

AN ANALOGY OF SCIENTIFIC KNOWLEDGE AND AESTHETIC EXPERIENCE IN BACTERIAL ART: A QUESTION OF CONTENT OR EMOTION?

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Abstract

Based on two exhibitions of bacterial paintings in 2018 and 2019, we posit that knowledge of bacteria can impede and enhance viewers' aesthetic experiences. Artists can manipulate biological material to create intriguing visual experiences that evoke emotions ranging from discomfort to admiration by understanding how different types of bacteria interact with one another and their potential uses for artistic expression. We revisited and challenged Noel Carroll's and Gary Iseminger's theories on the approach to aesthetics due to the inherent complexity of the making process and its philosophical implications in bacterial art. During the exhibition, 111 questionnaires and brief interviews were used to collect responses and comments from the audience. We discovered two main themes in the audience responses: "universal knowledge" of bacteria and "pursuit of truth," demonstrating distinct aesthetic experiences that is both cognitively motivated and emotionally engaged. From this perspective, bacterial art nudged audiences to look at these works of art with wonder and appreciation for the beauty they contain. As a result, having a basic understanding of bacteria allows us to encounter bacterial art in novel and intriguing ways.

Keywords: Bacteria, aesthetic experience, bacterial art, universal knowledge, pursuit of truth

Introduction

Bioart is a complex art form that not only works with biological materials but also requires an understanding of the implications of such practices as bioart's manipulation of living organisms opens not only moral, political, and legal debates but also appeals to ontology aesthetics directly (Valerio & Antonia, 2013). Eduardo Kac outlines that a bio artwork should follow either one of these features or all of them, i.e., (1) the coaching of bio-

materials into specific inert shapes or behaviours, (2) the unusual or subversive use of biotech tools and processes; (3) the invention or transformation of living organisms with or without social or environmental integration (Kac, 2007). This art form fuses science, technology, and aesthetics in order to create meaningful works that viewers can appreciate. When exploring such art forms, scientific knowledge and technical understanding are necessary to comprehend the complexities within them; however, this does not necessarily mean that one must have a degree in biotechnology or science to appreciate bioart. Specifically, in bacterial art, while knowledge of bacteria may impede or foster the viewer's aesthetic experience, much depends upon the individual's knowledge and expertise on the subject matter.

In this study, bio art pieces were designed to create an unsettling atmosphere using bacteria. Through this technique, we attempt to evoke feelings of unease or discomfort in the viewers. The fact that bacteria are living organisms can also be used to create works that provide a sense of mystery and surprise. In these cases, the audience would not know what would happen next as the living organism continued to evolve and develop. On the other hand, knowledge about bacteria can also be used to create uplifting and aesthetically pleasing artwork. Bacteria cultures could be used to create beautiful patterns or shapes in a variety of colours, which can give viewers a sense of awe or admiration.

We posit that knowledge about bacteria can impede and foster viewers' aesthetic experience, depending on how artists utilise it. By understanding how different types of bacteria interact with one another and their potential uses for artistic expression, artists can manipulate biological material to create intriguing visual experiences that evoke emotions ranging from discomfort to admiration. Because of the inherent complexity of the making process as well as its philosophical implications, both Carroll's (2015) and Iseminger's (2005) theories on the approach to aesthetics can be revisited and challenged when discussing bio art. By examining how these two theories could potentially influence our understanding of what constitutes "content," or meaning, within an artwork, we can gain new insight into how best to approach this artwork from an aesthetic perspective. Bioart, specifically in this study, elicits an intriguing debate: does knowing the underlying science of work enhance its aesthetic value? While there may be no definitive answer, it is an essential question to consider within this creative field. This paper aims to comprehend the discourse surrounding bio art from an aesthetic perspective as one of the contemporary art forms and to ascertain what bioart might add to the current aesthetics debate through the lenses of Carroll's and Iseminger's theories. It seeks to investigate aesthetic perception via the lens of bio art, which focuses on bacterial art or works that include bacteria as the principal material and to determine whether the audience's knowledge or comprehension plays a significant role in aesthetic experience.

Methodology

This research is practice-based in which there were artwork-making processes with exhibitions by the end of the practice. We conducted questionnaires and brief interviews as supplementary and additional data for the practice section, and this paper focuses on the survey section. This study utilised a non-probability sampling method with convenience sampling to collect responses from exhibition attendees. The survey and interviews were

conducted face-to-face and via telephone for some respondents who agreed to continue with additional interviews. The questionnaires were designed to get information from the respondent about their experience as well as their knowledge regarding bacteria. The respondents were approached in simplified terms and language regarding their experience by providing a broad selection of words representing aesthetic experience. The questionnaire surveys for each respondent were followed by a short semi-structured structured interview based on their previous answers in the questionnaires. The questionnaire and survey were built and based on Slobodan Markovic's empirical research on aesthetic experience and emotions in paintings, in which the basic idea is that aesthetic experience is not reducible to pleasure or a positive hedonic tone and that a person can be equally captivated by pleasant and unpleasant objects (Markovic, 2012).

