

BIOMIMICRY A MIMESIS OF COMMUNICATION FROM NATURE: A STUDY OF SELECTED CASE STUDIES IN ENVIRONMENT COMMUNICATION.

Abstract

Intro: Biomimicry, from the Greek words for "life" (bio) and "imime" (-mimesis), is an emerging field that aims to extrapolate the systems and structures found in nature to be used in a variety of man-made contexts. Biomimicry is the process of finding solutions to human issues by modelling human creations after solutions found in nature. But in environmental communication, we talk about how to use words to fix the planet's problems. In the domain of biomimicry, the term "mirroring" is used to describe the mimesis of communication. **Objective:** The purpose of this research is to gain a better understanding of the relationship between biomimicry and the process of communicating with the environment regarding anthropogenic causes. The research has a qualitative, social-scientific stance; it serves as a model for a case study on active apps that focus on pro-environmental behavioural goals. The study was conducted using a multidisciplinary approach, and the results zeroed in on the domains most profoundly impacted by biomimicry's use in environmental discourse. **Findings:** The outcomes of the study indicate an Indian-based programme called hejje (meaning pug mark) that was introduced in Bandipur Tiger Reserve that simulates tigers' territorial route migratory patterns to provide a potential trajectory path. In order to anticipate poaching activity within Bandipur Tiger Reserve, researchers have developed a trajectory path that is a simulation of the historical route used by tigers to establish their territories there. **Conclusion:** This case study suggests that biomimicry can be used as a means of

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resolving anthropogenic environmental challenges by employing technology that percolates from bio-mimicking.

Keywords: biomimicry; mobile application; mimesis; environmental communication.

I. INTRODUCTION

This anthropological study of biomimicry explores how American management consultants have conceptualized and used nature at the beginning of the twenty-first century. While "human-centered design" has given culture an economic boost, "biomimics" are consultants who value nature, specifically "life," as a source of technical innovation. According to their popular biology epistemology, 3.8 billion years of evolution have produced "adaptations" to the environment that are more potent, effective, and long-lasting than human invention [1]. An ecosystem of innovation consultancies has developed around the conventional wisdom that adopting biological "design principles" would lead to "sustainable innovation," following the example of author-turned-consultant Janine Benyus [1]. However, despite their commitment, not much has happened.

Environment and human development are inextricably linked concepts. Environmental concerns are still largely neglected more than 25 years after the Brundtland Commission report stressed the urgent need to establish and put into practise the blueprint for an environment-inclusive sustainable development strategy. A situation like this has clearly affected people's capacity to meet their basic requirements and concerns about their health, safety, and social cohesiveness. According to the United Nations' 1987 publication of the Brundtland Commission Report, "Our Common Future," [2]:

"Sustainable development is growth that satisfies existing requirements while not jeopardising the capacity of future generations to satiate their own needs. It includes two important ideas [3,4]:the idea of "needs," especially the basic requirements of the world's impoverished, to whom top priority should be given;the notion that the capacity of the environment to meet existing and future needs is constrained by the state of technology and social structure.

Putting an emphasis on environmental sustainability in the information age, when the relationship between man and nature has been severely harmed by excessive resource extraction and the employment of unfriendly environmental practises, leading to pollution and the deterioration of the natural environment Therefore, it is important to comprehend how people behave and think about the surroundings. Theoretically, three categories of considerations—behavioral belief, normative belief, and control belief—direct human behavior [5, 6, 7].

We must adopt an inclusive way of thinking in order to lessen this link. Biomimicry, which literally means "imitation of the living," is the process of drawing ideas from the natural world and using them to solve problems faced by humans [8]. Natural selection over millions of years has meticulously honed nature's techniques and patterns [9]. Since nature is much more advanced than us in research and development with regard to sustainable solutions, incorporating such tactics into modern living can really help us produce solutions that will be both viable and sustainable.

As an illustration, we can point out that a fallen wood on the forest floor is being recycled by nature into mushrooms that are being nibbled on by rodents, which in turn are the primary source of food for larger animals like hawks. The concept of upcycling entered study much later. Though nature had long before embraced the idea of upcycling [10].

