Design for This Century
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12.14.17

A Biologically Symbiotic Alternative of Communication Technology

Abstract

In this paper, we wish to explore the possibility of an biological symbiosis as means of communication technology. Through the discussion of the history of communication and the current state of communication technology, we recognize that the current digital technologies are not sustainable in terms of energy efficiency, land uses, visual pollution and detachment from the nature. In wish to solve or at least inspire scientists and engineers to design a better solution, we discuss the advantages and disadvantages of a biologically symbiotic coral-like organism as the carrier of the data transmission. Implication and potential problems are identified in the later sections of the paper to offer more extensive discussion into this topic. In the process of critical design, we wish to raise the concern of the dysfunction of our current technology in the future and expand the possibilities of alternative solutions.

The History of Communication

We’ve come a long way in the evolution of communication. From the early stage of human-human communication to the current state of the art telecommunication, human developed not only various technologies for better communicating with each other, but also improved the rhetorics of

communication so that we can understand each other more effectively. Two major categories of communication span from the age of human origin to the wireless technology that we're benefiting nowadays. Body language, writings and linguistics belong to the former category of human-human communication. The latter category, telecommunication, started with the uses of beacons and beacons. In 1837, Sir Charles Wheatstone and Sir William Fothergill Cooke first invented the electric telegraph (Hubbard, 2013). The first transmitter and receivers of telephone were invented independently by Alexander Bell and Elisha Gray in 1876 (Puleo, 2010). Italian inventor Guglielmo Marconi laid out the foundations for radio communication in 1894, which is the start of nowadays pervasive wireless communication (Nobelprize.org). Finally on the date of December 5th, 1969, a four-node network called ARPANET was implemented and would later become the universal Internet (Hafner, 1998). Since then, the advancement in wireless technology enabled us to enjoy faster speed, larger bandwidth and richer contents in today's Internet age communication

Current State of Communication

While the benefits of the current communication technology are significant as discussed in the previous section, our society started to realize the disadvantages in today's telecommunication-based realities. The adoption of current wireless technologies lead to the mass construction of communication infrastructure such as cell towers, power transformers, communication satellites, routers etc. All these infrasture not only demands a large energy consumption but also a radical change of the natural landscape.

Figure 1a-b: Infrastures of telecommunication. Photo left taken by Dina Lydia, photo right taken by Fré Sonneveld (Unsplash).

Architects and engineers managed to design and construct such infrasture in all three dimensions and every remote place on Earth. Animal and plantation activities and territorial needs are compromised by consumerism and the communication needs of humans around the world. It is a fact that the natural landscape and resources on Earth are limited. Even though Charlie Stross has argued that there is still a great potential to improve in terms of the power consumption of electronics despite the spatial limits of electronics are almost realized (Stross, 2012). With the demands for more powerful communication technologies and larger data storage, it is highly possible that a crisis for satisfying such demands in the face of land and energy shortage will occur in the near future.

In addition, if we pay closer attention to the implementation and protocols of various wireless communication, we can see that we are soon taking up the range of frequencies on the electromagnetic spectrum. With new generations of telecommunication technologies, companies are determined to quickly occupy the

rest of the space in the spectrum and start their standard communication protocols. What if one day, we have to reply on the frequencies in the visible range of the spectrum (waves of wavelength from around 400nm to 700nm) to transmit data and information? If that is the future that we are transforming into, then all electromagnetic waves that used to carry byte information will be visible and obtrusive like the wires and communication infrastures in our living space. I would like to argue that it seems dystopia for me to live in a space with wires intertwined and be surrounded by human artifacts without a glimpse of nature.