The exhibition entitled *Dispersing Sublime: Towards a Bacterial Landscape* was held at Piyadasa Gallery, Cultural Centre, University of Malaya from 22nd December 2018 to 28th February 2019 and followed by the second exhibition of *Another Us* through 'Young Contemporaries' competition organised by the National Gallery from 6th May 2019 to 6th September 2019. The *Dispersing Sublime: Towards a Bacterial Landscape* exhibition consisted of a series of bacterial paintings divided into three categories and one projection video. The painting series was *Domination* (Figure 1), *Recreation of The Scream* (Figure 2), and *Living Still Life* (Figure 3). *Domination* consists of 61 Petri dishes with Leonardo da Vinci's portrait drawn by environmental bacteria collected from the lake and soil sources, which were left to grow into Leonardo Da Vinci's portrait within 24 hours. After 24 hours, the portrait drawings of bacteria were sealed with a clear resin to prevent further growth. The resin keeps the bacteria in those patterns and textures for an extended period, allowing them to be displayed in the gallery space rather than frozen in the laboratory's freezer. *Recreation of The Scream* (Figure 4) used the same technique as *Domination* but with a different type of agar, explaining the different colours expressed by the bacteria that grew on it. *Recreation of The Scream* used a bigger custom-made petri dish than a typical laboratory petri dish.

On the other hand, *living Still Life* (Figure 3) did not have any clear resin applied to its surface to preserve or seal the bacteria. Instead, it was allowed to grow naturally throughout the exhibition. All those Petri dishes containing bacteria were kept in a glass box to prevent any contact with the visitors. After a week, each petri dish was decomposed and replaced with new ones until the exhibition ended. Daily, the *Living Still Life* artwork undergoes an ongoing change and transformation in its visuals (expressed by the growth of bacteria). The visuals expressed on day one will not be the same on day 2. The second National Art Gallery Kuala Lumpur exhibition featured the artwork *Another Us* (Figure 4). Like *Living Still Life*, *Another Us* used the same concept where the bacteria were left to grow throughout the exhibition within that gallery space. Four Petri dishes containing bacteria were placed alongside the speakers and LED lights inside four glass boxes, each acting as a frame or barrier between the petri dish and the visitors.



Figure 1. Domination. [environmental bacteria, Nutrient Agar (NA), Congo Red dye, Bismuth Sulfite (BS) agar, Sabouraud Dextrose (SDA) agar, Bacto agar, Resin, Acrylic Box]. Piyadasa Gallery. Universiti Malaya, Kuala Lumpur.
(Source: Nur Amira Hanafi, 2018).



Figure 2. Re-creation of The Screaming painting by Edvard Munch. [environmental bacteria, Nutrient Agar (NA), Congo Red dye, Bismuth Sulfite (BS) agar, Sabouraud Dextrose (SDA) agar, Bacto agar, Resin, Acrylic Box]. Piyadasa Gallery. Universiti Malaya, Kuala Lumpur.
(Source: Nur Amira Hanafim 2018).



Figure 3. Living Still-life. [Mixed-media miniature paintings, environmental bacteria, Nutrient agar (NA), Mannitol Salt (MSA) agar, Sabouraud Dextrose (SDA) agar, Petri dish]. Piyadasa Gallery. Universiti Malaya, Kuala Lumpur. (Source: Nur Amira Hanafi, 2018).



Figure 4. Another Us. [Mixed-media miniature paintings, bacteria, Nutrient agar (NA), photographs, resin, Petri dish]. National Art Gallery, Kuala Lumpur. (Source: Nur Amira Hanafi, 2019)

The questionnaire was divided into three sections, which are 1) general ideas on bacteria, 2) thoughts and feelings regarding the artworks, and 3) semi-structured interview questions regarding their response and emotions that they selected from section 2. Regarding the demographic details, the respondents were asked whether they have an art or science background as well as their current profession. During the daily exhibition hours of 10 a.m. to 5 p.m., the questionnaires were placed near the artwork's entrance and distributed to visitors. The visitors were instructed to answer the questionnaires during their time within the gallery. At the end of the questionnaire, visitors were asked to voluntarily write down their phone number or email if the researcher needed to contact them for further questions. Some respondents were contacted again to be interviewed

briefly through phone calls and text messages transcribed into the questionnaire forms. Some respondents were also interviewed shortly after completing the questionnaire forms in the gallery. Not just that, but a few respondents also contacted the researcher to share their thoughts and opinions regarding the exhibition.

The questionnaire forms were collected and compiled together by the end of the exhibition. The forms were then divided into four parts based on the respondents' background; - 1) Science background, 2) Art background, 3) Art and science background, and 4) Others (neither art nor science). The words chosen by the respondents for sections 1 and 2 of the questionnaires were listed down for each background. The first and second sections of the questionnaire provided the respondents with multiple-choice answers. However, the answer options are wider than typical multiple-choice, where the respondents' choice is not limited to one answer or any specific number. For section 1, the question regarding the visitors' general idea on bacteria provided 43 words that required the respondents to choose any word that may represent their thoughts or opinions. For section 2, the question about visitors' experiences with the artworks, respondents had 115 words to select. Instead of providing a subjective response, respondents were provided with a large pool of words with both negative and positive connotations. There was an open-ended question at the end of sections 1 and 2 for respondents to discuss or elaborate on why they chose the words they did to represent their thoughts. Some respondents explained the words they chose, whereas others did not.

Literature Review & Theoretical Framework

Aesthetic experience has always been a topic of interest and significance for philosophers, particularly in the context of art. Art is in a constant state of change, and with the emergence of contemporary art, many scholars and philosophers have developed new aesthetic theories to accommodate the various forms of art that require a new way of perceiving aesthetic value;- "there is no doubt the twentieth century experienced such a radical change in art forms that it also had to be accompanied by changes in the theoretical approaches used to explain it. In that sense, aesthetics, art history, art theory and critics have had to reformulate their concepts and theoretical frameworks to meet the challenge posed by contemporary art" (Valerio, 2013).

