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BIOMODD: EXPLORING RELATIONSHIPS BETWEEN BIOLOGICAL, ELECTRONIC, AND SOCIAL SYSTEMS THROUGH NEW MEDIA ART

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# BIOMODD: EXPLORING RELATIONSHIPS BETWEEN BIOLOGICAL, ELECTRONIC, AND SOCIAL SYSTEMS THROUGH NEW MEDIA ART

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## Abstract

Biomodd is a collaborative new media art project that explores the symbiosis between biological, electronic, and social systems. The project started in 2007 in the United States, and has since spawned multiple versions globally. The Philippine team was led by educators from the UP Open University, who organized a course on new media art practice as a springboard for exploring and developing the project. We discuss the imaginative and abstract relationships between biological, electronic, and social systems that learners articulated over the course of the project. We describe how local, culturally-specific narrative elements were imaginatively integrated into the physical and interactive design of the installation, resulting in a technically complex, visually poetic expression of the relationship between nature, technology, and humans.

Keywords: new media art; art education; collaborative learning; interactive art; bio art; drive

## 1 INTRODUCTION

Writing about emerging radical relations between art and science, Ede [1] observes that that the role that art used to play seems to have been co-opted by the sciences:

Contemporary scientists often talk about ‘beauty’ and ‘elegance’; artists hardly ever do. Scientists weave incredible stories, invent extraordinary hypotheses and ask difficult questions about the meaning of life. They have insights into the workings of our bodies and minds which challenge the way we construct our identities and selves. They create visual images, models and scenarios that are gruesome, baffling and beguiling... Is science the new art? (p. 1)

Though persuasively argued, the answer to Ede’s question might well be, “not necessarily”. After all, in contemporary Western art practice, there has been a converse turn towards not only towards the use of technology, such as in the case of digital media [2], but also towards adopting epistemological and methodological approaches used in the sciences as way to understand and present phenomena anew [3]. The schism between art and science has not always been so deep, however, and throughout history, both artistic exhibits and scientific experiments fields have served to enlighten, entertain, and engage [4].

A notable trend in the intersection between art and science involves the use of biological elements within digital art installations, resulting in hybrid digital-biological systems in which natural and human-made systems are brought into a close relationship with each other [5]. For instance, the Telegarden [5] was an art installation featuring a community garden tended by a robotic arm and remotely controlled by users on the Web. The Babbage Cabbage project [6] involved a mechanical system that injects differing amounts of acid into red cabbage, which alters the cabbage’s color and renders the cabbage as a kind of living media display. Commercial products also exist that tread the line between the biological and the digital. For example, a company called Botanicalls produces an electronic device that can be connected to a potted plant and which then tweets its owner whenever the plant needs watering [7].

In this paper, we describe the imaginative and abstract relationships between biological, electronic, and social systems that learners articulated over the course of Biomodd[LBA<sup>2</sup>], a collaborative art project and learning experience about the symbiosis of nature and technology which was used by the UP Open University (UPOU) as an educational platform in its Bachelor of Arts in Multimedia Studies program. We describe how local, culturally-specific narrative elements were imaginatively integrated into the physical and interactive design of the installation, resulting in a technically complex, visually poetic expression of the relationship between nature, technology, and humans.

## 2 BIOMODD AS A LEARNING PLATFORM

Biomodd ([www.biomodd.net](http://www.biomodd.net)) is a collaborative art project conceived to challenge presumed notions of opposition between nature and technology in different cultures throughout the world. The project started in 2007 during an artist residency of artist and scientist Angelo Vermeulen at The Aesthetic Technologies Lab at Ohio University, culminating in an interactive, large-scale installation piece. Since then, multiple versions of the installation have been built by Vermeulen, by his collaborators, and by other communities throughout the world. Biomodd art works have been created and exhibited in the United States, the Philippines, Belgium, Slovenia and New Zealand. Biomodd[LBA<sup>2</sup>] was the second of the series.

