RESEARCH DIGITAL EXPERIENCE

Literature review – The Evolving Bio-Age

Thanusha Kanagendran

BACKGROUND AND RATIONALE FOR THIS STUDY

Design reflects society and its developments in technologies that continue to emerge and change human physical and cognitive performance. The computer promises to increase human capabilities dramatically, and the world reacts with potential changes in that computer-filled future. The increasing interest and concern with users growing into adulthood alongside the internet have simultaneously shifted the focus of technology becoming permitted in intimate areas of lives. Likewise, there is a long history of humans modifying both body and mind to modify performance; examples range from products as energy drinks, brain-training video games, and specialized nutritional regimens for athletes (2012). Science and technology play a significant role in most aspects of our daily lives both at home and at work. Innovations in genetic editing and engineering allow researchers to create benefits in the growth of increasingly sophisticated scientific capabilities in medicine, biology, and electronics. The ability to modify human performance can create unexpected outcomes, both good and bad, resulting from human tinkering with living systems (Politiques, 2018). Although communicating for design with a scientific approach establishes a difference in the usual perspective. Exploring the relationship between design, science, and innovation holds the key to unlocking human potential. The evolving bio-age is mainly about the growing presence of electronic information technology, changing the design context and practice. We have reached a point where design as a discipline can contribute to scientific progress and become part of science.

This paper briefly highlights designers, scientists, and artists' ability to grasp significant technology, science, and history changes. Many designers, scientists, and artists have turned to design to give method to their productive tinkering (Antonelli, 2008). The merging of new scientific concepts focused on living systems, tools to analyze and manipulate those systems, and the potential to edit or design them for human purposes offers potential for creating a systematic process based on living systems rather than mechanical ones (2012). With the use of readings in public understanding, digital design, and a collection of projects that explore technologies based on biological systems and specific advantages observed in natural organisms into human technology, this paper aims to propose a discipline in designing alongside science with principles of ethos.

BIOMIMICRY AS PRAXIS AND METHOD

The impacts of digital, scientific and information technology often bring attention to regulators; business leaders and policymakers. The public understanding of digital and information technology broadly includes mathematics, technology, engineering and medicine, and the knowledge derived from research and investigations of the natural world (1985). Therefore, the minimal amount of knowledge becomes a potential risk raising foundational issues of ethics and accountability. In 1985, the Royal Society published a report titled "The Public Understanding of Science." The report appeals to logic by communicating the encyclopedic amount of information for an individual

is unprecedented and a social construct that leaves the public uninformed, becoming vulnerable to misleading ideas. The following passage from the report shares the importance of scientific ideology in digital design:

> Science and technology influence the individual's daily life in an enormous variety of ways in our gadget-filled, technologically based society. Ignorance of elementary science cuts off the individual from understanding many of the tools and services used every day. Some basic understanding of how they function should make the world a more interesting and less threatening place. It is obviously not necessary, and hardly possible, for an individual to understand the functioning of everything from a bus to a ball point pen or a television set. But those who have never been stimulated to enquire about how things work and who lack the basic knowledge to pursue such an enquiry are surely at a disadvantage in the modern world. Scientific literacy is becoming an essential requirement for everyday life (1985).

The emerging biological age could significantly impact intimate areas by radically disrupting our notions of what is natural, blurring the boundaries between the inorganic and organic, suggesting without the public understanding, the bio age poses fuel to ethical anxiety concerns (Politiques, 2018). In this context, communicating with design offers the social responsibility to change how people think about new innovative approaches. The article written by Boris Müller, Professor for Interaction Design at FH Potsdam, suggests “the creation of a museum exhibit, the design of an information graphic or the interactive simulation of an experiment, design can convey scientific insights in an intelligent, informative and delightful way. In order to achieve this, the designer has to work closely with scientists and communicators and convey the right message and the right amount of complexity” (Müller, 2017).

