Bio Art as a Trading Zone: A Creolized Art Form of Biology and Art

Jongcheon Shin
Media Art in Aesthetic Technology Lab, Soongsil University, Seoul, 07040, Korea
jasonshin@maat.kr

Siwon Lee
Fiber Science Design, Graduate School of Dankook University, Yongin, 16890, Korea
siwonlee@hotmail.com

Joonsung Yoon
Tianjin Normal University / Global School of Media, Soongsil University, Seoul, 07040, Korea
dryoon@maat.kr

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Abstract

This paper explores the identity of bio art in terms of trading between an artist and a bio lab and looks into the creation process of bio art through the concept of creolization, in order to consider bio art as a creolized art form of biology and art. The American physicist Peter Galison refers to the term 'trading zone' as the boundary binding together the heterogeneous subcultures and considers 'creolization' as the process by which the interaction among different disciplines builds a new interdisciplinary field. Galison's concepts can be applied to bio art where art and biology interact. Bio art is a trading zone that leads trading activities between an artist and a bio lab. Within the trading zone, artists and scientists trade their own goals on the premise of a shared context. As a result, the creation process of bio art shows creolization occurring within the trading zone.

The word 'creole' refers to people who are descended from White European colonial settlers. Each creole has a mixed identity and speaks a mixed language. That is why some linguists regard 'creole' as a type of mixed language and consider the mixing process of different languages as the term 'creolization'. It is especially used to refer to the mixing process of local languages with European languages (Burke, 2009). Furthermore, the concept of creolization has evolved to have different meaning at different times and has been more widely used in various disciplines. For the Argentinian historian Jose Luis Romero, creolization refers to the way in which the descendants of the early Spanish settlers adopted native customs and indigenous products in the colonial period (Romero, 1976). Meanwhile, the Swedish anthropologist Ulf Hannerz describes creolization as the emergence of a new culture out of the mixture of two or more cultures (Hannerz, 1987), and the French sociologist Nicole Lapierre says that creolization is the unpredictable process that creates encounters, interferences, shocks, chords and discords among cultures (Lapierre, 2004). Even the American physicist Peter Galison states that people from the different subcultures of physics communicate in a mixed language that can be described as a scientific creole (Galison, 1997).

Among them, Galison's creolization is noteworthy in that it explains the interdisciplinary integration beyond language and culture. He regards 'science' as the totality of interactions among heterogeneous subcultures such as theory, experiment, and instrument making, and describes the term 'trading zone' as the bounded area in which the heterogeneous subcultures can communicate (Galison, 1997). In the trading zone, there are the problems related to pidginization and creolization of scientific languages. A pidgin usually designates a simple contact language used as a means of communication among people who do not share a common language; pidginization is the process of simplification by which a pidgin is produced (Muysken & Smith, 1995). On the other hand, a creole can be referred to as a pidgin extended and complexified to the point where it can serve as a stable native language; creolization is the process leading up to such a newly created natural language (Muysken & Smith, 1995). Galison has expanded the meaning of creolization by applying the dynamics of contact languages to the interactions among scientific subcultures. He explains the linguistic interaction among scientific subcultures as the process by which theorists, experimentalists and instrumentalists simplify their practice for presentation to the other subcultures (Galison, 1997).

Therefore, Galison's creolization is involved in the expanded integration that originates from the complex relationship among theory, experiment and instrument building in science. It can be applied to the integration between science and the other discipline, especially art (Galison & Jones, 2014). Galison's creolization might be a tool to effectively explain the process by which the encounter between science and art creates a new interdisciplinary field.

That is why creolization is actively utilized in the process of discussing bio art.

