

Bio-Design Integration: User Preference

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Abstract. Bio-design is a practice that learns from and imitates the strategies found in nature to solve human design challenges. The merging of new scientific concepts focused on living systems, tools to analyze those systems, and the potential to edit or design them for human purposes offers potential for creating a process based on living systems rather than mechanical ones (2012). The literature in digital design and collection of projects explore technologies based on biological systems and specific advantages observed in natural organisms into human technology. Considering the likelihood Bio-design will make its way to the consumer class, pin-pointing specific aspects of Bio-design including innovation, education, and inspiration to address the successfulness will provide clarity for digital experience design (2016). The paper presents the result of ongoing research suggesting innovative, educational and inspiring processes as highly promising approaches. Findings will bring forth insight regarding the proposal of Bio-design for consumer class.

Keywords: Bio-Age, Innovation, Education, Inspiration, Biomimicry

1 Introduction

The impacts of digital, scientific and information technology often bring attention to regulators; business leaders and policymakers. Design reflects society and its developments in technologies that continue to emerge and change human physical and cognitive performance (2012). 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. Science and technology play a significant role in most aspects of our daily lives at home and work. The innovations include the ability to modify human performance which can then create unexpected outcomes, both good and bad, resulting from human tinkering with living systems (Politiques, 2018). However, 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 term Bio-Age implies new paradigms and approaches. As a result, innovations by drawing upon designs in nature introduce concepts of sustainability and environmental efficiency. Biomimicry has become a forefront term coined as opposing the industrial age and instead, a methodology to assist in inspiring, educating and partnering with to innovate new systems. It is important to note, design values from the manufacturing world have moved our

minds perception into a constantly evolving system through dispersed, integrated and perpetual design research (Dubberly, 2008). The figure of the designer is changing to interpret, develop and share the process over the product design. Therefore, consumer knowledge and preferences shift.

This paper starts with a critical review of current products, and scientific literature that use biological tools in product design and inspiration. Next, an assessment section examining the knowledge and awareness individuals contain in regard to the Bio-age as well as terminology surrounding the new paradigm. Moreover, the preference of technology implementation, sustainability practices and education concerning biomimicry. A semi-structure approach is adopted to facilitate an opinionated collection of results. The collection then presents a coding system generated to point to answering whether users desire innovation, education or inspiration for Bio-design. The paper ends with discussions on secondary research highlighting existing products which favor to the majority results on the preeminent integration for consumer class.

2 Literature and project review

The literature review outlines current research on biologically inspired design and shift to organic design. It begins with an overview on the Bio-age impact to regulators; business leaders and policymakers rather than consumers. Then, a review of the Bio-age in relation to the digital design age.

As a paradigm shift in the direction of sustainability, exhibiting buildings that suggest nature as inspiration tabulated in Table 1 is a social responsibility to change how people think about new innovative approaches (Sai, 2020). Science and technology influence the individual's daily life in an enormous variety of ways in our gadget-filled, technologically based society.

Name of building	Inspiration	Biomimicry Approach	Biomimicry Level	Biomimicry Concept Functions	How Biomimicry Concept Affects Sustainability
MMA Office Building, Qatar	Cactus	Design looking to biology	Organism and behavior	Cactuses choose to perform transpiration at night rather during the day in order to retain water	Depending on the intensity of the sun during the day, the sunshades can open or close to keep out the heat when it is too much
DNA Towers, China	DNA helix	Design looking to biology	Organism	A DNA molecule consists of two strands that wind around each other like a twisted ladder	Revealing the notion of ultimate balance between the human being and the nature, Better functioning under wind loads

Table 1: The applications of biomimicry in tall building (Mirniazmandan, 2017).

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 (2016). Biomimicry 3.8 provides immersion programs, workshops and innovation services to deliver ideas on how bio-design can be applied to benefit your organization.

These companies are likely aware that biomimicry encounters many of the same hurdles as other approaches to research and design (Bernett, 2016). Emerging design practice is largely information-based, applications change and evolve similarly to manifestations of biology. Ongoing development of the service system can be illustrated by streaming services. Some of these studies' benefits are improved structures, actuators, sensors, interfaces, controls, and software (Davidov, 2019).

3 Summary of Proposal

This project's methodology is derived from the emerging research reflected in its literature review. In addition, the focus of this research are the topics derived from literature on the Bio-age and digital design theory. The overall aim of this proposed project is to bring forth insight regarding the future of Bio-design integration for consumer class, while considering respondent knowledge and awareness.

The literature portion underlines existing structures used as potential actuators to shape society. Therefore, the research portion will answer how bio-design for the consumer class will be considered a success regarding innovation services as opposed to education and inspiration.

