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Designing with Biological Generative Systems: Choice by Emotion

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Consumers as co-producers or co-designers are frequently presented as the solution for mass-*customization*, but the success of these systems as enhancing emotional bonds between user and object seems to be questionable. Making choices may not be enough to generate a bigger connection between people and their things. Artifacts produced using biological systems with generative potential, where nature's randomness and physiological processes have an important role in the definition of form, may have the capacity to foster the emotional connections that are missing, arising from nurturing and from an understanding of their morphogenesis, from the proximity and time required for their growth and development.

1 Introduction

More than thirty years ago Alvin Toffler in *The Third Wave (1980)* projected that the consumer would be integrated into the production process and that goods and services would be self-customized to a point where consumption and production would be intertwined as one. He called this producer-consumer a *prosumer*. It seems like Toffler wasn't completely wrong, as we see many companies shaping their business plans to integrate users into their design and production processes (Piller, 2004), but he wasn't also completely right.

In *The Paradox of Choice*, Barry Schwartz points out that the lack of success of these systems based on *co*-production or *co*-design resides mainly on the fact that consumers don't know or don't want to make choices: "As the number of choices grows further, the negatives escalate until we become overloaded. At this point, choice no longer liberates, but debilitates. It might even be said to tyrannize." (2005). This is where mass-customization may lead to "*mass confusion*" (Teresko, 1994) due to great uncertainty and the burden of choice. (Piller, 2004)

Digital generative systems may be part of the solution, their capacity to produce new designs automatically, modifying one form into another with algorithms guarantying a unique outcome each time; this means that with one single choice – when to interrupt the process – the consumer obtains a one-of-a-kind product.

Although we can see great potential in digital fabrication (mainly additive manufacturing) for the production of complex, unique and innovative artifacts, as the technology presents itself today, it has many limitations when compared to production with standard manufacturing methods, not guaranteeing the quality one can expect in a consumer good (Grimm, 2012).

In biological systems with generative potential, where nature's randomness and physiological processes have an important role in the definition of form, we understand that artifacts have the capacity to foster emotional connections that arise from their nurturing and from an understanding of their morphogenesis, from the proximity and time required for their growth and development. Choice in this scenario may not be a burden but rather a pleasurable action like feeding a pet or watering a plant.

These systems seek to develop artifacts in a *sprouting* stage as well as the constraints for their *growth*. Artifacts resulting from these processes are the result of a close relationship between the various constituent elements, as the system will only outcome in a final product if it is understood and nourished. The end result is singular and unique, with aesthetic qualities that arise from the understanding of the artifact and the connection created with

it. In this context, there artifacts are *individualized*, more than *customized*.

We are developing a series of DIY matrices for the production of artifacts made with mycelia (the vegetative part of a fungus, consisting of a network of fine white filaments) in an embryonic stage, to be distributed to users that will be asked to nurture them into final objects; in this process each user will *nurture* their artifact into a *final* object, where all options will be of their responsibility, from sunlight exposure to interruption of growth. To better understand how individuals respond to this type of objects and to the choice making, each user will be requested to register the daily evolution of their artifact and to describe their feelings towards it.

2 Context

In *The Meaning of Things, Domestic Symbols and the Self*, Mihaly Csíkszentmihályi and Eugene Rochberg-Halton, affirm that to most people, plants are one of the most cherished possessions in the household. They defend that this happens due to the "slow, growth-producing nurturance and life-giving concern", we can also add that because a plant is a living thing with an *existence* of its own, we tend to look at it differently than we do to inanimate objects (1981). Bruce Sterling in *Shaping Things* forecasts a near future where humans and objects are part of "comprehensive and interdependent" systems, in a "*technosocial"* culture (2005).

Biological systems that are generative or have generative potential can produce artifacts that provoke new ways of relating to our things, questioning the standardization seen in mass production, as stated by Deyan Sudjic in *The Language of Things*: "the role of the designer when working for the industry is more than the one who conceives the form of things, it is to think out the interaction between people and the artificial world, and in particular how we become attached or not to things"(2009).

Projects like *Veiled Lady* by Studio Eric Klarenbeek and *Silk Pavillion* by the MIT Media Lab are examples of how objects can evolve from an embryonic stage into complex unique artifacts if they are nurtured and understood, and can reinforce the relationship between users and their things.

Veiled Lady is part of the *The Mycelium Project - Print and Grow*. Using a 3D printer with two independent extrusion nozzles, an inoculated straw based substrate was deposited inside bioplastic structures printed at the same time with the configuration of a bench and, after a few weeks it bloomed. The growth process was interrupted by dehydrating the mycelia resulting in a stable unique product (Klarenbeek, 2014).

Fig. 1 *Veiled Lady* by Studio Eric Klarenbeek © Studio Eric Klarenbeek 2014

In *Silk Pavillion*, A structure was made out of a silk thread laid down by a CNC (Computer-Numerically Controlled) machine. A swarm of 6,500 silkworms was positioned at the bottom rim of the structure, and autonomously reinforced the gaps across CNC-deposited silk fibers. Following their pupation stage the silkworms were removed (Oxman et al., 2013).