BIOLOGICALLY INSPIRED

The exhibition "Design and the Elastic Mind," curated by Paola Antonelli, now converted into a virtual interface, highlights the consideration of possible science and design concepts through ongoing research and prototypes. The interface construes processing and responsive design to discover the boundaries of bio-design. In Antonelli's article about the purpose of the exhibition, she emphasizes nanotechnology as a tool that "offers the promise of the principle of self-assembly and self-organization that one can find in cells, molecules, and galaxies" (Armstrong, 110). Perhaps, the use of natural sciences in design can give a persona to technology that eases their communication with people and other objects. As a social responsibility, designers can set the foundations for an influential theory by merging form and function and an awareness of natural science expressed with industrial production. According to the exhibition concerning viewing bio-age, several projects explore nature and science with engineering help to achieve an optimal solution for design problems. Design problems using biomimicry; modelling a design after the functions of biological entities is an adaptive way of solving life and economy problems, found in nature, i.e. by imitating natural phenomena and processes (KEKIC). Underlined in Antonelli's exhibition is the Flybot, a device the size of an insect-inspired robot with potential uses in crop pollination, search and rescue missions, surveillance, as well as high-resolution weather, climate, and environmental monitoring (). According to the head designer, Robert J. Wood, "the device seeks to extract principles from biology and reproduce them in robotic devices to attain the robust locomotion performance that natural organisms can achieve. The resulting devices can faithfully reproduce insect wing motions at high speeds and can produce enough thrust to enable these robots to take off" (2019). However, the use of biomimicry for robotics suggests minimal innovative solutions. Currently, research in science and technologies produce genetic medication and brain physiology. In that case, potential world-scale errors resulting in innovations with military use may arise.

DECONSTRUCTION OF BIOMIMICRY

By deconstructing biomimicry, a social science perspective can portray the focus on the militarization of biological life. Insights from environmental anthropologist, Veronica Davidov's paper on "Biomimicry as a Meta-Resource and Megaproject" include a highly relevant history of biomimicry in a research project within DARPA, The Defense Advanced Research Projects Agency (Davidov, 2019). According to Davidov's literature, part of the militarized implement of nature included vivisystems (e.g., using bees or moths for environmental tracking) and hybrid biosystems designed to create animal-robot cyborgs for surveillance purposes, similarly to the Flybot (Davidov, 2019). In order to comprehend the extent of the possibilities of militarized bio-tech, Charles Zerner, a researcher at Duke University: "imitating not only the structure or appearance of a certain organism but the evolutionary strategy of stealth nature-- nature as a weapon against perceived threats being rescaled down can become harder and harder to detect" (Davidov, 2019). The introduction to biomimicry and military use brings back the ideology of animals integrated into a war as a means for transportation, weapons platforms, weapons in themselves, and surveillance. In many ways, drones' concept, the central focus of the robotics revolution, are bio-inspired robots (Davidov, 2019). By dissecting biomimicry, ethics of biomimicry imply laws, strategies, and principles for evolving bio-age to see a positive direction in bio-design. Finding the orientation between scientists and designers by questioning biomimicry principles and how we perceive the meaning can help invent something that caters to consumers. Design is changing with the presence of technology. By experimenting with viewing new circumstances, developing models for design and production can advocate evolution in society (Antonelli 110). According to the designer, Paul Rand, "design is a means for invention and experiment" (Maxim, "Good Design Is Goodwill by Paul Rand").

Designing for invention and experiment in the biological world consists of a diverse set of species that vary in source material for scientists and engineers. The number of robots developed and inspired by the biological world has been derived from fungus-like organisms such as the slime mold all the way to primates such as monkeys and human beings (Pfeifer, 2012). An article by Rolf Pfeifer, “The Challenges Ahead for Bio-Inspired ‘Soft’ Robotics”, states:

> “Biology contains especially rich knowledge for robotics in disciplines such as neuroscience, biomechanics, and systems biology. Building on the seminal work of Rodney Brooks at MIT in the 1980s, which was the starting point for the field of “embodied intelligence” in artificial intelligence and robotics, a striking variety of bio-inspired robots have been built over the last 20 years. Bio-inspiration has driven research and applications on robot locomotion (crawling, walking, running, climbing, jumping, swimming, and flying), navigation and orientation behaviors, spatial memory formation, exploration, environmental monitoring, manipulation, imitation, and cooperation, among other” (Pfeifer, 2012).

As the bio-age evolves and declares further research on the benefits of using biology to design and re-think existing systems, demand will increase. Therefore, the biologically inspired robot integration influences sociality to change how people think of robots. Furthermore, becoming a potent strategy by using biological terms, can enhance products, environments, communications and corporate identity. Introducing safe interactive robots such as the Festo Bionic Handling Assistant, a gripping mechanism inspired by elephant trunks, can ultimately merge form and function and an awareness of human values, expressed in relation to industrial production for a democratic society.