The researcher needs to concentrate on the notion of how to convey the following to the general public when we talk about these developments. When scientists collaborate in the lab, they do so in secret jargon that only they understand. Journal publications or other products with roots that are obscure to the general public serve as the contact between the communicable work of scientists and the general populace [11]. We all agree that we should use sustainable products, but explaining why may be quite difficult. By leveraging environmental communication and educating the public on biomimicry, we can perhaps address the effectiveness problems that sustainable technologies around the world are currently experiencing. By examining situations in which we may do this, the research assists in giving us answers to the problem by allowing us to connect the usage of biomimicry solutions with pure modern technology.

II. BACKGROUND

In order to build a model for the usability of mobile applications and to analyse its impact on the sustainability of the environment by studying user behaviour towards their surroundings, the researchers have chosen the information and communication route for this study. Understanding their surroundings is facilitated by modelling the information and communication flow process. This aims to develop a model for the interaction between "Human Nature" and the information society, which is driven by many applications for every action. The application of bio-mimicry in the production of media products has resulted in revolutionary developments [12]. Future smartphone technology that incorporates biomimicry is already a dream [13]. The research's fundamental goal is to communicate the appropriateness factor to the general population in a way that will encourage acceptance of and retention of the technology. It is not about the technological revolution or the necessity for it. The process's result is environmental communication technology, or the paradigm for using environmental information that is covered in the research's following sections.

The Following Are Some Examples of Biomimicry Processes: In order to endure extreme temperature variations, Mountain Stone Wet as, the largest freeze-tolerant insect in the world, may freeze 80% of its body components for months at a time [14]. Water bears, also known as tardigrades, are reputed to be the world's toughest animals. They have developed to be able to withstand temperatures near to zero and temperatures hotter than boiling water, survive for ten years without food or water, and withstand radiation 1,000 times the deadly dose for humans. Eagles and falcons are examples of raptors with eyes that can produce incredibly detailed images that far surpass what the human eye is able to see. In the winter, North American wood frogs progressively allow up to 65% of their bodies to fully freeze [15]. With such superpowers, it's not surprising that scientists are looking to nature for inspiration in human pursuits like smart phone design [16].

According to the Biomimicry Institute, "Biomimicry gives a sympathetic, integrated view of how life works and ultimately where humans belong in" [17]. The objective is to develop new methods of living that address our major design problems in a way that is both sustainable and supportive of all life on earth. To date, biomimicry has been applied to the production and storage of electricity, the manufacture of thin and powerful computing components, and the construction of durable body armour [18].

Researchers are looking at octopus-inspired robots that can pick up fresh fruit and vegetables from trees with little harm. Hospitals and medical facilities are looking at sharkskin's antibacterial qualities, which stop microorganisms from adhering to surfaces. Insects and reptiles serve as inspiration for the self-repairing elements used in the construction of new bridges and buildings [19]. Thus, the study seeks to substantiate the notion that communication might mimic the environment.

III. LITERATURE REVIEW

Today's interaction between humans and computers and between humans and nature scholars have primarily concentrated on either sustainable development or the growth of information, communication, and technology (ICT). The mobile phones that we use today are one of the tangible representations of the idea of ICT; with an increase in global usage, they have evolved into a highly significant communication tool in people's hands. There is a mobile application today for every type of communication, including interpersonal, group, public, and intrapersonal. By using the environmental psychology perspective, Song and colleagues identify the association between application quantity and application discoverability [20]. This relationship, however, is deteriorating, and the solutions for it, as the researcher discusses in the paper, call for the incorporation of biomimicric designs into our daily lives. Biomimicry has been the inspiration for many designs, including fiber-optic sensors enhanced soft robotics and dynamic microwave photonic technologies [21]. Biomimicry in Embedded Soft Robotics using Microwave, Photonic, and Fiber Optic Sensors. Conference on Optical Fiber Communication, conveying ideas, and producing 2D and 3D design artefacts. Optica Publishing Group. Students' spatial thinking through a biomimicry design project, among other design subjects [22]. Designing a Project Inspired by Nature to Support Students' Spatial Thinking in the Primary Classroom. Designing A Better World Through Technological Literacy for All, PATT 39 On the Edge Proceedings, p. Biomimicry has unintentionally been influenced by technology and nature, particularly in relation to ties to electromagnetics in navigation and communication systems. Many tools, phenomena, and methods of problem-solving are taken into consideration. We investigate how subtle discovery is guided by observation of phenomena like synchronicity, periodic architecture, whispering gallery modes, and quantum entanglement. This chapter lists, analyses, and considers these parallelisms and links, as well as their potential impact on creativity. A connection between experiences, observables, and how we conceptualise and develop new technologies is sought after [23]. Communication technologies and natural phenomena are comparable.