The Trading Zone as a Key of Creolization

Galison explains science using the plywood metaphor. The diversity and hybridity of science can make science more robust, just as plywood, which is made up of stacks of different laminated plates, is stronger than solid wood. It means that science is not weakened by the fact that there is no unified methodologies or principles. In this regard, he criticized both the logical positivism in the early 20th century and the antipositivism in the mid-20th century. That is because both of them wanted a single master narrative that can sustain the whole of science. Indeed, the logical positivists such as Rudolf Carnap argued that the unity of science is from the solid observational foundation (Carnap, 1963). The antipositivists such as Thomas Kuhn, on the other hand, argued that theoretical changes bring about all the scientific shifts with the totality and abruptness of a Gestalt switch (Kuhn, 1970). As Galison puts it, both models as flip-side versions of one another have a well-established hierarchy that brings unity to the process of scientific work (Galison, 1999). In other words, the logical positivism and antipositivism are each involved in the reduction to experience and the reduction to theory, but they share the assumption that the important experimental and theoretical breaks occur contemporaneously.

Galison discusses the logical positivism and antipositivism in terms of language. For both of them, language was the linchpin of science. The logical positivists sought to find a universal scientific methodology and a protocol language, as some linguists have searched for a unified grammar and a universal language that is the source of various languages. The antipositivists, on the other hand, said that scientific theories cannot be reduced to protocol languages, arguing that a shift from one paradigm to another is a radical change of incommensurability by the scientific revolution. However, Galison says that the potocol language of logical positivism and the incommensurability of antipositivism are hasty conclusions which give a one-sided impression of science (Galison, 1999). It means that the communication among different scientific subcultures is possible without a protocol language or under a different paradigm.

Here, Galison focuses on anthropological researches, in order to solve the problem of communication between heterogeneous scientific subcultures. It involves a trading zone that enables trade between two villages with different languages and cultures. He applies the concept of trading zone, which is a linguistic, practical and geographical space, to science. A trading zone formed among heterogeneous scientific subcultures is similar to that formed between two villages with different languages. Examples of trading zones include the MIT Rad Lab (Radiation Laboratory), which developed radar in collaboration with physicists and engineers during the Second World War, or formal and informal meetings of the National Accelerator Laboratory (later Fermilab), which consists of theoretical physicists, experimental physicists, and various engineers (Galison, 1999).

In a trading zone, two groups can hammer out a local coordination despite vast differences. It is related to pidginization and creolization. While the former is the process of creating a simple common language in which people from different cultures can communicate, the latter is the process of creating a full-fledged language with more complex vocabularies and grammars. As a result, a trading zone is a domain in which a simple contact language is first created and then a new constructed language emerges. The core competence of creolization is derived from a trading zone. Here, the anthropological picture is relevant to the way that theorists, experimenters, and engineers interact (Galison, 1999). Galison's examples such as the MIT Rad Lab or the National Accelerator Laboratory demonstrate that people from different scientific subcultures can hammer out a local coordination despite the differences in methodologies and standards of demonstration. In addition, the interactions among different scientific subcultures in a trading zone can lead to the creation of a new interdisciplinary field. That is why the trading zone is the domain where the local coordination among various disciplines takes place and a new interdisciplinary field emerges.

Trading between an Artist and a Bio Lab

Galison presented an interesting analysis of the relationship between science and art. If science is not related to a huge theoretical system but to an entanglement of theory, experiment, and instrument making, the boundary between science and art can be formed in various ways (Galison, 2014). Indeed, some new art forms in the twentieth century show various boundaries between science and art. New media art, including kinetic art, cybernetic art, system art, digital art, net art and so on, has expressed the boundaries between science and art through various technologies. Recently, some artists have enabled living creatures to become the aesthetic object or theme in their artworks by using biotechnology. Such attempts led to the birth of a new genre called bio art.

Artists such as Eduardo Kac, Joe Davis, Marta de Menezes and Anna Dumitriu have pioneered this new field of art. They have worked with living tissues, living organisms and life processes, using a variety of biotechnologies such as genetic engineering, tissue culture, and cloning (Pasko, 2007). New media artists mainly create their artworks using new media technology or digital technology in their own studios, but bio artists work in a life science laboratory. They approach to cutting edge researches in life sciences and apply the research outputs to their works. Therefore, the laboratory of life science becomes the studio of the bio artist. It means that the so-called bio lab can play a role as the place of the trading zone. In the place, artists and scientists exchange their views and knowledge, collaborate to produce new outcomes, and lead to interactions among different fields.