SHIFT TO ORGANIC-DESIGN

Through further research, biomimicry innovations challenge policymakers and the business industry towards solutions that achieve energy efficiency, safety and security, communication, and distribution purposes. The leading bio-inspired company, Biomimicry 3.8, is represented by Microsoft, Google, and Ford, to name a few. Biomimicry 3.8 provides immersion programs, workshops and innovation services to deliver ideas on how bio-

design can be applied to benefit your organization. Therefore, the public understanding of science through design plays an important role. Implemented in the strategy to bring awareness, Biomimicry 3.8 creates infographics on biomimicry regarding prominent aspects of everyday life, including transportation, sustainability systems and packaging. Under sustainable packaging, Biomimicry 3.8 provided the consumer products for Natura, a skincare line with mechanical or chemical strategies in the context of a representative organism, such as a poppy flower bud, tortoise shells, or beetle wings to a product packaging concept design (2016). According to the case study published by WIT press, "the methodology could easily be adapted and incorporated by other groups working on the research and development of a new product. By adopting our methodology as a means to accelerate the creative process and optimize the development of new products and technologies" (Neves, 2012). The merging of new scientific concepts focused on living systems, tools to analyze and manipulate those systems, and the potential to edit or design them for human purposes offers potential for creating a shift in design thinking.

Our current understanding of emerging design, manifestos of biomimicry, nanotechnology, and organic systems ethos has related manufacturing design to natural sciences. Dubberly's article, "Design in The Age of Biology," the shift from mechanical-object ethos to an organic-systems ethos underlines the rise of service design explicitly (Dubberly, 2008). Dubberly identifies the question of what electronic media and designing have to do with biology as "a shared focus on information flow, networks of actors operating many levels, and exchanging the information needed to balance communities of systems" (Dubberly 2008). Ultimately, suggesting an organic-systems ethos provides ongoing development, interaction flow and encourages an avant-garde approach to designing systems. The inventions from biology from the early 1800s using the Golden ratio and modern computing using terms such as cellular have suggested that users and viewers embrace characteristics of science in design. The arts regularly use science as a metaphor and model. Looking at the arts and sciences' intersections can help put science in perspective by creating an emotional need to understand what science has to teach us. Emerging design practice is largely information-based, the idea that what the service is connected to and does is more important than anything else. For example, a phone does not concern a user if it does not include applications to serve the user's society's larger purpose. Therefore, applications change and evolve similarly to manifestations of biology. Ongoing development of the service system can be illustrated by streaming services. The purpose of changing the entertainment on streaming services is a flux and flow that conveys a constantly evolving platform by seeking rules, concepts, and biology principles to inspire new possibilities, including materials, mechanisms, algorithms, and fabrication processes. Some of these studies' benefits are improved structures, actuators, sensors, interfaces, controls, and software (Davidov, 2019).

CONCLUSION

This paper synthesized and reviewed the various literatures on the bio-age by underlining the public understanding of science as a practice and examples of digital design theory to grasp the contrasting concept of biomimicry. For ethical exploration, a praxis for design that ranges in its applications from military to environmental have provided the information resulting in embracing the complexity of science (Davidov, 2019). By critiquing the literature, ethnographies of biomimetic projects are minimal. The notion that accountability in sustainability is measured in products and listed on packaging, however not regarding biomimicry projects, implies a materialized nature. Going forward from the research, the next generation of challenges in the evolving bio-age mimics the inventions described above. Bio-designs are encouraged by regulators; business leaders and policymakers, similarly to all science disciples. The emerging of the bio-age suggests the potential to shape society through devices such as the *Flybot*. Instead of operating under the terms of science and design, borrowing methods of philosophers, engineers, and inventors may introduce bio-design as at term that refers to an approach rather than a chosen media. That what comes from outside and influences the process, such as: nature, society, or human interaction should fit within a framework. Rapid development and widespread use of bio-age technologies could give rise to social issues centered on the divide between organic and augmented humans. As a result, the research portion will answer how to inform society of bio-age technology worldwide for diversity, the successfulness of a handbook for bio-design, and the criteria to introduce products considering bio-design may propose harmful substance manufacturing.

Citation

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