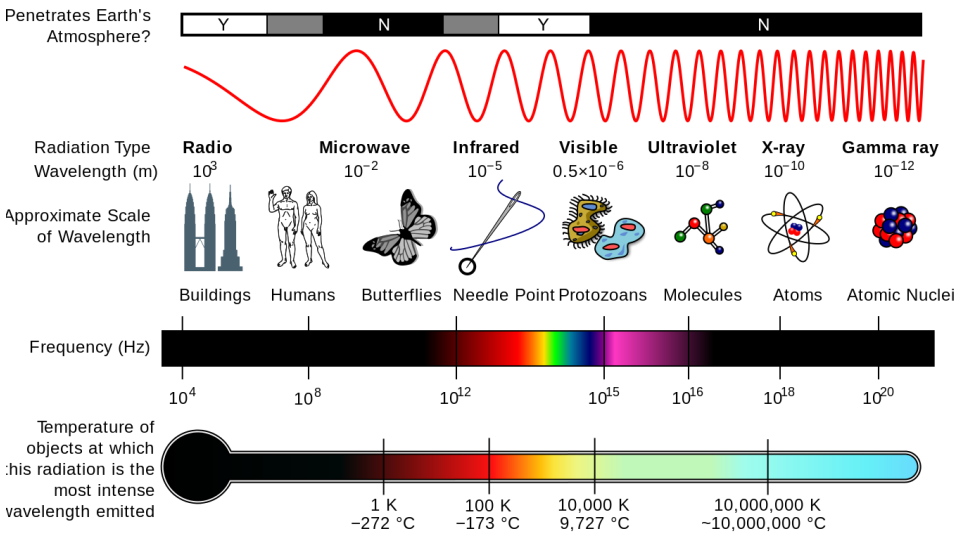

Figure 2: Electromagnetic spectrum (NASA, 2007).

Apart from all implications and disadvantages of current communication technologies, it is essential to realize that while the number of data packages in today's world has increased dramatically for the past decades, the meanings and knowledge we created from all these communication practices are not proportional to the increase in data transmitted. More and more people started to observe that we are further detached from our environment, both the

natural landscape and phenomena of the Earth and all the other organisms in the world. Technology itself cannot completely substitute the need to interact with our ecosystem and ecological biome. Mixed reality applications may help people to partially experience the nature, but their experience can never be equated to the real interaction with nature. The quality of our life largely depends on the way we experience with the external world. In a world that is engulfed by the artificial creations and meaningless human activities, it is extremely difficult to imagine that our quality of life can be greatly enhanced.

Biologically Symbiotic Communication (Coral)

Ever since we enter the digital age with the invention of long-wave telecommunication (radio) and Internet, our world has gone into the tendency of everything becoming digital. From science and engineering perspectives, being digital does have unparalleled advantages over analog communications. Digital signals are easier to encode, less likely to lose power, less prone to errors and considerably more convenient to store. However, when we look at the implications of a digital age, a vast number of problems started to emerge. The very contents of our communication became unrecognizable to humans, since everything is stored in binary format (Paglen, 2017). Twenty percent of the Twitter traffic consists of bots (Campbell-Dollaghan, 2016). All of these incidents or implications should alarm us about a future where a party behind a bilateral communication can even be non-human and the contents of which are meaningless to ourselves. This motivates me to look at other forms of communication and some technology prior to or outside of the digital age. During my research of an alternative communication technology, I try to answer

the following questions: how do we reconnect with the nature that we are so detached to; how to create more meanings with an alternative means of communication; how to go beyond the purpose of communication and have a carrier that does not only embody information but other forms of human needs; what are the advantages, disadvantages and concerns of a new form of communication?

To answer these questions, I decided to enter the biological realm of the existing technologies that may help the human society. In 1897, professor Charles Darwin proposed that all forms of organism stems from the same origin. Through evolutions, various forms of life branches out as trees in developing its own characteristics (Darwin, 1897). When we look at millions years of evolutions we start to observe a pattern that at the bottom of the evolution branches are the single-cell species, often plantations. Humans on the other side, has arrived to a branch that is far from other forms of life on Earth.

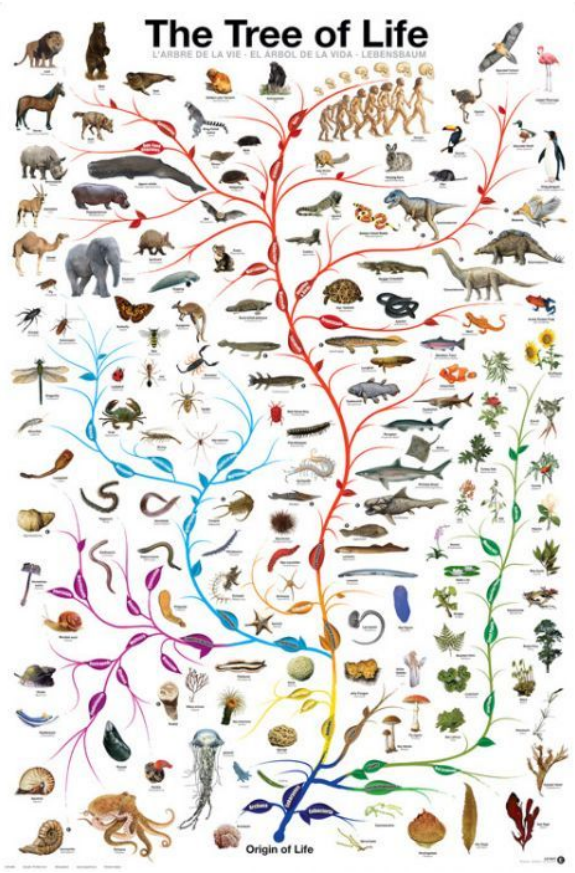

Figure 3: Tree of life (Web Image).