With the publication of *Aesthetica* by Alexander Baumgarten in the middle of the 18th century, the nature of aesthetic experience became a focal point of philosophical inquiry, at least in Western thought. This is not to say that aesthetics-related issues were not discussed previously or by others, but the mid-18th century German school of philosophy was the first to investigate the nature of aesthetic experience. The current debate on the nature of aesthetic experience is generally divided between two opposing viewpoints. Carroll Noel refers to them as content-focused, and Iseminger focuses on what he calls effect-focused approaches. Scholars support either the view that the object itself is necessary and sufficient for aesthetic experience to occur or that the viewer's mental state in relation to the artwork is the source of the experience. These two sides pose various questions when defining the aesthetic experience as an investigative project. The content-oriented philosophers inquire whether the aesthetic experience is an 'experience of what?' In contrast, affect-oriented philosophers investigate the aesthetic experience by asking

'what is distinct about the experience'. This article does not attempt to evaluate the project's fundamentals; rather, it examines a particular instance of bio art to contribute to the discussion.

Carroll Noel, the principal proponent of the current content-oriented approach, argues that despite anti-aesthetic works, it is possible to have an aesthetic experience with objects designed to evoke an aesthetic experience in the viewer. Carroll identifies three types of properties that can be sources of aesthetic experiences, either individually or in combination: formal properties (formal elements such as colours, lines, paintbrush, etc.), aesthetic properties (smoothness, rigidity, massiveness, plasticity, etc.), and expressive properties (sadness, happiness, fear, etc.). According to Carroll, these properties require viewers capable of experiencing such a thing. According to Carroll, a crucial aspect of these properties is that they are response-dependent, requiring viewers who are capable of experiencing them. Simply put, although a cuttlefish can see formal elements such as colours and lines and can even reproduce them on its body, it is assumed that it cannot experience these elements in a way that would result in an aesthetic experience. Although it is acknowledged that the viewer must be capable of such an experience in the content-oriented approach, the aesthetic experience is impossible without a particular set of qualities possessed by the object of art. This does not imply that the viewer must have the appropriate attitude towards the object; rather, it simply indicates that she must be capable of having this experience. Carroll adds that viewing the artwork requires "attention to and contemplation of the work's purpose as well as attention to the manner in which the work's purpose has been presented or embodied," which increases the viewer's responsibility in this experience. In other words, in the same way that an artwork's aesthetic and expressive qualities take precedence over its formal qualities (for example, the aesthetic quality of delicacy takes precedence over specific formal aspects of the lines used in the piece), these qualities can also take precedence over "relational properties, including art-historical ones, such as genre and category membership (Carroll, 2015)."

Although the bacteria have a particular visual and textural quality on the agar, even in relation to the agar, the formal, aesthetic, or expressive qualities of the bacteria are not the source of the experience in bio art made with bacteria; instead, it is the knowledge that the medium is bacteria. Undoubtedly, the medium plays a key role in form; Jackson Pollock's paintings are a great example of this. However, works of art that concentrate, or even essentialised, on the medium itself call attention to its properties. However, in the case of bacteria art described in this study, understanding bacteria is more important than investigating the medium as a "thing" in and of itself. Consequently, our experiences with bacteria art and Jackson Pollock's paintings are distinct. This implies that Noel Carroll contends that the viewer must be able to "see" the properties even though they may exist. "Seeing" in this context denotes the capacity to understand how these properties function rather than having a vision, as this is one of the goals of the work as an artistic creation. For instance, a Haiku by Master Chiyo-ni (Donegan & Ishibashi, 1998) can offer an aesthetic experience, but for the viewer to do so, they must comprehend and look for the harmony and relationship between the Japanese poem, the calligraphy used to write it, and the accompanying ink painting. Suppose one is unaware of the definition, objectives, structure, or techniques a master poet like Chiyo-ni employs to express her poems. In that case, a Haiku is still an intriguing work of Japanese art, but the viewer will not be able to

appreciate its aesthetic qualities fully.

Regarding the origin of aesthetic experience, this could pose a problem for the proponent of the content-oriented perspective, as one can have an aesthetic experience of nature without understanding what they see. When it comes to the potential aesthetic experience of an artwork, however, the content-oriented approach to the nature of the experience is evident; for the aesthetic experience to occur, the viewer must be able to recognise and seek out the properties of a work. Consequently, knowledge precedes sensory experiences, such as seeing for the visual arts or hearing for music. For Carroll, these works of art must be viewed with understanding. He explains that this is done to understand the artwork's purpose and the steps taken to achieve it. "Aesthetic experience" is defined as "attention directed with understanding to the form, expressive, and/or aesthetic properties of the artwork, and/or to the interaction between these features, and/or to how the factors above modulate our response to the artwork (Carroll, 2015). In other words, as Carroll presents it, a viewer's experience is an aesthetic experience if these are meant.

Is it possible to have an aesthetic experience in the presence of Bacterial art? The required "understanding" or knowledge is based on familiarity with the object's material rather than its shape. Does one's experience have a limit based on their understanding and/or knowledge of the bacteria? Does "understanding" or knowledge depend more on the material's formal characteristics than its aesthetic or expressive qualities? However, it does not depend on their hues, contours, or lines (although these are included in the artworks). The experience's purpose is based on the artwork composed of a particular material—bacteria—whose forms cannot be determined. The potential source of the aesthetic experience is the awareness of being in the presence of bacteria and the experience of being in the same room.