IV. METHODOLOGY FRAMEWORK

The Study is qualitative in nature and the case study method has been employed in the research. A study on sharklet was conducted in the area of biomimicry by (Nield, 2007) because Sharklet has been proven to be successful in stopping bacterial development. According to one study, Sharklet is 99% efficient at stopping the growth of the germs *Staphylococcus aureus*, which is frequently seen in hospitals. The framework for the method used is similar to the work of Nield (2007) as used in the paper.

flowchart (TD) Select a case -> Gather data --> Analyze data --> Draw conclusions-
->Biomimicry --> Interviews, surveys, documents --> Qualitative analysis, quantitative
analysis, combination of both --> Conclusions

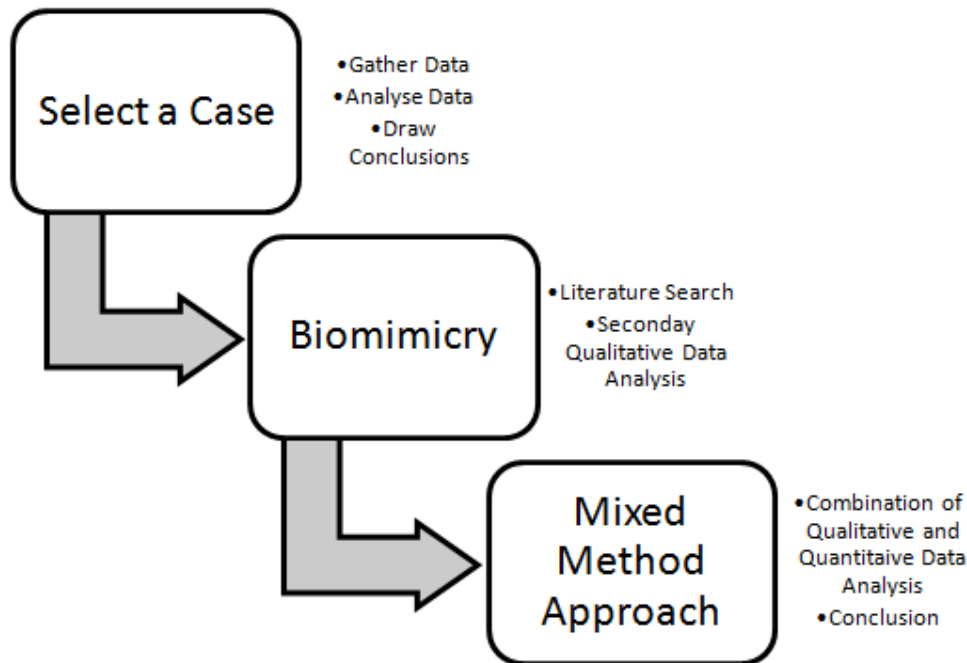


Figure 1: Flowchart of Methodology Used In the Study

The conclusion and recommendations followed the mixed method approach according to the top down (TD) flowchart

V. SMART PHONE TECHNOLOGY AND BIO-MIMICRY

Researchers are using biomimicry for everything from batteries and cameras to coatings and microphones to boost smartphone development [24]. The list of elements from the natural world that are expected to be used in future smartphones is somewhat evocative of the Witches' most well-known chant from Shakespeare's Macbeth (eye of newt and toe of frog, wool of bat, and tongue of dog, etc.). But there's a little more to the procedure than just putting things in a cauldron and casting a spell.

1. High-Quality Camera Lenses: Humans are not recognised for having keen eyesight, as was already said. In fact, animals with better eyesight include beetles, dragonflies, owls, and even goats. Researchers and technology developers have long been interested in learning more about lenses from various animals' eyes.

For instance, the compound eyes of fire ants and bark beetles have about 200 different optical components, giving them an unlimited depth of field in addition to a wide-angle view. The examination of these eyes has inspired scientists to create tiny

hemispherical cameras with 180 microlenses. This lens creates a clean 160° frame, more than double the lens on the iPhone X [25].

- 2. Longer-lasting Batteries:** A sugar-powered battery that is low-cost, biodegradable, and highly effective has been invented by Virginia Tech researchers and is being praised as the perfect alternative energy source [25].

