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INTERVIEWS

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. Filmic 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.

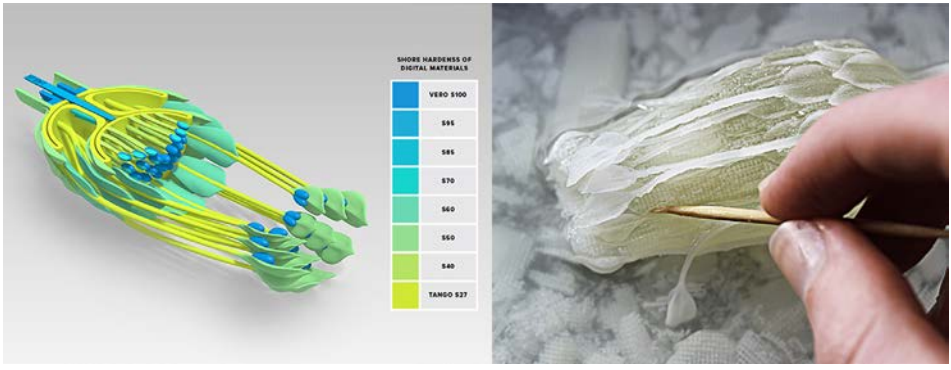

Figure 2. Nicole Hone, a digital drawing of the cross section view of the *Heaven Flower* (from *Hydrophytes* project), and Nicole carefully cleaning off the support material after 3D printing. Courtesy of Nicole Hone.

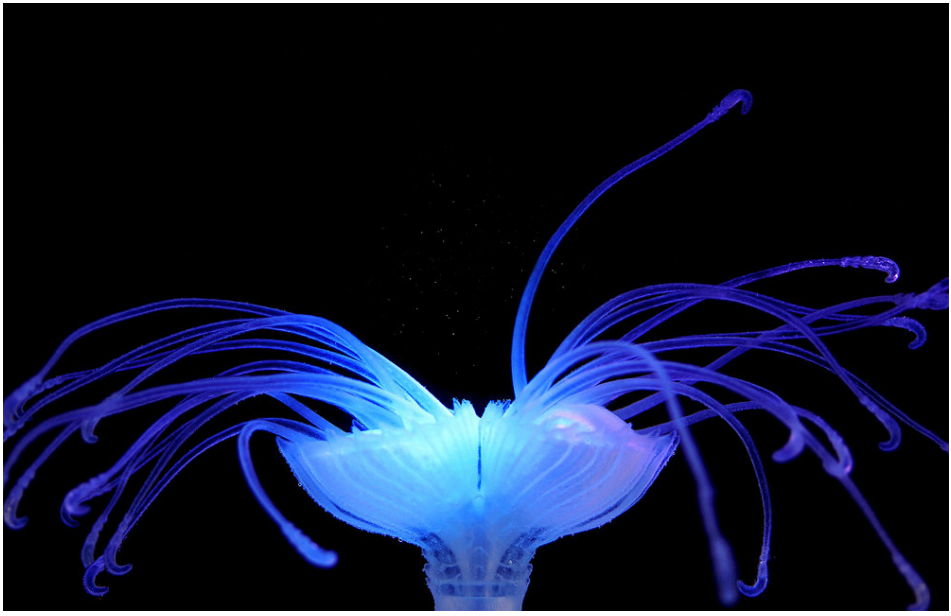

Figure 3. Nicole Hone, *Nomadic Cleaner* from *Hydrophytes* projects, a futuristic aquatic plant, 2018. Courtesy of Nicole Hone.

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.

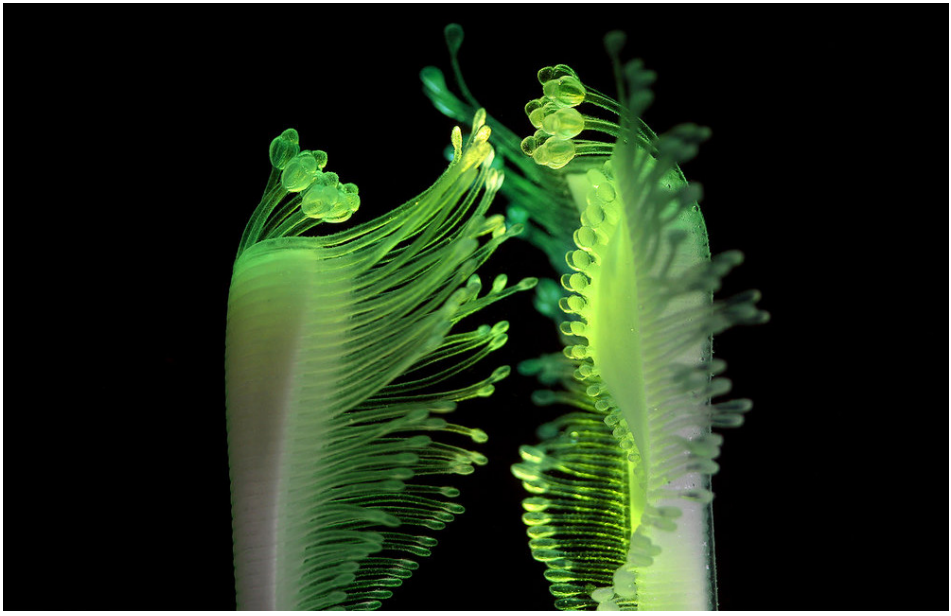

Figure 5. Nicole Hone, *Features Nurse* from *Hydrophytes* projects. Courtesy of Nicole Hone.

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-

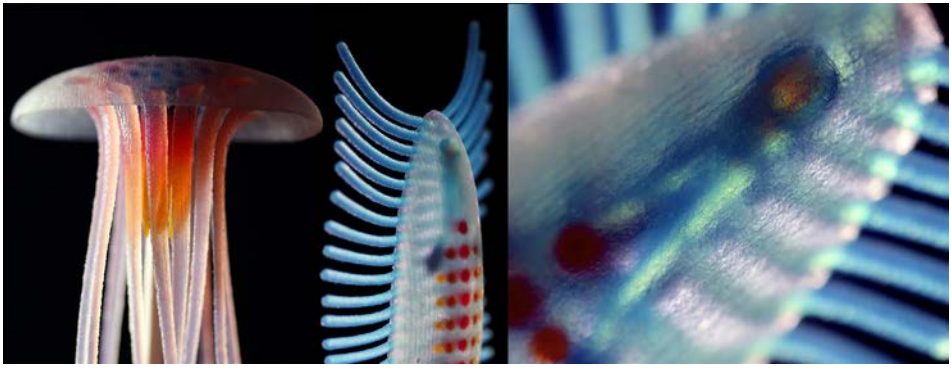

Figure 6. Nicole Hone, *Synthetic Jellies*, an exploration on 3D printed objects move independently thanks to a unique digital material memory, 2017. Courtesy of Nicole Hone.

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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