Biomodd is collaborative on multiple levels. The project leads work with teams in which every individual is encouraged to add something substantial to the work. Furthermore, the work is recreated in different places throughout the world, each time with different groups of people. Additionally, Biomodd is predicated on a basic set of themes [8]:

- **Case modding and hardware hacking** – Biomodd’s name derives in part from the practice of *case modding*, the creative transformation of computer cases into imaginative structures. Biomodd draws upon the codes and methods of the case modding subculture, transforming multiple, networked computers into an expanded sculpture featuring an ecosystem that lives with the electronics.
- **E-waste and its creative reuse** – Old hardware is reused in Biomodd functionally and aesthetically.
- **Digital games and gaming culture** – Each Biomodd installation can function as a gaming platform for a fully functional multi-player environment. The games that are employed are either modified open source games or new games developed by team members.
- **Symbiosis between electronic and biological systems** – Biomodd aims to bring biological life as physically close to the electronics as possible, and allow them to communicate with each other through meaningful symbiotic relationships.
- **Juxtaposing the local and the global** – Biomodd is nomadic. Versions of the installation are built with different collaborators and new materials, but they reinterpret the original concept according to local cultural and social conditions.
- **Open sourcing** – Biomodd encourages the use of open source operating systems and software applications in order to extend the modification potential for the art work as far as possible. The Biomodd project as a whole has also taken an open source nature; people interested in building their own version of the installation can find instructions online.

### 2.1 Biomodd[ATH<sup>1</sup>]

In order to best appreciate the project, we describe the version immediately previous to Biomodd[LBA<sup>2</sup>], known as Biomodd[ATH<sup>1</sup>] and illustrated in Figure 1.

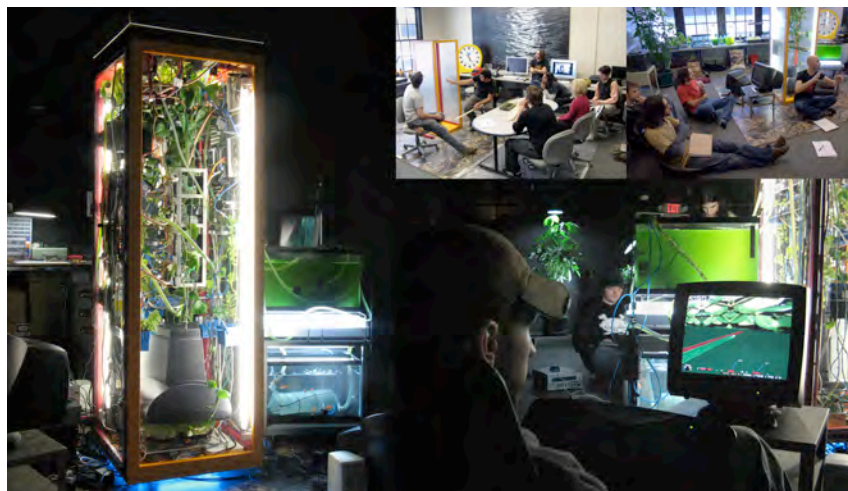


Figure 1. Biomodd[ATH<sup>1</sup>]

Led by Vermeulen and co-created by a group of artists, technologists, and other collaborators, the Biomodd[ATH<sup>1</sup>] installation featured a metal case covered with acrylic panels and contains exposed computer components, including hard drives, motherboards, and all the electrical cabling needed to power them. Some of these motherboards were cooled using a liquid cooling system that ran algae-filled water, which can be seen in the top aquarium in Fig. 1. Living plants were also housed within the case and were nourished both by the heat produced by the computer components and by the water from a second aquarium filled with tropical fish right underneath the algae tank. This second, tropical fish-filled tank was also used to cool down the algae, which heated up. Finally, the computers ran a multiplayer game; the installation also thus functions as a social gaming station [9].

The hybrid relationships presented in Biomodd[ATH<sup>1</sup>] were novel for the intellectual and cultural context of the UPOU learning community, and provided avenues for leveraging Biomodd as a springboard for learning. In 2008, UPOU partnered with Vermeulen to develop a course on new media art practice, Multimedia Studies 198 (MMS 198), based on the emerging Philippine version of Biomodd, which is now known as Biomodd[LBA<sup>2</sup>]. The final physical form of [LBA<sup>2</sup>] is shown in Fig. 2. Biomodd[LBA<sup>2</sup>] clearly has some of the features of [ATH<sup>1</sup>]. However, in addition to obvious differences in the materials used (e.g., the case is made of wood, not metal), the sculpture departs from [ATH<sup>1</sup>] in significant ways, which we discuss in the next section.