The objectives of this project are as follow:

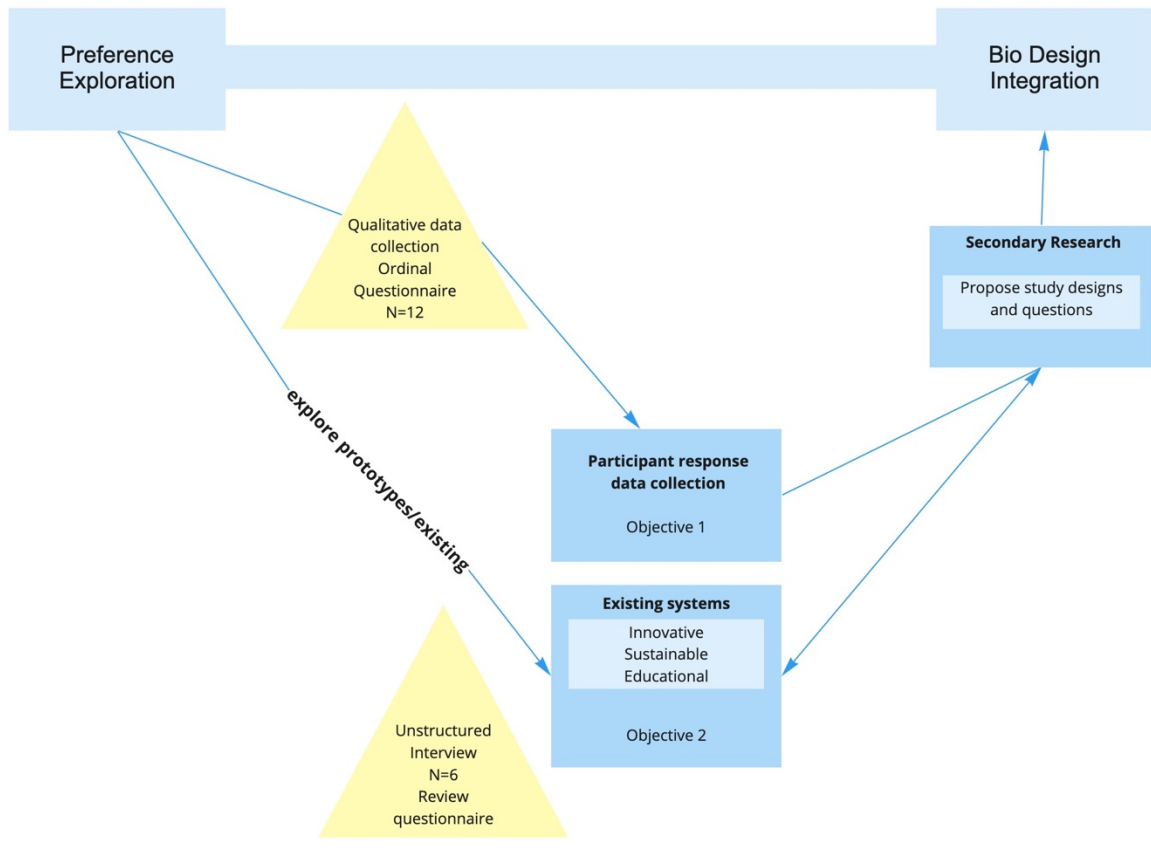
Objective 1: To understand consumer's preference for Bio-design integration.

Objective 2: To spread knowledge and awareness on the growing presence of the Bio-age.

3.1. Method

To establish whether bio-design is intriguing to the consumer class for future implementation, a semi-structure approach was adopted to facilitate an opinionated collection of results. Two data collection methods were used to conduct the research portion of this project. Key aspects associated with this task included facilitating questionnaire and interview studies to conceptualize and initiate the defining stage.

Figure 2: Conceptual Framework and Methods



Participants – 16-30 as this demographic will have the possibility of having grade 9 + level understanding of biology. In regard to the participant sample size, 12 individuals to be selected to take part in the questionnaire and 6 for the interviews.

Procedure – Data collection consisted of arranging the respondent’s answers in a coding system generated to point to answering whether users desire innovation, education or inspiration for Bio-design. Identifying the relevant data sources will include project results. When analyzing the appropriate figures, secondary research for assessing the results delivered a list of prototypes similar to the resulting category (innovation, education, inspiration). Understanding products associated with category in return, identified the wider scope of integration.