Affect-oriented proponents of aesthetic experience focus on the mental state of the viewer or the artist, or they believe both parties should have the same experience. Baumgarten examined the artist's mindset when he first used the concept of aesthetic experience and attempted to isolate it philosophically (McQuillan, 2021). Using an affect-oriented perspective, Iseminger defines the distinctive and sufficient condition of the aesthetic experience as "appreciating as a state of affairs only if she or he values the experiencing of that state of affairs for its own sake." In other words, the aesthetic experience we recognise and value results from our appreciation of the object. Consequently, Iseminger views the aesthetic experience as tracking these properties for their own sake, whereas Carroll views it as the "tracking" of formalistic, aesthetic, and expressive properties and their interrelationships.

This experience, as described by Iseminger, is cognitive. Iseminger defines "cognitive" as "the idea of noting something"; however, he states that this concept — or way of knowing — is non-inferential and, therefore, we can only assume that it does not involve meaning-making due to the experience. Rather than "understanding" the artwork, the affect-oriented approach emphasises the importance of being aware that we are looking at it and paying attention to it. Aesthetic experience depends on "paying attention" or approaching the work properly. According to Iseminger, "the aesthetic state of mind — appreciation — is essentially the valuation of an experience for its own sake (Iseminger, 2005). Iseminger defines aesthetic experience as the appreciation of an aesthetic state of mind.

Regarding the aesthetic experience as a distinct state of mind, concepts of value are crucial, if not fundamental, to comprehend the concept of the state. According to Iseminger, the experience of the object is not aesthetic; instead, the aesthetic experience is derived from the object's appreciation. Consequently, according to Iseminger, the experience of the object is not an aesthetic experience in and of itself; instead, the evaluation of the experience, the appreciation of this experience, is significant and constitutes the aesthetic experience. Iseminger believes that appreciation is not limited to sensory perception. However, he adds that this sense perception frequently involves sophisticated conceptual thought. Consider literature; literature appreciation transcends sensory perception. Because 'understanding' is "lived through," he includes it as a potential application of sensibility. What does this mean for our knowledge of bacteria? We need not experience the bacteria's inherent form, aesthetics, or expressive quality; instead, we can experience it merely as a material aspect of sharing the same space. The exercise in this situation appears to push one cognition in favour of another. The subsequent question is whether excessive knowledge hinders or enhances the aesthetic experience.

Dialogue on Bacterial Art

According to the survey results, all participants were aware of bacteria in general; bacteria are living microorganisms, and most people associate bacteria with the concept of something harmful, infectious, and deadly. We also observed visitor behaviour, such as how some visitors, despite not receiving a questionnaire assessing their knowledge of bacteria, inquired first of all of the artists about the difference between bacteria and viruses. Evidence shows that some visitors associate bacteria with the virus, giving bacteria a negative and frightening image and perception.



Figure 5: Series of Bacterial Paintings Exhibition in Piyadasa Gallery, Universiti Malaya (Source: Nur Amira Hanafi, 2018).



Figure 6: Bacteria Art Installation in National Art Gallery, Kuala Lumpur, May 2019
(Source: Nur Amira Hanafi, 2019).

Bacteria are not a discovery, and we can say that knowledge of bacteria is universal rather than limited to a small number of people or groups. Some individuals, such as scientists and other professionals, have a deeper and more precise understanding of bacteria than the general public. In general, even if someone has never seen bacteria cultured in a petri dish, they know and understand what bacteria are in the most basic sense when we mention the word "bacteria" by associating it with viruses, diseases, pandemics, or even yoghurt. They associate it with something they believe to be bacteria. It can be seen that respondents had fundamental concepts about bacteria based on knowledge gained prior to the exhibition, such as through schooling or mass media such as movies and television, among other sources. However, almost all respondents said they had never considered bacteria an artistic medium. While the works in this study are displayed by elevating the aesthetic value of bacteria through paintings, it can be seen that the audience's basic ideas about bacteria and their backgrounds influence how they perceive the works of art.

Table 1: Percentage of frequency in word selection representing respondents' perceptions of bacteria

Microorganism	79%	Abundance	30%	Painting	8%
Infection	50%	Harmful	27%	Dangerous	27%
Disease	46%	Living Things	65%	Beautiful	24%
Mystery	31%	Science	60%	Epidemic	16%

Laboratory specimen	39%	Uncontrolled	13%	Prokaryotes	5%
Spreading	64%	Have Patterns	52%	Aesthetic	18%
Pathogen	30%	Yogurt	44%	Significant	27%
Artistic	15%	Bioart	19%	Contemporary Art	8%

Note: Data collected by authors through the exhibitions in 2019-2020

According to Table 1, some scientific terms such as "pathogen," "epidemic," and "prokaryotes" were included in the questionnaire to determine whether respondents were familiar with the term and could relate it to bacteria. The word "prokaryotes" has the lowest percentage value (5%), indicating that only a few respondents understand why they chose it. Except for 1% who come from non-science and non-art backgrounds, all respondents who chose "prokaryotes" have both art and science backgrounds. From the data collected for the audience's knowledge of bacteria, we can conclude that all of the audience know when they hear the word "bacteria" or read a word written "bacteria." They immediately associate it with negative concepts such as "diseases," "harmful," etc. This type of reaction occurs in all audiences, regardless of demographic background, whether they come from a science or art background or none. We can see here that "bacteria" is a universal concept, just as people perceive the ocean, mountains, and other natural wonders to be majestic and beautiful.

Nonetheless, based on the demographic data and questionnaire in this study, while the majority of the audience has a general knowledge or basic understanding of bacteria, some of the others have a more complex and detailed understanding of bacteria because they not only have a science background but also work with biological specimens (bacteria included) daily. To return to the central question of this paper and research, does this knowledge influence the audience's aesthetic experience when confronted with art such as bacterial art? Let us examine this circumstance through Noel Carroll and Gary Iseminger's aesthetic approach.