Figure 2. The Biomodd[LBA<sup>2</sup>] sculpture

### 3 COURSE DESIGN

MMS 198 was offered as a *blended learning* class, which involves combining online learning with more traditional methods of learning and development [10], [11]. A total of 24 students spanning across two course offerings were involved during the entire Biomodd[LBA<sup>2</sup>] project. Because MMS 198 was offered as a course in new media art practice, students were expected to participate in the process of taking an artistic vision from concept to execution. Students were assessed on the following criteria:

- Contributing a minimum number of hours working on the Biomodd installation (e.g., designing the sculpture, choosing and sourcing materials, building specific components of the sculpture), with direct, face-to-face supervision of the faculty
- Designing, building, and/or writing a detailed proposal for a new media art project based on the Biomodd themes
- Participation in online and face-to-face discussions around issues raised in assigned readings on new media art, as well as issues directly related to the design and construction of the Biomodd installation

The face-to-face component of the course revolved around a set of extended face-to-face workshops on hardware hacking, plant care, game design, and open source software configuration. The workshops introduced participants to the themes of the project in a hands-on manner, and from which ideas for the final installation were derived [12]. In this section, we discuss the innovative departures from [ATH<sup>1</sup>] that the learners developed during the course of the workshops.

### 3.1 E-waste and case modding workshops

In this workshop, learners were taught how to disassemble, reassemble, and repurpose computer hardware that would otherwise have been rendered as electronic waste. One exercise involved mounting the hardware in an imaginative way on shower racks—purchased from a local hardware store—in such a way that they might still be used as working computers (Fig. 2). In the spirit of case modding, workshop encouraged learners to think of the computer as a set of *modular functionalities* instead of a functional “black box” that was physically limited within a fixed form factor.

The ability to reimagine the physical form of a computer is a crucial skill that was necessary in assembling the final installation. One of the critical skills in any art form is being able to recognize and work with the affordances and limitations of the medium. For the final display, for instance, it was critical for the learners to understand how to mount computer components alongside biological components (such as plants, tropical fish aquariums, and algae-filled plastic tubing) in a way that would create a feeling of danger and precariousness, while actually being physically safe.



Figure 3. Case modding computers using shower racks

### 3.2 Hybrid systems integration workshop

In another set of workshops, we asked the learners to imagine the ways in which biological systems might interact with electronic systems to form hybrid, closed systems. The idea was to create closed loops of interaction or resource flow whenever possible within the installation. In [ATH<sup>1</sup>], for example, waste heat in computers was transferred to the algae tank, and any excess heat in the algae tank was transferred to the tropical fish tank.

Over the course of several weeks, it eventually became apparent to the group that one of the points for improvement in [ATH<sup>1</sup>] was in the way water was being used and recycled in the installation. In [ATH<sup>1</sup>], water from the tropical fish tank was used to water potted plants that were in the installation.

But from thereon, the water was neither tracked nor reused to benefit other subsystems in the installation. The learners identified a solution: incorporate an *aquaponic*-inspired system that combines fish rearing with plant growing, using waste products from the fish to fertilize the plants growing in a non-soil medium, and then returning the water back to the tropical fish tank to form a closed system [13]. The insight was due in large part to one of the experiences of the learners in actually managing an aquaponic tilapia-growing system.



Figure 4. The aquaponic system in Biomodd[LBA<sup>2</sup>]

Another feature of the installation that signified a departure from [ATH<sup>1</sup>] was the use of electronic sensors coupled with an Arduino board to gather environmental data—such as humidity, light, and temperature—from the interior of the installation. An Arduino board is an open microcontroller that allows sensing and robotic systems to be implemented and integrated in projects [14]. The intent was to be able to feed this information into the game (which we describe in the next section). Restrictions on time unfortunately prevented the group from implementing this fully, although this was implemented in a subsequent version of Biomodd.

### 3.3 Game design workshop

The most significant departure from [ATH<sup>1</sup>] was in the multiplayer game that ran on the networked computers. In [ATH<sup>1</sup>], the computers ran a modified version of an existing car-racing game. We posed the learners the goal of designing and implementing a game that embodied both the highly interconnected and hybrid nature of the installation as well as the unique cultural heritage of [LBA<sup>2</sup>].

A small team from within the group took up the challenge, and after many iterations of storyboarding, prototyping, and testing, they arrived at a poetic response. Biomodd[LBA<sup>2</sup>] was largely built at the foot of a mountain in the Philippines called Makiling, in which a deity, named Maria, is believed by locals to protect the mountain from ecological decay. With this in mind, the team developed a game that requires players to work together to work with Maria to protect the mountain by planting trees and building walls that deter unspecified (but visually distinct) destructive forces from attacking the mountain. At the heart of the mountain is Maria, represented as an abstract avatar (Fig. 5).