4 Findings/Results

Highlights:

- ⇒ Bio-design can inform innovative approaches as inspiration to product development, research and design
- ⇒ It proposes greater affiliation to sustainability objectives
- ⇒ Future research should explore how regulators; business leaders and might better emulate nature to inspire

With SPSS Statistics, the selected questions provided the following chart/results:

In regard to the 1st objective - To understand consumer's preference for Bio-design integration, the accumulated charts provided insight on the presence of sustainability. Participants associate the Bio-design with inspiring innovations. This finding suggests that there is an overlap for consumers to see Bio-design integrated in various ways. Note: the following tables produced with no interview data collection:

Participant preference for Bio-design integration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Innovation	2	8.3	16.7	16.7
	Education	4	16.7	33.3	50.0
	Inspiration	6	25.0	50.0	100.0
	Total	12	50.0	100.0	
Missing	System	12	50.0		
Total		24	100.0		

Table 2: Summary of Investigation

Table 2 presents the 15-part questionnaire analysis broken down from participants overall opinion on the three variables. The table represents inspiration as participants main interest as a consumer for bio-inspired products. Significant frequency of inspiration over the hypothesis of innovations was found.

a. Incentive programs should be developed to encourage business's to become more sustainable?

12 responses

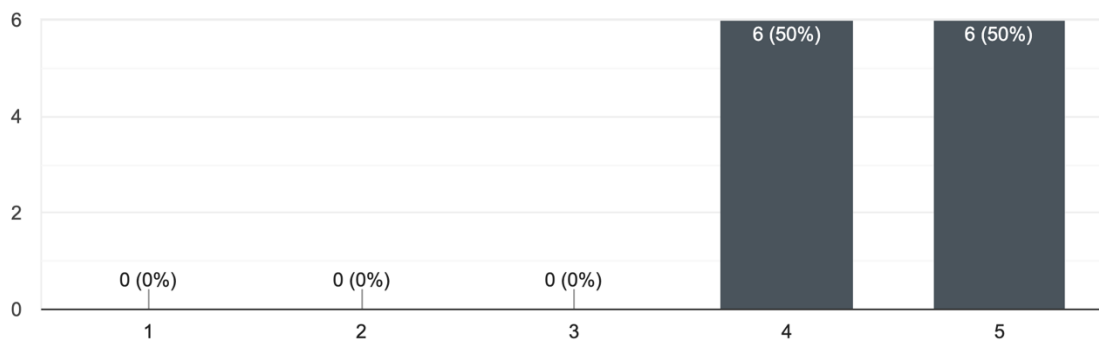


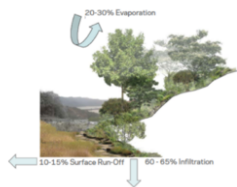
Figure 3: Incentive for sustainability

Participants unanimously agreed/strongly agreed on the idea of businesses becoming sustainable as an inspiration. This approach conveying a paradigm shift in the direction of Bio-design integration through sustainability. From the total of 6 participants in the collection method of interviewing, the contingent circumstance of more than one sector (Innovation, Education, and

Inspiration) to hold popularity for consumer class, required secondary research to convey consumer preference may alter after being provided visual or tangible products.



Bumblebees exhibit an interesting strategy for modifying countercurrent heat exchange.



Ecosystems provide services, such as stormwater management, in ways that can be very different than our own best practices.

Figure 4

Desirable consumer prototype

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Innovation	5	20.8	41.7	41.7
	Education	2	8.3	16.7	58.3
	Inspiration	5	20.8	41.7	100.0
	Total	12	50.0	100.0	
Missing	System	12	50.0		
Total		24	100.0		

Table 2: Existing system observations

The increase in innovative responses correlate with the notion of visuals being displayed. Tactile prototypes such as wearable technology portray a personal implementation to the participants in comparison to educational infographics. However, infographics that displayed the use of biomimicry and the end result interested (fig.4) the participants to acclaim they were more inspired by. Furthermore, participants found prototypes to be more effective when the design reflected the research of biomimicry.

Learning about solutions benefit my willingness to purchase and/or invest in an idea

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	4.2	8.3	8.3
	Neutral	1	4.2	8.3	16.7
	Agree	4	16.7	33.3	50.0
	Strongly Agree	6	25.0	50.0	100.0
	Total	12	50.0	100.0	
Missing	System	12	50.0		
Total		24	100.0		

Table 3: Participant's purchase habits

The culminating findings focused on participants purchasing habits. Providing research on user's willingness to purchase a product based on specifications, brand name, or price. Participants conveyed interest in price rather than solution. Furthermore, participants notion of company incentive described to be more encouraged. The results of Table 3 suggest Bio-design integrated products may need to provide information on the science specifications. The second objective of this research regarded consumer knowledge.

How would you best describe Bio-design based on the descriptions given?

