazing! How long did design and printing take? What were the major difficulties for you in approaching the 4D printing technology and advanced materials in your project?

A: The *Hydrophytes* were filmed in a small fish tank while their movement was activated through a series of hand-held pumps. Coloured light was applied using an LED projector to complement the personality of each plant and enhance the perception of sentience. Filming took place across two days. The final film is true to life with no effects created in post-production. The *Hydrophytes* were developed over approximately four months within the master's research project. This included generating ideas, sketching, 3D modelling, material testing,

3D printing, cleaning, filming and evaluating. The objects themselves only took a few hours to be printed on the Stratasys machine. More time was required to carefully clean off the jelly-like support material that encased the objects. One major challenge for this project was the initial unpredictability of the materials and the resulting movement. The soft Tango material used at the time has low elasticity and durability levels, meaning a large amount of testing was required to understand tolerances and the behaviors of the materials.

Q: Do you think this technology is much better used for simulating natural creatures?

A: The way that PolyJet technology creates objects is becoming more like biology. A designer can control variation in material shore hardness, opacity and colour. With blends of hard bone-like structures and soft flesh-like areas printed in a single object, the materials feel and behave in strangely organic ways. Due to these aesthetic and performative qualities, multi-material 3D/4D printing is well-suited to simulating natural creatures.



Figure 4. Nicole Hone, interacting with the *Imp-root Hydrophyte* creature. Courtesy of Nicole Hone.

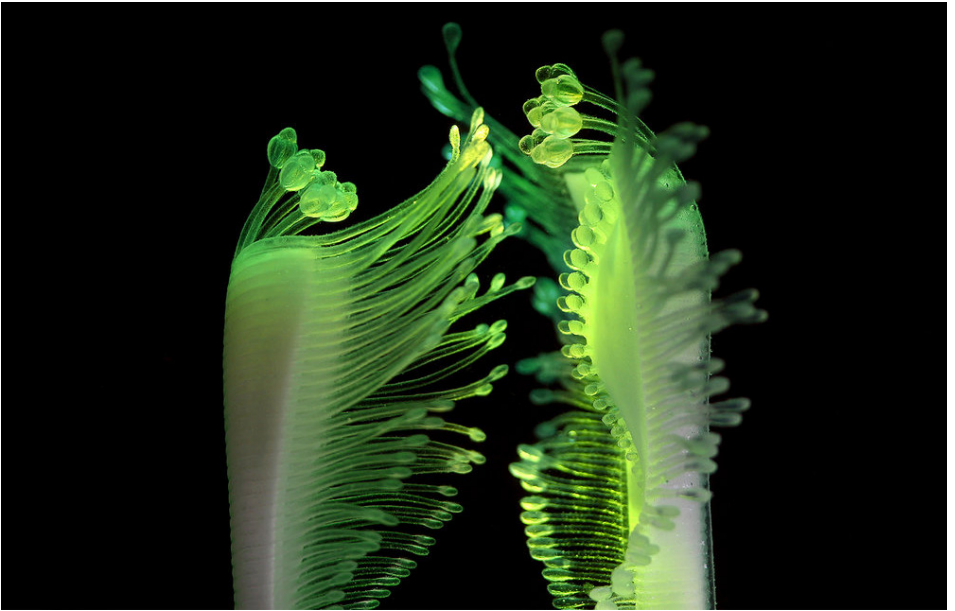


Figure 5. Nicole Hone, *Features Nurse* from *Hydrophytes* projects. Courtesy of Nicole Hone.

Q: Is there any audience or market demand for this project?

A: This type of 4D printing offers advantages for the film and exhibition industries. Film props designed with multi-material 4D printing could help prompt genuine reactions from actors and create convincing object-environment interactions. These props could even be used at promotional events or theme parks based around the film. There is also the possibility to create immersive educational experiences within the contemporary museum space. For example, natural history museums or aquariums could feature 4D printed animals to create exciting, interactive encounters for guests. With the efficiency of designing and manufacturing multiple variations of creatures such as the *Hydrophytes*, entire “forests” could be created with

diversity in character and movement. I think the tangible aspect of this technology is quite amazing making it great for use in the film collectables market – printing functionality directly into the objects and seeing them come to life in your hands. I have received many messages from people in a range of disciplines that have been interested in my work – from artists and designers to engineers and scientists, as well as the general public. They have been interested in potential collaboration projects, including the Hydrophytes in exhibitions, 3D printing awards and even showing enthusiasm to purchase the models. I am amazed that my work has been so well-received and I am thankful for all of the messages!

Q: Could you explain your words “this balance between controlled design and uncontrolled natural interaction leads to the creation of compelling organic performances”?