Noel Carroll's content-oriented approach to understanding the nature of aesthetics is predicated on the notion that an aesthetic experience can be derived from objects designed to elicit it. To deepen our understanding of this concept, Carroll identifies three distinct properties that can contribute to aesthetic experience: formal properties, aesthetic properties, and expressive properties (Carroll, 2015). Carroll argues that by considering all three properties together—formal ones, such as design elements; aesthetic ones, such as texture; and expressive ones, conveying emotion—we can better understand what constitutes an aesthetically pleasing experience in viewers engaging with the work. Furthermore, he maintains that even if it contains anti-aesthetic elements (i.e., those not conventionally thought to be aesthetically pleasing), an object or artwork can generate an aesthetic reaction in viewers if all relevant factors are properly considered.

Carroll stated that the audience must work and exert effort to gain a proper aesthetic experience at the exhibition: "attention to and contemplation of the purpose of the work, as well as attention to the mode in which the point of the work has been presented or embodied." Consider that when a person observes the formation of patterns or colours, for

example, caused by the growth of bacteria or fungi in their natural habitat, the viewer may have an aesthetic experience without needing to understand what they see. Is this true, however, when we consider bacterial art? The difference between seeing bacteria or fungi in their natural environment and seeing them in a painting is that the former is a natural formation that was not changed or added to by the artist, and the latter is shown to meet the artist's purpose, which is to use organic and living bacteria as a medium for making art.

This study used questionnaires and brief interviews to collect responses and comments from the audience during the exhibition of bacterial art. The study was qualitative, and audience data were compiled in NVIVO and coded. We found two main themes from the audience's response: the "universal knowledge" of bacteria and the "pursuit of truth" that is not in isolation of each other but connected as each respondent's answers or experiences are not only binary but also multi-dimensional.

Universal Knowledge of Bacteria

As demonstrated in the preceding section of this paper, audiences were given questionnaires that asked what comes to mind when they hear the word "bacteria." Next, the audience was given a list of words and asked to circle any words they could relate to and understand involving bacteria. This group of words includes some that are negative, some that are neutral, and some that are scientific. Nearly all viewers choose identical terms, such as "disease," "infection," and so on. This is done to determine whether the bacteria is well-known or limited to a small group of people. Bacteria, like mountains and oceans, are forms of universal knowledge.

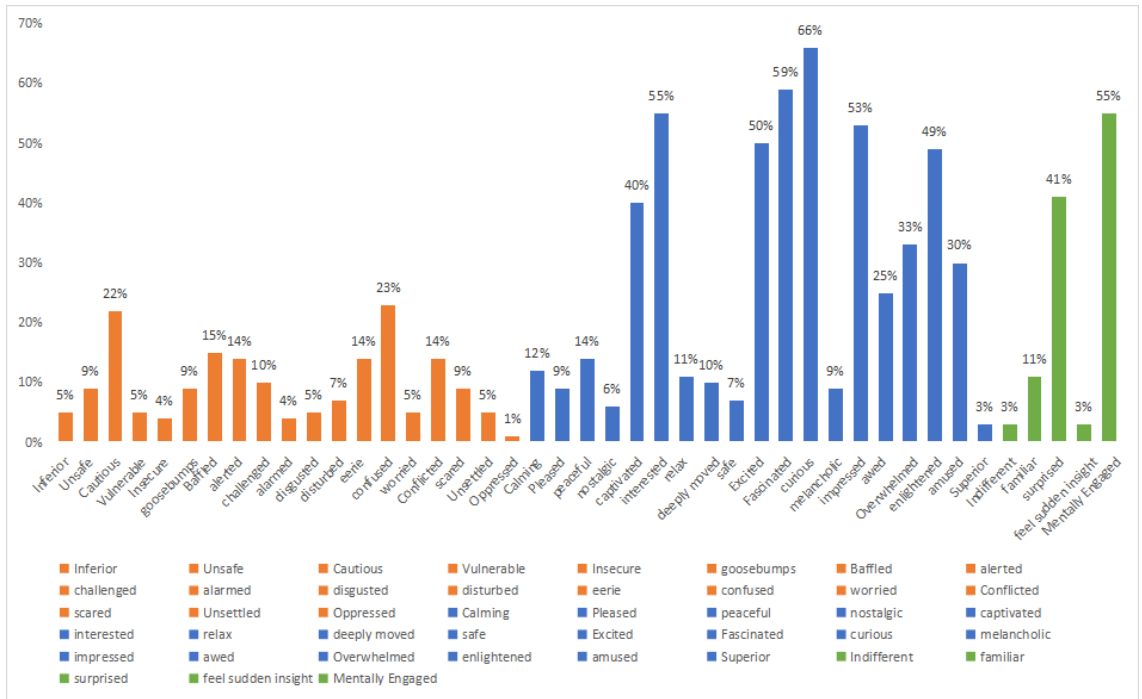


Figure 7: Percentage of frequency of word selection that reflects respondents' experience (Source: Data collected by authors through the exhibitions in 2019-2020)

A quick audience poll found that most respondents chose descriptions like "fascinated" and related expressions while also expressing negative sentiments. The visuals of the artist's paintings presented or performed, in which the artist can manage and produce such recognisable drawings or images, are what the respondents said cause such feelings or experiences. Creating colours, lines, and textures in paintings substantially contributes to the audience's aesthetic experience. However, it is not the audience's only feeling, as bad emotions are also there. Markovic (2012) further pointed out that the aesthetic experience is not limited to happy emotions or a favourable hedonic tone but may be connected with both beautiful (pleasant) and repulsive (unpleasant) paintings. Although Markovic alludes to traditional paintings as evidenced by his images or subject matter, this viewpoint may also be used to study bacterial art in this research because the work is likewise in the form of painting, despite the unconventional material. Similarly, the aesthetic impressions encountered by the audience in this study were commonly related to negative or unpleasant feelings such as 'scared,' 'cautious,' and so on. Based on questionnaires and interviews incorporating good and negative emotions, this illustrates the audience's aesthetic experience.