A sugar battery was developed by a different research team at SUNY Binghamton using paper and exoelectrogens (a type of bacteria capable of transferring electrons outside of their cells). This battery has a four-month shelf life, making it perfect for usage in cellphones as well as small devices in remote locations with little electricity.

- 3. Waterproof Coating:** Researchers from Ohio State University found parallels between roof shingles and butterfly wings. Both have grooves that allow water to flow off their surfaces. They gave a coated plastic surface a similar feel and discovered that it was considerably simpler to maintain. This coating can be used to protect a smartphone's screen from dirt, dust, and moisture [25].
- 4. Regenerating Screens:** The invention of self-healing plastics was made originally by Nancy Sottos from The University of Illinois. A resin that promotes healing is infused into the plastic, and it activates when a repair is required. Meanwhile, researchers at Pennsylvania State University have created a plastic polymer with built-in healing properties that are activated by pressure, heat, and water. Squid teeth, which can repair fissures by reuniting hydrogen bonds, served as the inspiration for the polymer [25].
- 5. Sound-isolating Mic:** The microscopic hairs on the body of insects like crickets and mosquitoes are used to determine the direction of sound waves. They can isolate specific noises and filter out others as a result. In order to simulate this process, the startup Sounskrit has created gear that measures the particle velocity of incoming sound waves. For speech recognition programmes like Apple's Siri and Amazon's Alexa, this will be helpful [25].

The use of mobile applications and their psychological impact on users also influence the usability and efficacy of smartphones.

VI. MOBILE APPLICATIONS AND ENVIRONMENTAL PSYCHOLOGY

A significantly wider client base and complex computer systems are finding their way into daily life. Because they have almost immediate access to the information and services they want, mobile applications help consumers live more productive and pleasurable lives. Environmental psychology is the area of psychology that focuses on giving a comprehensive explanation of how people and their environments interact. According to this viewpoint, the environment exerts a strong and direct causal influence on how people behave. The environment is crucial because it influences human behaviour as well as providing opportunities for subsequent action [26].

The usage of cognitive maps is one method that people manage the processing of information, according to the environmental psychology perspective. People can navigate an area by using their cognitive maps, which serve as an accumulation or synthesis of their

experiences. In the study of the connection between environment and cognition, the cognitive map thus seems to be a viable idea.

The development of efficient surroundings in which users may digest information is crucial, according to the environmental psychology viewpoint. To explain how people use knowledge to satiate their want to make sense of and explore an uncertain world, Kaplan and Kaplan established a preference framework [27].

The study of environmental psychology offers tools for comprehending how to encourage interactive encounters. According to them, delivering information in a variety of ways, such as through signs, features, visual aids, and technological supports, has an impact on how a person perceives their surroundings [28]. By perceiving settings as giving information in a variety of ways, such as through signs, icons, words, layout atmospheres, and other similar forms, environmental psychology offers a way to comprehend how to facilitate the interactive experience [28]. This study takes into account the coherence of application stores, user-generated reviews, and multi-channel engagement as three facilitators that enhance application discoverability.

VII. 'HEJJE' MOBLIE APPLICATION- A CASE STUDY

Another flexible use for tiger monitoring and natural life preservation in Bandipur's anti-poaching camp is dynamic monitoring and greater staff cooperation [29]. Because "Hejje" (Pugmark), a locally developed Android app, was launched in Bandipur on February 4th, 2014. H.C. Kantharaj, Conservator of Forests and Director of Bandipur Tiger Reserve, initiated the request [30]. It was created by Bangalore-based Key Falcon Solutions.

According to the following, the Hejje flexible application's primary goal is:

- By keeping the range timberland officers distinct from the woods workers, it will make it easier to observe them on foot.
- Live updates on their anti-poaching monitoring activities, such as watch times, lake water levels, suspicious activities, tree populations, and forest fires.

The primary tiger natural surrounds at Bandipur were modernised with the creation of the Hejje portable application. Poaching leaves Bandipur's tigers with no protection. By employing this new instrument for checking, the new application must incorporate sufficient security of this living place [30].

The crew can take images using the mobile application, and it will instantly send them to the base camp so that senior officials can make decisions based on constant data flow from the beginning. "Hejje" will be used by the counter-poaching camp staff during their routine watching, and range backwoods officers would get continuous updates of watch begin time, end time, separate secured, and creature located. In the event that water levels run out, an analysis of a progression of pictures taken from the field can help evaluate the seriousness of the situation. Data is now secured and has been scrambled; only authorised workers will have access to it going forward. Every underground insect poaching camp will have one of these devices, and the software will be downloaded on 40 phones that will be provided to the Bandipur Tiger Reserve crew.