Can we go back to the root of the Tree of Life, and establish the carrier of our communication so that we can communicate with all forms of organisms. The carrier has to be simple enough, at the bottom of the tree of life in order to be highly compatible in the process of communication.

Imagine a world where we have a coral-like organism (from now for the simplicity of demonstration, we will call it coral) that reside on our body. The majority part of the coral consists of polyp whose root extends below our skin to capillary vessels. As a symbiotic relationship, we provide the coral shelter, mobility and a optimal temperature of living as our body temperature. On the other side, humans use the coral and the sperms/eggs which they eject

as medium of information and communication protocol. The sperms/eggs of corals are mainly amino-acid (protein), which can be decomposed by other corals and enter our bloodstream as a form of energy. When we are ready to send a message, the coral can produce a single sperm/egg and propagate it into the air like dandelion. The sperm/egg is lighter than density of atmospheric air, therefore can float in the air. The distributed sperm/egg can then be captured by destination coral stomach, which is in the center of coral polyp, and decoded as hormone when it enters the human bloodstream. The sperm/egg of coral is smaller than the smallest particle that is visible to human eyes and can be carried out in air through current or other indicators. In nature, the sperms/eggs of coral are sonotaxis and phototaxis, meaning they are responsive to sound and light signals. This means that they can be easily directed and be effectively travelling in the air.

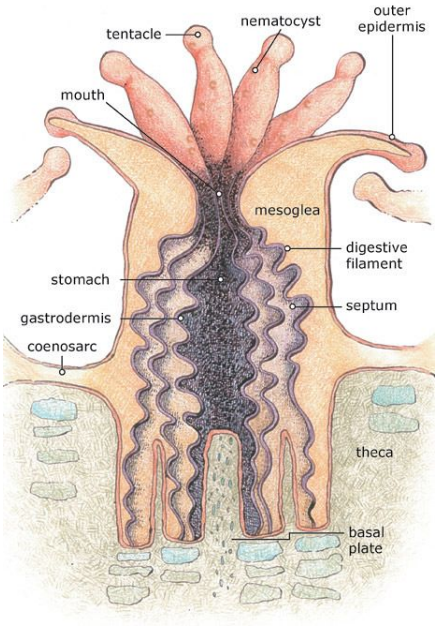

Figure 4: Coral polyp (NOAA, 2006).

Note that, here I'm only proposing an alternative way of communication. It is not my intention to fully eliminate the existing digital technologies, rather

by offering an option to utilize this biologically symbiotic organism to facilitate us in communicating in certain scenarios. It is highly effective when we wish to reconnect with our natural ecosystem, richer in meanings because hormones formed in our bloodstream can produce stronger and richer feelings than digital media. It is invisible to human eyes and does not require any forms of manmade construction as its infrastructure. By establishing this symbiotic relationship, we created a equal relationship with the organism we use to help us communicate and this organism was not created solely as a human artifact, yet an example of the existing coral biome.

Let us revisit the questions I wish to remind me of when designing this new form of communication: how do we reconnect with the nature that we are so detached to; how to create more meanings through means of communication; how to go beyond the purpose of communication and have a carrier that does not only embody information but other forms of human needs; what are the advantages, disadvantages and concerns about a new form of communication? It is the intention of inventing such single-cell carrier to facilitate our communication so that we can communicate with organisms in all branches of the tree of life. Through this type of biological way of encoding and decoding messages, we enjoy a larger bandwidth in which information can be transformed: feelings, emotions and experience and be transferred much more efficiently in hormones. In addition to solely serving as the carriers of message, the sperm/egg of the coral can be further digested by other coral and used as a form of energy. Finally, the implications and problems of this alternative approach of communication will be discussed in the **Potential Problems and Implications** section of the paper.