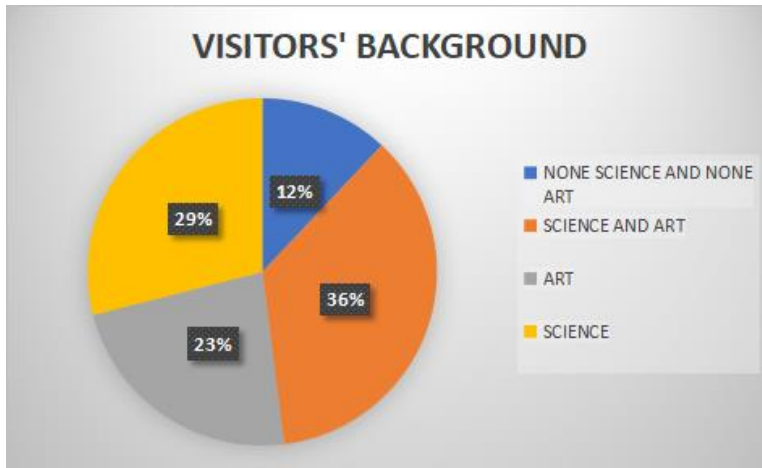


Figure 8: Respondents' Background

(Source: Data collected by authors through the exhibitions in 2019-2020)

According to Carroll's content-oriented approach, a perfect aesthetic experience is only obtained when the audience understands or has knowledge of the aesthetic object through recognition of all or one of the three elements, namely its formal properties, expressive properties, and aesthetic properties, or when the experience is the result of a relationship formed from these three elements. The demographic information shows that 36% of respondents had a science and art background, 29% had a science background, 23% had an art background, and 12% had a non-art and non-science background. As a result, 88% of respondents are thought to have some understanding of or experience with science or art. According to Carroll, the knowledge or understanding at issue is not the search for truth but rather an awareness of how the audience understands formal qualities, expressive properties, and aesthetic properties in the development or production of a work that meets the purposes of its creator. The audience's comprehension of the formal features of a drawing and the formal properties of artworks changes when seeing an abstract drawing or sculpture, for example, since the flatness factor in a drawing is not required for constructing a 3D sculpture.

This, however, varies from the work of Bioart, such as the bacterial paintings explored in this study. Even though it is in the form of a painting, it is clear that the audience's perception or knowledge goes beyond the formal features of a painting to encompass the materiality of the painting, which is bacteria, as something organic and living. In this context, knowledge and comprehension extend beyond the essentials of appreciating a piece of art to encompass an understanding of science and nature.

"because we all knew that the bacteria were dirty, our mindset about bacteria made me feel disgusted, but in the meantime, this work is beautiful. The bacteria that grow here are unlike what I imagined when I think about bacteria. So, I feel nice when looking at these visuals."

"Dangerous because of the mindset about bacteria. No longer feels danger because artists control bacteria into beautiful images."

I am aware of the negative bacteria because they are a reminder to me, to be careful and take good care more. However, in your exhibition part, I see them (bacteria) as a model that displays what they can do. It is behind my thought that they can react in various ways and in expected or unexpected ways. So, I can say that exhibiting the small creatures through a combination of their hard work and art (directed by the artist) gives a different perspective on appraisal instead of denying them for being harmed.

The explanation I just mentioned here is my awareness of the present bacteria reaction in your exhibition, which is also displayed in the images. At first, I saw the bacteria spreading and ing disgusting, odour and not soothing, but the reactions towards the images changed how I looked, and I became aware that bacteria work at that moment. This is what I feel. Personally, it's definitely towards self-reflection.

According to the respondents' descriptions in the brief interview, respondents frequently mention the term "mindset," which is a permanent perception or hold on bacteria that is generally harmful to humans. When confronted with bacterial art, universal knowledge of bacteria emerges as an inseparable element of aesthetic experience. Respondents also expressed appreciation for the aesthetic value of the visuals produced by the bacteria because, in their view, the visual production also symbolises the artist's ability to control the growth of bacteria and instil confidence that it is safe and under control in addition to showcasing the artist's skill in working with living materials.

This project's series of drawings of bacteria aims to demonstrate both the aesthetic value of bacteria and the artist's ability to create visuals through the experimentation of organic matter. Observations of the textures, lines, and bacterial growth, considered formal properties in work, reveal that respondents acknowledge them by appreciating the aesthetic values displayed through visuals of the resulting drawings. Respondents have a universal understanding and knowledge that bacteria are a dangerous form of life, but they can also appreciate the visual images that result from the collaboration between artists and bacteria.