A: This sentence is explaining how believable organic movement can be created through a combination of the designer’s hand and nature’s hand. I will use the Haven Flower as an example to illustrate this. I designed the technical parts of the multi-stage blooming motion by controlling the shape and flexibility of each part in the computer (controlled design). Once printed and inflated the Haven Flower’s movement conforms to the “rules” of the real world as opposed to being designed through digital animation. Such real-world factors include gravity, water ripples or currents and interaction with other physical objects. This results in features such as the irregular arrangement and swaying of tentacular branches, sideways wiggling upon blooming and the bending action of the branch-

es caused by human touch (uncontrolled design). Elements of randomness and serendipity from the physical world enhance the lifelike qualities of the organic performance.

Q: Could you please tell us about your project team? What is the gender composition of your project team?

A: I created the *Hydrophytes* on my own as part of my master's thesis. I had two male supervisors – Ross Stevens and Bernard Guy.

Q: Imagine if this same project was approached by a male designer. Do you think it would be very different, apart from a difference in personality? Do you think there are differences between the female and male approaches to design in designing and approaching new technology?

A: Perhaps a male designer would have approached the project from a more technical perspective, looking more at the scien-

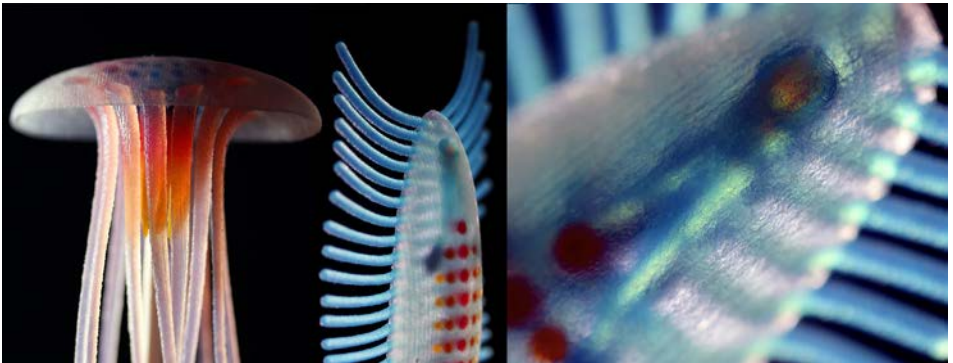


Figure 6. Nicole Hone, *Synthetic Jellies*, an exploration on 3D printed objects move independently thanks to a unique digital material memory, 2017. Courtesy of Nicole Hone.



Figure 7. Nicole Hone, *Sap Dwellers*, fantasy creatures that inhabit the dark depths of the forest, made up of varying degrees of flexibility allowing different parts to move when triggered. Courtesy of Nicole Hone.

tific properties of the materials and how they affect movement. While I did carry out my own material testing, I also assessed the designs from a more intuitive perspective in terms of whether the movement communicated the right character and emotion. I cannot say for sure if this is due to myself being a female designer. However, I do know that this perspective was an important part of being able to connect audiences with new technology and create immersive experiences.

Q: Do you think women’s sensitivity is more suitable for arts and crafts or for the new technologies? Why?

A: I think women’s sensitivity could actually enhance the connection between arts and crafts and new technologies. The digital age has brought about a variety of digital modelling and manufacturing tools that I believe has made industrial design more accessible to women. With these digital tools comes a new era of craft – where we harness the power and nuances of computers and machines to develop a new style of making.

Q: Do women have special sensitivities and contributions in future applications and implications of the fastest developing technology? Could it be said that they are closer to nature and have a stronger perception of “environmental footprint,” they have more environmentally conscious, and they are more able to produce friendly environmental works?

A: I think that it is important for people of all genders to work together to develop new technology and innovate applications, to incorporate multiple perspectives. Generally speaking, the caring, protective nature of women and our ability to slow down and think holistically could be an advantage to creating works with consideration for the environment.

Q: What role do you think women will play in the future of design?

A: Computer technology is allowing greater design freedom with the ability to model and manufacture nearly any imaginable form, once difficult to create with traditional methods. With such technology becoming of greater interest to women, I think we will continue to advance the digital aspects of design. We can expand our knowledge through coding and generative/procedural design, gaining enhanced skill with machines and ultimately strengthening the connection between technology, art, nature and people.

Q: What’s your plan with your design in the future? Are there any specific plans for further development and continuation of this project?

A: In 2019 I was working on a research project at Weta Workshop that involved combining voxel technology with multi-material 3D/4D printing. A voxel is a three-dimensional pixel. Voxel technology allows control over colour, transparency and materials on a particle by particle basis. This offers exciting opportunities to create more complex and realistic 4D printed objects with microscopic control. Voxel printing requires the use of procedural modelling tools during both the design and print slicing stage. I started to develop such methods in Houdini to advance on the research I did during the Hydrophytes project in 2018. While such research is currently on hold, I would like to continue exploring voxel 4D printing with organic themes – ie. printing animals, humans, environments or fictional creatures. Being able to incorporate sensors, 3D print with ‘smart’ materials or even living materials that can grow and evolve would also be fascinating. This would offer an enhanced ability to programme movement into the materials and create objects that really are alive!

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