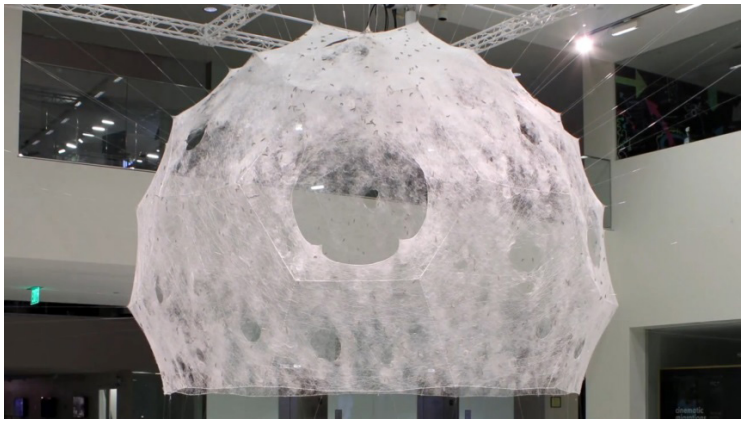

Fig. 2 *Silk Pavillion* by MIT Media Lab © Steven Keating 2013

3 Testing

A small series of DIY casts and step-by-step instructions will be distributed to allow people to build their own matrix and grow their own product with the intention of better understanding how individuals respond to these objects. The casts will consist of a STL (Stereo lithography) 3D printable format and a PDF drawing of the cutting dimensions for a plastic sheet. After being printed and cut, these materials are easily assembled and filled with mycelia inoculated straw. To ease the users' job we recommend the transfer of the content of a commercial mushroom kit into the predefined form. Dimensions will be constrained by the printing volume of an average low-cost 3D printer, and the initial user group will be

selected among people with some experience with commercial mushroom growing kits. The choice of this user group guarantees some familiarity with the nurturing process and can give us an emotional comparison between a traditional commercial kit with the only focus on producing edible mushrooms and the possibility of giving the substrate a second use.

Each user will be asked to nurture their artifact into a final object, and for this they will have to follow the normal instructions of the familiar commercial kit. All options will be of their responsibility: sunlight exposure, room temperature, when and how much to water, growth interruption, etc.. Each user will be asked to make a log of their options and a photographic register of the mycelia's expansion and mushroom growth and a questioner will be used to understand their feelings towards it the various stages.

> Natural forms are continually modified during growth by their surroundings. Theoretically all the leaves of a single tree should be identical, but this could only happen if they were able to grow in surroundings completely devoid of outside influences and variations. All oranges should have an identical round shape. But in reality one grows in the shade and another in the sun, another in a narrow space between two branches, and they all turn out to be different. This diversity is a sign of life as it is actually lived. The internal structures adapt themselves and give birth to many diverse forms, all of the same family but different (Munari, 2008:167).

The system and the initial template will be designed, leaving most of the growth constraint choices for the user. We believe that a greater awareness that their actions helped define the final object, will also generate a greater tie-in between user and object, a connection by emotion and understanding more than the mere relationship of possession.

In the presented case, the filing of the cast results in a hollow conical geometry that can be used as a suspending lamp shade, we understand that proposing an artifact that can have some kind of utility will help the users to easier relate to it and will facilitate their ability to question its aesthetic qualities by having the possibility to compare the object to a well-known, common product. The option of designing an artifact with a simple geometry has the intent that the growth of the mushrooms will have a bigger emphasis in the overall aspect.

We understand that the outcome of these systems may not be perceived as having the traditional attributes that are connoted with quality products, one has to be connected to the artifact by

the whole understanding of the process and not only simply by looking at its surface. As Donald Norman explains:

> Attractiveness is a visceral-level phenomenon – the response is entirely to the surface look of an object. Beauty comes from the reflective level. Beauty looks below the surface. Beauty comes from conscious reflection and experience. It is influenced by knowledge, learning and culture. Objects that are unattractive on the surface can give pleasure. Discordant music, for example, can be beautiful. Ugly art can be beautiful (2004:98).

> The problem is that we still let logic make decisions for us, even though our emotions are telling us otherwise. Business has come to be ruled by logical, rational decision makers, by business models and accountants, with no room for emotion. Pity! (2004:21)

By comparing the questioners we aim to be able to better understand if and how the emotional connection evolved between user and object, the daily photografic register may offer a better understanding on how the base geometry *evolved* into its final form and what factores motivated the variations.

We intend that before the end of March 2015 the user group will be defined and briefed to initiate the experimentation with the proposed templates, if we consider the average growth rhythm of the mushrooms, the final results should be ready before May 2015, giving us time to analyse the data before June 2015.

4 Conclusion

In systems that rely on the consumer as a *co*-producer or *co*-designer, the way choice making is forced on them can be a problem, and does not guarantee a greater empathy between a person and their objects. To achieve artifacts that are traded in an embryonic stage and that rely on a biological actuator with generative potential to produce unique individualized outcomes, but at the same time, are dependent on the user for their evolution and final conformation is one of the expected results.

In the same way we can say that when a plant grows it is also responding to its grower, and that this creates unique bonds that are different from those common between people and their inanimated things. We look forward to the idea that these systems will catalyze greater empathy between objects and their users although they are not living artifacts themselves but the result of a living system.

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