In this case, what is the relevance of the respondent's universal knowledge of bacteria to aesthetic experience? Even Goldman (2013), who is notoriously opposed to Carroll's theory, acknowledges the presence of cognitive elements in aesthetic experience. Wanzer et al. (2018) also stated that the cognitive dimension examines how knowledge—about the artist, the work of art, and art in general—affects how an individual comprehends it. This dimension is compatible with models that emphasise memory retrieval during information processing and the significance of cultural and historical understanding of art. Carroll emphasises the audience's comprehension when identifying formalistic/expressive/aesthetic properties that result in the audience's appreciation of the work. All the statements pertaining to knowledge or cognition refer to art knowledge or the ability to appreciate art. However, when it comes to Bioart or bacterial art, this element of knowledge becomes more complex as it requires a comprehension that goes beyond typical artistic comprehension and involves knowledge from non-art niches.

If we look from Carroll's perspective, if the audience understands the glass or metal in work such as a sculpture made of metal or glass, they will have a more proper aesthetic experience because they will be able to appreciate the process by which these elements are combined and shaped according to the artist's intent. From Carroll's point of view, the respondent's general knowledge of bacteria can be seen as providing insight or improving the experience of appreciating the visual or final product. We are not claiming that knowledge is a requirement for the aesthetic experience because, as we are aware, the aesthetic experience debate is too broad. Even without knowledge of the bacteria, the audience may be able to appreciate the painting's aesthetic value due to its aesthetically pleasing visuals. Those with universal knowledge of these bacteria, who see and comprehend that bacteria are *living, invisible, harmful organisms*, influence their approach to bacteria-related work and elicit unpleasant emotions. However, respondents can enjoy or have an aesthetic experience through the recognition of formalistic properties exhibited through the colours, lines, and textures, which ultimately form visual portraits (which are thought to serve the artist's purpose) and are strengthened when they realise that the formalistic properties are also the result of the formation of bacteria that they believe are harmful, alive, invisible and so on., but capable of being controlled by the artist.

In contrast, Iseminger's approach to the nature of aesthetic experience stems from his affective-oriented perspective. His view is that for an aesthetic experience to occur, it requires some emotional engagement between the viewer and the artwork. He believes this emotional engagement must be reciprocal—the viewer and the art must respond emotionally. Iseminger argues that aesthetic experience cannot be objectively defined as a solely intellectual or purely visual process but must involve an emotional component that is subjective to each individual. Based on the respondents' reactions and remarks, it is clear that the audience is aware of and that the presented art's core material is bacteria. From our observations, the respondents had no idea which species were considered harmful. As a result, the respondent's general understanding of bacteria is based on the idea of bacteria as micro-sized, invisible to the human eye, illness and infection carriers, and so on. Respondents perceived bacteria as a type of hazardous organism in general, and this impression had developed into a mindset. The audience sees and feels the works in this research by adopting this viewpoint. Respondents did not approach the artwork, unaware that this painting is made of microorganisms. Bacteria may be regarded as a formal feature of this artwork since the sights, colours, textures, lines, and patterns are all the products of bacterial development. Bacteria constitute a major and vital formal property in this work, in addition to using readymade objects such as scientific equipment (a petri dish, etc.).

One of Iseminger's main arguments is that to have an authentic aesthetic experience; one must open themselves up emotionally to the artwork. He believes there should be some genuine connection between the viewer and the artwork, which he calls "aesthetic empathy"—experiential sharing between two entities. This means that when a viewer gazes upon a work of art, they should come prepared with an openness towards being moved by what they are looking at; without this openness, Iseminger claims, there can be no true aesthetic experience.

"Because there are bacteria, but you made it beautiful; I am still unsure and hesitate about the safety, and is it okay to touch it?" At first, I was tempted to touch

it, but I do not know if they would die. I'm scared that if I touch it, it will have some effect on my body. "But it is unique, aesthetic, and hard to find in Malaysia."

"Because the bacteria is dangerous and scared me, but the artworks are beautiful and make me excited and happy."

"I am alerted because it is something that I have no knowledge of and do not know its capabilities." However, I also felt calm, contemplating the visuals displayed by the bacteria. "The artist had successfully controlled the bacteria, which makes me feel relaxed and calm."

Iseminger also emphasises the importance of the viewer's attitude when approaching an artwork—in other words, how willing they are to put themselves into it and let it capture their imagination. For an aesthetic experience to happen, he argues that viewers must bring a certain level of enthusiasm and curiosity toward what they are seeing; they should desire to enter into a dialogue with it and allow themselves to get lost in its details and depths. This is important for having a successful aesthetic encounter with something and demonstrates Iseminger's understanding that aesthetics involves much more than just physical sight; instead, he suggests it ultimately depends on how we engage emotionally with something.

"As far as I know, bacteria carry and spread diseases; it attracts me when I can see bacteria being used as part of the art."

"Seeing the bacteria up close amuses me and makes me curious about the process." Also, I adore how the ambiguity takes place in the bacteria's life story.

"Life is a question, and death is a question." "Humans control science, and to a certain point, what happens when humans lose control of what they shape?"

"The use of biological agents in the art is quite interesting and invokes my curiosity to learn more about them."

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Pursuit of Truth: Content or Emotion?

Carroll explains that when it comes to aesthetic experience, the act of understanding or knowledge that is intended does not involve the pursuit of truth. Therefore, the understanding element in Carroll's content-oriented approach does not require specialised knowledge, clarification, or advancement; if it involves nature, it is not scientific knowledge. Does this understanding or knowledge, as depicted in the bacterial paintings, not involve the pursuit of truth? Or does truth-seeking play a role in bacterial art? According to their responses, most respondents have a general understanding of bacteria. They are aware that bacteria is the key factor in the work's success and that the growth of bacteria produces the visuals. Nonetheless, some respondents attempt to gain a more precise or scientific understanding by asking the artist about the origin of the bacteria used (the source is sampled, such as water or soil), the parameters that are controlled, whether the resulting colour is the actual colour of the bacteria or not, the duration of the bacterial life cycle and so on.