Above all, Kac demonstrates that bio art acts as a trading zone. His works show that bio art can be considered as a social and intellectual mortar that binds art and biology. For example, *GFP Bunny* (2000) and *Natural History of Enigma* (2009) show how artists and scientists trade predictions of transgenic outcomes. While the former is a transgenic rabbit injected with a GFP gene extracted from a jellyfish, the latter is a transgenic flower expressing an immune gene extracted from the blood of Kac into a red leaf vein of petunia. According to Kac, the transgenic rabbit is a chimerical animal capable of glowing with a bright green light (maximum emission at 509 nm) under a blue light (maximum excitation at 488 nm) (Kac, 2000), and the transgenic flower is a plantimal created by a protoplast fusion of plant cell and animal cell (Kac, 2003). Here, Kac predicts the existence of an individual with intuitive certainty. Creating his works, Kac feels certain that genetic modification can be transformed into a tool of art, and considers the process and procedure as a practice of art. Here, Kac predicts the existence of an individual with intuitive certainty. On the other hand, the scientists involved in Kac's works accept the prediction as something like an interesting hypothesis to develop the next version of their experiment. Although it is not easy for artists and scientists to coordinate their different positions, they can sometimes have a consensus within the creation process. It means that there exists a context within which artists and scientists can trade their different goals in the trading zone called bio art.

The Creation Process of Microbial Art and Creolization

Looking directly into the creation process of bio art provides a chance to reason what happens in the trading zone called bio art and how creolization proceeds in the interaction between an artist and a bio lab. The creation process of bio art by the textile designer and bio artist Siwon Lee is a good resource for such reasoning (Lee, 2017). She had the microbial art project called Apple project for 24 days starting April 14, 2016, and then has been working on the other microbial art project since September 6, 2017, in a laboratory in the Department of Microbiology at Dankook University in Korea. She kept the apples at room temperature, and then observed the fungi produced in the apples. The most commonly used apparatuses in the project are an optical microscope (IMT cam3PN: TP603100A Olympus CX41), agar plates with Dichloran Rose Bengal Chloramphenicol (DRBC) Agar Base, and incubator for cell culture. Figure 1 is the process of observing the fungi with a microscope in the laboratory, and figure 2 is the process of artificially culturing the fungi in an incubator. The artificially cultivated fungi in the incubator grow rapidly in a petri dish. As shown in figure 3, Lee arranged various patterns according to the life cycle of fungi. Then, as shown in figure 4, she transformed them into various images using a computer graphic program.

Figure 1. The process of observing the fungi in the laboratory © 2017 Siwon Lee.

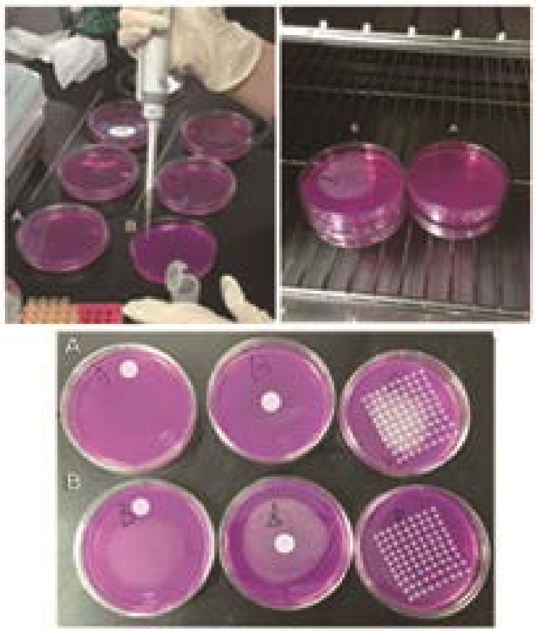

Figure 2. The process of artificially culturing the fungi in an incubator © 2017 Siwon Lee.