Highlighting the app's benefits, pug impressions and animal behaviour may be seen by recently snapping a snapshot and uploading it with the GPS location, just as tiger development around the boundaries can be differentiated by a ready system that will help make preventative steps. Water gaps can be observed for levels, woodlands fires can be noted, and regular ongoing maps can be made to help define inclined zones. The product can be used to alert authorities via notices of forest fires.

VIII. FINDINGS

1. Process of HCNI Paradigm

- **Human:** The forest staff who are enforcing the wildlife sanctuary's anti-poaching patrols and the forest office's administrative headquarters together are one level of information sender/receiver. In order to process information at the micro level, the 'Hejje' procedure involves sharing images (pug-marks, water levels, etc.), words, and geo-location data. The entire human species, on the other hand, is the macro level sender and receiver because it depends on the ecological balance for survival.
- **Interface:** The Hejje application serves as the interface and is a two-way virtual instrument for information dissemination. It gathers environmental data and transforms it into a usable format that can then be used to the case study's stated objectives.
- **Communication Medium:** Internet-based mobile application technology is a sort of information communication technology (ICT).
- **Nature:** The flora and fauna that make up the Wildlife Sanctuary, such as the Bandipur Tiger Reserve, function first as receivers (for the purpose of protecting wildlife), then as senders (Source of Information) Using information acquired from the natural world, ICT technology makes it feasible to safeguard wildlife.

The graphic below shows how the communication process can be drawn out in detail.

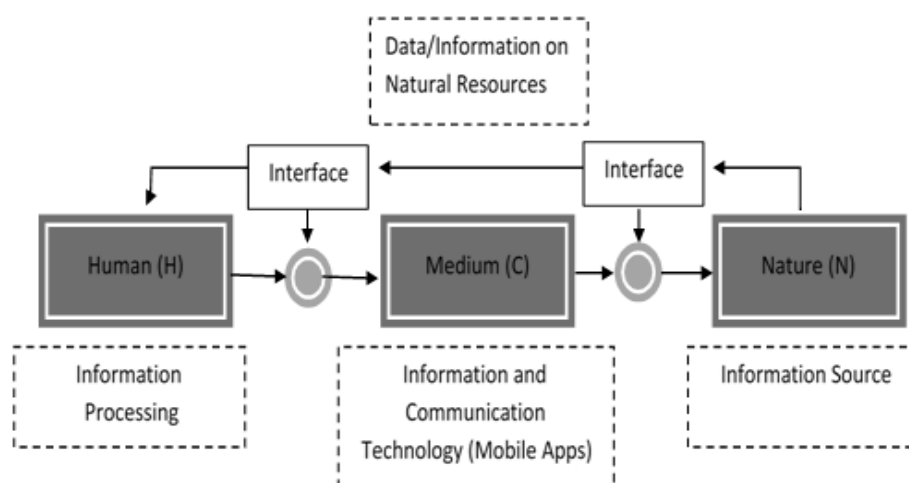


Figure 2: Human Communication Nature Interface (HCNI Model)

IX. CONCLUSION

We can uncover similarities between the use of mobile applications such as 'hejje' and the use of a smartphone of the future through our research into biomimicry, which has led us to discover that biomimicry is not just about replicating the process, but also about mimicking the system. The utilisation of biomimicry may alter the way in which we engage with nature, and the anthropogenic interaction that we currently have may become more beneficial as a result. It is possible to achieve the Sustainable Development Goals (SDGs) if we are able to implement an inclusive technology that can learn from nature's R&D time and then use that knowledge to enhance ongoing technological development. The communication of environmental issues is essential to the process of conveying the issues that must be addressed and the solutions that must be found. The nature of the research is theoretical, and it requires evidence from the real world.

- **Limitations of the Research:** The study is qualitative and is based on secondary data to come to the conclusion hence research findings may change when conducted in a much more primary data setting.
- **Scope for Further Research:** The study can be a basis for understanding the use of biomimetic in a more primary data search and analysis and models for further usage with suggestions and recommendations can be sought for further research looking ahead on the research already conducted above.

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BIOMIMICRY A MIMESIS OF COMMUNICATION FROM NATURE:
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