Designing with biological generative systems: choice by emotion

Abstract.
Consumers as *co*-producers or *co*-designers are frequently presented as the formula for mass-*customization*, but the success of these systems as enhancing emotional bonds between user and object seem to be questionable. Choice making may not be enough to generate a bigger connection between people and their things. Artifacts produced with 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, these connections arise from their nurturing and from an understanding of their morphogenesis, from the proximity and time required for their growth and development.

Keywords: biological design, generative, choice, customization, emotion.

1 Introduction

More than thirty years ago Alvin Toffler in his book *The Third Wave* 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 (1980)*. 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 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." (Schwartz, 2005) where mass-customization can lead to "*mass confusion*" (Teresko, 1994) due to great uncertainty and the burden of choice. (Piller, 2004)
Digital Generative systems could be part of the solution, their capacity to produce new designs automatically, modifying one form into another with an algorithm guarantying a unique outcome each time; this means that with on simple choice: when to interrupt the process; the consumer obtains a one of a kind product. Although the potential that resides in digital fabrication, does not guarantee innovative artifacts, designed for a specific individual and not for the masses (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 my not be a burden but 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 this process seek to be the result of a close relationship between the various constituent elements, 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. Although, in this context, the term individualization my fit better than customization.
We are developing a small 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* his artifact into a *final* object, where all options will be of their choice, from the sunlight exposure to the 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, affirms that to most people, plants are one of the most cherished possessions in the household, he affirms 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 a *will* of its own, we tend to look at it differently than we do unanimated 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 with 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"(Sudjic, 2009).
Projects like *Veiled Lady* by Studio Eric Klarenbeek and *Silk Pavillion* by 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 reinforces the relationship between users and their things.
Veiled Lady is part of the *The Mycelium Project - Print and Grow*: inoculated straw was 3D printed inside a 3D printed bioplastic structure with the configuration of a bench, after a few weeks it bloomed. The growth process was interrupted buy dehydrating the mycelia resulting in a stable one of a kind 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 threads laid down by a CNC (Computer-Numerically Controlled) machine. A swarm of 6,500 silkworms was positioned at the bottom rim of the structure, they 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 on a STL (Stereo lithography) 3D printable format and a PDF drawing of the cutting dimensions for a plastic sheet, after printed and cut these materials are easily assembled and field 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 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, for this, they will have to follow the normal instructions of the familiar commercial kit. All options will be of their choice: sunlight exposure, room temperature, when and how much to water, growth interruption, etc. each user will be asked to make a written log of their options and a photographic register of the mycelia's expansion and mushroom growth and to describe their feelings towards it.

> "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

For this reason the system and the initial template will be designed, leaving most of the growth constraint choices for the user, we believe that a greater consciences that his or hers 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.
we understand that the outcome of these systems may not be perceived as having the traditional attributes that are connoted to 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." … "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)

4 Conclusion

In systems that rely on the consumer as a *co*-producer or *co*-designer, the way choice making is forced on him/her can be a problem, and does not guarantee a greater empathy between a person and his/her 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 ate 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 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.

References

Csikszentmihalyi, M. and Halton, E. The Meaning of Things Domestic Symbols and the Self, Cambridge Cambridge University Press, 1981.

Piller, F., Koch, M. and Möslein K. From mass customization to collaborative customer co-design. *European Conference on Information Systems (ECIS).* Turku, Finland, 2004.

Grimm, T. Additive Manufacturing is a Poor Substitute *TCT.* Tattenhall UK: Duncan Wood, 2012.

Klarenbeek, E. Mycelium Project 2.0 - Veiled Lady. Zaandam, 2014.

Munari, B. *Design As Art,* London, Penguin Books, 2008.

Norman, D. A. *Emotional Design: Why We Love (or Hate) Everyday Things,* New York, Basic Books, 2004.

Oxman, N., Kayser, M., Laucks, J., Uribe, C. D. G. and Duro-Royo, J. Silk Pavillion: CNC Deposited Silk & Silkworm Construction - MIT Media Lab. *Mediated Matter* [Online]. Available: http://matter.media.mit.edu/ee.php/environments/details/silk-pavillion [Accessed 10-06-2013], 2013.

Schwartz, B. *The Paradox of Choice: Why More Is Less,* New York Harper Perennial, 2005.

Sterling, B. *Shaping Things,* Cambridge, Massachusetts, The MIT Press, 2005.

Sudjic, D. *The Language of Things - Design, Luxury, Fashion, Art: how we are seduced by the objects around us,* London Penguin Books Ltd, 2009.

Teresko, J. Mass customization or mass confusion? *Industry Week/IW* 243**,** 45, 1994.

Toffler, A. *The Third Wave,* New York, Bantam Books, 1980.