Figure 5. The Biomodd[LBA<sup>2</sup>] game, inspired by Maria Makiling

It is a never-ending game; once users stop playing the game, the walls deteriorate and the trees subsequently destroyed by these unnamed forces. Unlike many other computer games which partitions the users into winners and losers, the Biomodd[LBA<sup>2</sup>] game is played entirely collaboratively; players either “win” or “lose” en masse. The game is designed to be a parable on sustainability—maintaining ecological balance is a never-ending task, and the fate of one participant is inextricably linked to that of others’.

#### 4 REFLECTIONS ON THE CREATIVE PROCESS

Encouraging a learning atmosphere with a community feel was very beneficial. While very difficult to quantify or qualify at face value, it is manifested indirectly through other outcomes. Among assessed student output, the most visible evidence is through their blogs and other communiqués – passionate and even argumentative messages, discourses, comments and suggestions. All of these point to a definite sense of community, not just within the group of students, but also of them with the rest of the Biomodd team.

One of the most challenging issues we faced while facilitating the course was guiding the group through the process of taking an idea, to a working prototype, to an installation-ready product that visitors in a gallery can interact with over an extended exhibition period. In a post-hoc summative evaluation of student performance, we observed that both instructors and learners went through a four-stage process of dealing with the relationship between a high-level artistic vision, and the limitations and opportunities of the materials and tools for artistic expression (i.e., the *artistic media*) of artistic expression that impinge on or enrich the original vision.

1. Naïvely sophisticated: Learners proposed deeply creative ideas without knowing how feasible they are given the available artistic media.
2. Paralyzed: Learners realized that their artistic visions are non-viable and are unable to reformulate new ones.
3. Explorative: Instructors provided learners with simple, exploratory activities that allow the learners to understand the fundamental properties of the artistic media. These activities sometimes merely replicated existing, non-novel ideas.
4. Empowered: Learners reformulated the relationship between artistic vision and their understanding of the artistic media. They demonstrated their artistic intent in physical, aesthetic artifacts with novel form factors.

We found that most of the key contributions to the final [LBA<sup>2</sup>] installation that set it apart from [ATH<sup>1</sup>] occurred in phases 3 or 4. Indeed, it is in the process of trying out and attempting to build different solutions that insights occurred. With this mind, in addition to having learners work on the main [LBA<sup>2</sup>] installation, we also asked them to design and exhibit their own version of Biomodd (Fig. 6).



Figure 6. The learners’ independently-designed version of Biomodd

In facilitating Biomodd[LBA<sup>2</sup>], one of our goals was to encourage the development of a community of practice engaged in “citizen science”, wherein non-scientists engage in research projects that enable them “to act as agents of change” [15]. Yet one of the challenges of trying to community participation and deep engagement in a project that aims to get users to meditate deeply on themes of sustainability and symbiosis is that often the engagement can be fairly “thin”, as was found to be in the case of other similar projects, such as the Telegarden [16]. Asking learners to design their own version of the installation was a strategy for creating a deeper engagement with Biomodd’s principles.

## 5 CONCLUSION

On the one hand, much of the arts-based training in the Philippines focuses on traditional artistic disciplines—within the visual arts, for instance, this would include drawing, painting, and sculpture. The poetics of digital interactivity is beginning to be only more actively being taught and explored at the university level. Furthermore, though new media art has had a documented history in the Philippines (led by key groups such as SABAW Media Art Kitchen [17]), Biomodd[LBA<sup>2</sup>] is to the best of our knowledge one of the first projects (if not, indeed, the first) in the Philippines involving a large-scale, interactive hybrid of biological and electronic systems. We are also fairly certain that MMS 198 class associated with Biomodd is one of the first university-level classes in the country that has led students through a systematic discovery process of thinking and designing radically hybrid systems as a form of art practice.

On the other hand, science university courses tend to underemphasize the role that creative exploration and interdisciplinary inquiry play in the most significant leaps in scientific research [1]. They also gloss over the fundamental ontological and epistemological assumptions upon which scientific disciplines are built. We advance that the process of actively finding symbiotic relationships between seemingly inconsistent systems and functionalities is crucial to for developing the cognitive and creative skills needed to discover solutions to some of humanity’s most current pressing problems, such as resource use and climate change. While we do not claim that Biomodd[LBA<sup>2</sup>] represents a finished and fixed solution to such problems, we find ourselves agreeing with Kera and Graham, who elegantly capture one of our key goals in choosing to work on the Biomodd project:

The aim of such systems and interaction is to instigate thinking about different possibilities, to contemplate the design as part of creation of such large information systems and to reflect the possibilities that technologies bring. In this sense we are not designing just new types of objects, but rather new types of ecologies and symbiotic relations between different actors and agencies. [18]

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