Implementation

This biologically symbiotic alternative communication carrier may seems intimidating at the first glance. The majority of human society is not readily comfortable with the concept of cyborg or parasite, nor does humans are willing to share the control of their body and information with an external organism. The coral can start off as fashion, a way of personal style and manifesto. The coral species has hundreds of variations, which gives human enough options to choose from. Once the coral has been tested and used in our daily life, the late adopters and majority of the society can begin to invest in such symbiotic relationship to communicate with each other. As mentioned above, the coral can be used as personal clothing styles and manifesto of values or personalities. This imply that everyone is their own designer in the future, where they can choose to grow such coral on certain part of their body and choose the specific species of coral, which has diverse color ranges.

Another major issue with the existing telecommunication network is the large consumption of power - inefficient power conversion from natural resources (fossil fuels) to electricity, then conversion from electricity to electromagnetic waves through antenna. During the process, due to multiple conversions between different forms of energy and the energy lost in transmission, even the state of the art technology cannot limit the fact that current communication technology is low in energy efficiency and wasteful in total power consumption. With the biological symbiosis of corals. The world's chemical elements are absorbed and grown into the polyps of the coral and can achieve 100 percent energy conversion. Once the coral is grown on the human skin, it can be fully self-sustained with photosynthesis and digestion of the

sperms/eggs of other corals. In this scenario, the world's organic matters are propagated into the air and ready to be redistributed throughout the world. In the future, we envision that there will be coral farms all over the world, where this living organism can be grown locally, bought or distributed within the society and be mass-produced in a sustainable way without the use of chemical substances that are usually found in other kinds of farms.

Once implemented, the corals can be fully self-sustainable with an equal relationship with the host person. The impact of such alternative technology of communication is profound since not only the information can be transmitted in a larger bandwidth and richer format, but the global organic matters can be re-distributed around the world without any cost of energy consumption. This is a system that can be fully functional by itself and since we distribute the device to everyone, there is no need for a dedicated land to build all the infrastructure for a certain range of service. The extensive land use and energy consumption problems can be solved in a much efficient and meaningful way with this symbiotic organism.

Potential Problems and Implications

With each solution or proposal, there come the implications and potential problems. We have to recognize that this alternative does not necessarily deal with the problem of security and privacy. The sperm/egg of coral are well spreaded out in the air and can be accessed by anyone if using dedicated devices to detect them. The open transmission path can be tampered by weather conditions or other manmade micro-environments. In addition, there is no ways to prevent a mass surveillance network that can be developed by governments

and any large institutions. As in the description of the law enforcement surveillance network used in the city of Compton, law enforcement can also use some types of coral to capture the large quantity of information that is propagating in air to order to form hijack the free data through their transmission channels (Friedersdorf, 2014). It has brought to our attention that while mass surveillance and privacy remain the centerpiece of the transmission danger, bio-hacking and deliberate poisoning can cause more damage to our coral society as well, if not more to the host human. Through advancements in DNA engineering and other biotechnology, people will be able to modify the information that is being encoded onto the coral sperm/egg or even manipulate the sperm/egg itself so that it can cause incorrect or even harmful emotions when formed as hormone. Furthermore, airborne pandemic disease can even be harder to counter, since now there are million of handy carriers floating in the air and serving as the most direct way to enter the human body. Apart from all the concerns we've discussed above, trash and littering problems can also be disturbing, as the solutions are scarce when some encoded sperms/eggs are not being used by any destination coral. There is definitely a chance of failure for sperm/egg to not reach its final destination; however, how to differentiate between valid sperm/egg and invalid one and who to decide such validity has also to be discussed further through the implementation.

Despite all the potential problems we have recognized above, we still believe that such biologically symbiotic alternative of communication has great potential in terms of achieving a more equal relationship with nature and our physical environment. The urban architecture can be dramatically shifted to a

more spatially efficient manner, since we no longer need bulky infrastructure to sustain our communication needs.

Conclusion

In conclusion, we use critical design to propose an alternative way of communication inspired by the life of coral, an invertebrate animal that lives on the surface of sea beds. We wanted to create an equal relationship with the symbiotic organism, therefore sharing our bloodstream so that hormones can be formed within the coral and passed down to the blood vessel. According to the Tree of Life, we wish to re-establish the keen connections with the our nature though this simple animal plankton. Although biological communication technology remains problem-some nowadays, we do believe that such critical design proposal can help our scientists and engineers to rethink our current communication technologies and be concerned of the consequences and implications of such digital-only mentality. The evolution of communication technology brought us into a byte age; there is no reason to think that the next generation of communication can be biology-based and inclusive to the entire ecosystem.

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