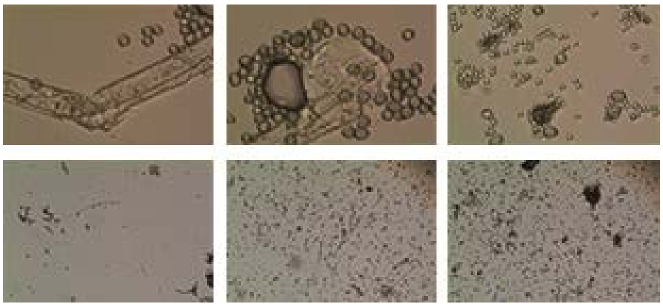

Figure 3. Siwon Lee, The various patterns according to the life cycle of fungi © 2017 Siwon Lee.

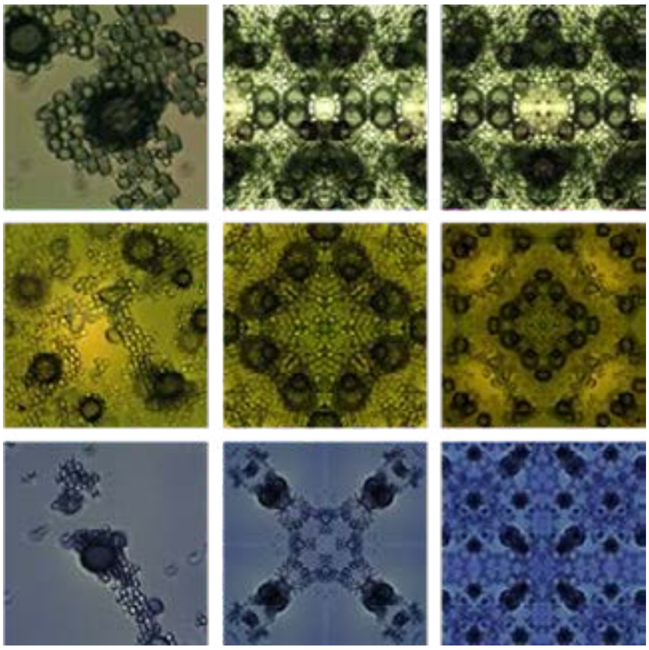

Figure 4. Siwon Lee, *Apple project*, The various fungi pattern images transformed by a computer graphics program © 2017 Siwon Lee.

Furthermore, she has grown the artificially cultivated fungi on fabrics. Figure 5 is images observed on cotton (left) and wool (right) after 5 days of fungus inoculation. In fact, scientists involved in the microbial art project have revealed their interest in this part. It becomes the context within which Lee and scientists can trade each goal. That is why it is the direct cause of trading between an artist and a bio lab in the project. Lee predicts meaningful results with intuitive confidence in the cultivation of fungi in fabrics. That is to say, she is convinced that the growth pattern of fungi can be transformed into a tool of art, and utilizes their growth processes as artistic outcomes. On the other hand, scientists accept the prediction as an interesting hypothesis to develop new experiments. Indeed, Jieun Kim, a scientist who has participated in the project with Lee, says: "It was a new attempt to observe the growth of fungi in the fabric. It is likely to be a meaningful experiment if we check whether the fungi are absorbing nutrients from the fabric itself. In the future, we will try to see if the fungi are growing even when the fabric is soaked only with distilled water, and we will check the growth pattern of the fungi in various environments including the fabric."

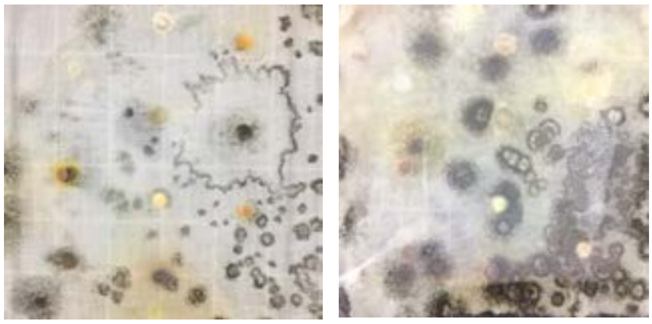

Figure 5. Siwon Lee, The images observed on cotton (left) and wool (right) after 5 days of fungus inoculation © 2017 Siwon Lee.