"Through the exhibition, I can see the reaction of the bacteria that react aggressively, silently, or slowly, even though I do not know how far they can detriment me. But, it reflected me very well how the environment influences the creatures' reactions – the humidity or its environment determines the flow of the bacteria reactions."

"The explanation I just mentioned here is my awareness of the present bacteria reaction in your exhibition, which is also displayed in the images. At first, I saw the bacteria spreading and looking disgusting, odour and not soothing, but the bacteria's reactions towards the images changed how I looked, and I was aware that bacteria work at that moment. This is what I feel personally, it is definitely towards self-reflection."

If viewed superficially, this respondent's understanding appears to be a pursuit of closure or the truth, contrary to Carroll's definition of understanding. However, if observed more deeply and carefully, the respondents' questions are intended to better appreciate the formality of the properties in the drawing—or, more precisely, to comprehend how these formal properties function. For instance, in Figure 3, which depicts a portrait of Leonardo da Vinci, respondents attempt to comprehend the properties or characteristics of the bacteria that produce the colour, as well as the time required for the bacteria to grow and be calculated in order to produce an image that the artist deems ideal. Furthermore, Carroll claims that "it appears rather uncontroversial to propose that we can regard artworks as having purposes, on the one hand, and ways those purposes are articulated, on the other." Our scientific understanding enhances the aesthetic experience in the case of bio art, or in this study, bacterial art, because the artist used scientific knowledge, skills, and equipment in the production of the work, and the visual or final form of work could not have been created without the biological processes of the organisms involved, i.e., bacteria. This is because the bacteria in such works not only serve as tools or materials but also as agents or co-artists involved in the production of the paintings. Understanding science or bacterial

behaviour is intended to help one comprehend a piece of bacterial art's formal, expressive, and aesthetic qualities.

Even so, a better scientific understanding or more scientific progress will likely take away from the aesthetic experience. Even though only one respondent gave this type of answer, we think it is still significant enough to highlight and discuss.

"Bacteria is everywhere and capable of spreading even through the air; as I do not know how all these are being controlled or maintained, I am very concerned regarding safety."

This respondent is the only one who expresses negative emotions without any positive or pleasant emotions, even in the multi-choice questionnaire. We believe it is important to discuss this response even though it represents such a small percentage. From the respondent's demographic perspective, he is an expert in microbiology with daily exposure to bacteria handling. The first thing he mentions is the security concern. At the show's beginning, he also seemed uncomfortable and asked the artist to explain safety concerns. Only after he was informed of the procedure involved in exhibiting bacteria did he begin to feel at ease and engage with the artwork. This suggests that scientifically advanced knowledge of bacteria can also hinder the aesthetic experience. However, since only one respondent was surveyed, perhaps additional research should be conducted by exhibiting or interviewing a focus group with the same demographic characteristics and a larger sample size.

Alternatively, Iseminger's view of the aesthetic experience is that it is a cognitively driven experience of appreciation; this contrasts Carroll, who views the experience as formalistic. The affect-oriented approach provides a different perspective on appreciation and its relation to the aesthetic experience. More significantly, Iseminger's notion of appreciation allows us to consider the aesthetic experience as something that can be experienced through art and nature. Considering the conceptual thought involved in sense perception, Iseminger acknowledges that there is more to appreciation than simply looking at a work of art or experiencing an environment. Finally, his view on the exercise of sensibility enables us to consider the possibility of pushing one cognition aside in order to appreciate an object. Finally, Iseminger's concept of aesthetic experience provides us with a better understanding of how we can appreciate art and nature to their fullest potential.

Conclusion & Recommendations

Iseminger offers a useful perspective by identifying the cognitive component of aesthetic appreciation and noting how emotional engagement may alter the experience. In doing so, he reminds us that great aesthetics entail more than just gazing at something; it also entails connecting intimately and imaginatively with it. In today's world, when passive consumption of visual media reigns supreme, Iseminger's approach to the aesthetic experience serves as a reminder that to enjoy art and its different forms properly, one must be prepared to engage in a dialogue with what they are witnessing. Only then will the audience be able to discover all of the hidden beauty inherent within their subject matter. Viewers may access the full force of the aesthetic experience by keeping an open mind,

exploring, and being enthusiastic while engaging with art and its varied forms. The element of knowledge in Carroll's content-oriented approach simultaneously provides a path and insight into the role of understanding and elements of knowledge in bio art, which involves the application of scientific knowledge, skills, and equipment, as well as the participation of living organisms to achieve the artist's intent. In this sense, Iseminger and Carroll's approaches to the aesthetic experience help us comprehend the significance of meaningfully connecting with art and the environment. Both theorists enable us to reach the power of aesthetics, which can be experienced via physical sight and emotional involvement, by urging viewers to actively investigate the depths of what they are watching. We acquire a stronger awareness of our surroundings via their perspectives, from fine art experiences to natural beauties, letting us marvel at its beauty in all manifestations. Finally, we can explore the depths of our natural world and enjoy its beauty in new using a scientific understanding of bacteria and how it may be used to produce art. When we engage with this art form, we get a distinct aesthetic experience that is both cognitively motivated and emotionally engaged. With this awareness, audiences can gaze upon these artworks with wonder and appreciation for the beauty they hold. Thus, a universal knowledge and element of understanding enable us to encounter bacterial art in novel and intriguing ways.

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