12 responses

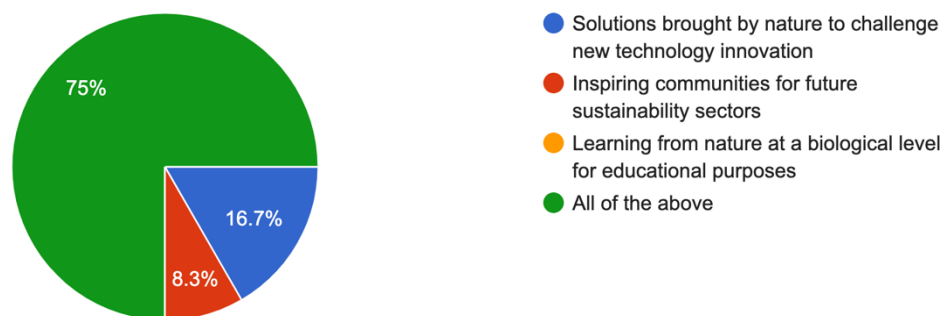


Figure 5: Participant Knowledge

Giving the answers to questions for participants to read and identify as well as background information when interviewing provided limited extent of knowledge. However, given the minimal knowledge prior to the research portion, 75% the participants answered correctly and 83% stated they were interested in the research paradigm.

4 Discussion

The research portion hypothesized how Bio-design for the consumer class will be considered a success regarding innovation services as opposed to education and inspiration. While implementation challenges remain, the results provide evidence that the incorporation of biology can inspire individuals through informative images and prototypes. These findings offer regulators an opportunity to be transparent when Bio-design emerges. Based on the findings, achieving consumer goals will require companies to inspire individuals to shift in the objectives, perspectives and principles of Bio-design.

The results provided insight on sustainability incentives as a popular appeal for participants to regulators; business leaders and policymakers. Provided the bio-design integration would have a similar impact to companies as sustainability measures proceed, the user preference is more govern to the Bio-Age as a system rather than a product. Further secondary research was conducted to find user preference in relation to design. A prediction model was conducted by MDPI on biologically inspired design (BID) based on designers to “facilitate the use of biological features in product design and thereby enhance the market importance of BID (Luo, 2020). Although this paper is not focused-on consumers, the paper implied inspiration as a great significance for designers. This research solved the problems associated with the cognitive limitations of designers and with the combined results of this paper, the similarities between designers and users, as inspiration being a desirable trend (Luo, 2020).

The findings from the unstructured interviews using prototype observation, user's found innovative examples more appealing. For the Bio-Age to streamline the front end of innovation for environmentally sustainable products, Biomimicry 3.8, the world's leading bio-inspired consultancy offering biological intelligence consulting, professional training, and inspiration have reported on solutions (Bureau, 2020). Solutions for innovative preferences include company options such as requesting a speaker or hosting a Biomimicry design jam. According to Biomimicry 3.8, "A leadership development consultancy based in Vancouver Island, B.C., recently used biomimicry as a training tool that helped a client maximize its partnerships in the community by boosting leadership internally. The work, detailed in this Sustainable Brands article, fuses biomimicry and social innovation, and quickly produced results thanks to guidance from lessons from nature" (Cederberg, 2017). In addition, researchers at Global Business and Management Research (GBMR) suggested in with regard to innovation, "biomimicry is a powerful driver to accomplish and sustain innovation processes. Biomimetic leadership will provide an environment that is suitable for any type of innovation. Finally, Biomimicry can be a universal language that can be used by organizations in order to build business future (Celep, 2017). Therefore, the findings for consumer preference in Bio-design integration holds similar values to accomplishable methods researched.

Based on the paper, the findings in this research proved the basic knowledge of Bio-design conveyed to participants. Next, the propositions for knowledge and understanding of the Bio-age can be extended and developed. Finally, for future research, exploring how leaders might better emulate nature to inspire consumers rather than internal members may enhance consumer knowledge.

5 Conclusion

This study addressed a consumer view on the evolving Bio-age and suggested inspiring innovations as opposed to educational toolkits as a preference for the process of companies. The objectives were to gain knowledge on this preference as well as spread knowledge to participants on the evolving Bio-age. The culminating findings focused on desirable purchases, interest and regard for businesses. The objective to spread awareness proved to be sufficient for basic understanding and intrigue, further implying inspiration as the consumer preference. The literature reviews have provided information on the science and design behind the processes, however, lack the connection to the consumption of individuals outside of the development team. On the other hand, participants proved an overwhelming accord to informing approaches as inspiration to product development, research and design. Moreover, products that held a greater affiliation to sustainability objectives proved to carry out a stronger desire. Concluding, the Bio-age for consumer class prefers Bio-design to advance in terms of function over form.

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