The fact that artists and scientists have a considerable consensus within the creation process does not necessarily mean that they should share the same goal and the same language. Just as the concept of trade does not presuppose the concept of universal currency, trading between artists and scientist does not rely on a universal language. It depends on whether artists and scientists have a shared context or not. In other words, within the trading zone called bio art, all artists and scientists need to do is to share a context within which they can trade their different goals. Even though they use the different terms or the same terms with different meanings, they can create their own language through a shared context. It means that creolization is taking place in bio art.

Just as learners with different linguistic backgrounds stabilize the simply mixed language called pidgin and contextualize the more complexly expanded language called creole, artists and scientists using different languages can experience creolization in their collaborative project. For example, as Lee says, artists and scientists use the term 'contamination' differently. Scientists in the laboratory think of contamination as a very serious risk, because it becomes a failure factor of the experiment that makes it impossible to identify various microorganisms. Artists, on the other hand, view contamination as a chance to create mixed media formed by a mixture of new materials, because it is involved in their imagination that the intervention of various microbial species is like a mixture of new materials. Such a difference made communication between Lee and Kim difficult at first. However, as the collaborative project progresses, they become able to understand that the term can be used differently from what they originally thought to be. In the situation where only one type of microorganism needs to be separated from other types, contamination should be avoided. On the other hand, in the situation of experimenting acceptance capacity of a new environment such as fabric, contamination can be a phenomenon that can be exploited. Thus, in the microbial art project, both the artist and the bio lab experience a kind of creolization coordinating the different terms or the same terms with different meanings.

Conclusion

A few years before Kac first used the term 'bio art', all nucleotide sequences of Heamophilus influenza bacterial genome were published. This is evaluated as a new milestone in the history of science. After that, the genome sequencing of hundreds of prokaryotes and dozens of eukaryotes has been completed. Of course, it includes a human genome with 3 billion nucleotide sequences (Campbell, 2008). The results imply that biology has become one of the most notable areas for the future of mankind. It is derived from the development of biotechnologies such as genetic engineering and cellular engineering as well as biological subcultures such as molecular biology and genetics. Above all, the development of biotechnology has opened up the possibility of active intervention in life phenomena beyond observation of life phenomena. In fact, artists using biotechnology challenge such possibilities. Thus, the places in which bio artists work are related to both artists' studios and scientists' laboratories.

Interestingly, from the perspective of the trader described by Galison, such attitudes of bio artists are not different from that of Einstein who changed the notion of time and space, or Feynman who opened a new chapter in quantum electrodynamics. Galison says that theorists and experimenters are traders who coordinate the research parts of interpreted systems, not miraculous instantaneous translators (Galison, 1999). The theory of special relativity is linked to Einstein's experience in dealing with technology patents on clock synchronization in the Swiss patent office, and the Feynman diagram is involved in Feynman's experience in developing atomic bombs at Los Alamos. It means that science has not been developed as a simple theoretical system, but has been developed by a lot of trading between theories and experiments. In that sense, artists who are willing to enter the laboratory of science are traders who are encouraging a practical interaction between art and science.

Furthermore, they predict that there exists emergent evolution at the boundaries between art and biology. While scientists generally try to obtain more definite results in controlled experiments, artists try to get extended outputs by connecting objects with external environments. Such different views sometimes cause conflicts between artists and biologists. But when they cannot find proper answers for themselves, sometimes the different views might provide useful solutions each other and contribute to a healthier growth of our societies (Malina, Topete, & Silveira, 2017). Thus, bio art can be a trading zone that leads to trading activities between artists and scientists. Actually, as we saw in the collaboration of Kac and some scientists, in the trading zone called bio art, artists and scientists can trade their goals assuming a shared context.

As a result, the creation process of bio art shows the creolization that occurs within the trading zone. Even though artists and scientists use different languages in the trading zone called bio art, they create their shared language through a shared context. As we saw in the final chapter, Lee's Apple project is under creolization. In the ongoing project related to microbial art, both the artist and the bio lab experience creolization coordinating their different languages. It means that a new interdisciplinary field called bio art is a creolized art form of art and biology.

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