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# Empathetic Biological Media

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**Abstract**

Biological media offers a new direction for development of radically new interactive digital systems. We present two research prototype ambient information systems, one utilizing genetically altered bacteria and the other based on a color changing plant. We then discuss the interactions made possible with such systems and argue that biological interactive media can engage and motivate users in ways not possible with traditional media including the promotion of empathetic connections and a deep emotional impact. We conclude by providing a vision for the future of biological interactive media and some important related research issues.

**Keywords**

Biological media, ambient interfaces, empathy

**ACM Classification Keywords**

H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

**Introduction**

Since the beginning of time, man has survived on the bounty available in nature. With an advanced brain, humans developed tools and technologies, but these have always been rooted in lessons learned from the structures and processes seen in nature. Art has also developed out of themes from nature, either by the

artist mimicking the beauty of natural forms or by taking an element from nature and transforming it into a new message, which inevitably speaks of the underlying force of nature and also the hand of the artist. The hand of humans in the creation of glass, metal alloys, and the cutting of gemstones were some early steps towards the production of objects back in the Middle Ages that radically broke from the look and feel of nature. Traveling forward through time through the periods of industrialization, there were objects, which have been produced with precision and with repetition such that manufactured objects are even more easily identifiable as being a departure from nature. If we then look at the Digital Age, we see communication media and digital technologies touching every part of our lives yielding amazing possibilities of connectedness and empowering human achievements. Our interaction through digital media has, until recently, only been through electronic lights, actuators sensors, data storage, etc. Then very recently, Bioart has emerged as a new movement based on technology, which makes an unabashed partnership with elements from nature. Following in the famous words of Marshall McLuhan, "The medium is the message," Bioart has involved dialogues with nature and amongst people in ways that have renewed the spirit of communication through a warmth and realism that electronic lights and motors can only hope to mimic.

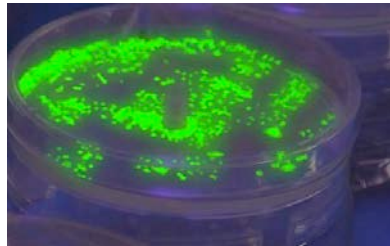
Recognizing the amazing potential for engaging users at deep emotional levels, bioartists have created a wide variety of works from the very early and more static works of Alexander Fleming with the bacteria based still images [5], to the more dynamic works of Marta De Menezes' butterflies [4].

### **Empathetic Living Media**

Eduardo Kac created the term, "telempathy," which refers to the ability to have empathy at a distance [7]. Building upon this concept and recognizing that living things evoke special emotions [10], our research into the transfer of emotions has focused largely on this more 'soft' aspect of user experience. Roy Ascott described the future of new media as being a 'moistmedia' [1] in which the old paradigm of bits and signals give way to the full embrace of nature. Therefore, future technologies could then provide a fluid reality in which the relationship between humans and the intelligence from nature could be more closely intertwined. Two of our works that seek to demonstrate this new relationship of biological media and human communication are now described.

#### *dDNA: Empathetic Living Media*

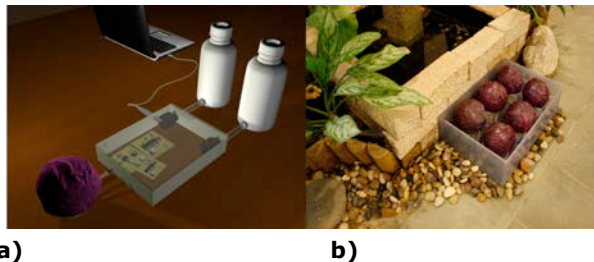
Utilizing e Coli bacteria and the genes from a jellyfish, a glowing transgenic bacteria was coupled with information in the world to yield an ambient information system to encourage the attention to important humanistic issues around one's life including relationships, personal health and the environment [3]. The system provides a near real-time change according to this information coupled in an impedance matching to the glow of the bacteria through the mechatronic system controlling the nutrients supplied. A close-up image of the system is provided in Figure 1.



**figure 1:** Close-up view of the transgenic, bacteria based 'dDNA' biological media system

*Babbage Cabbage: Empathetic Biological Media*

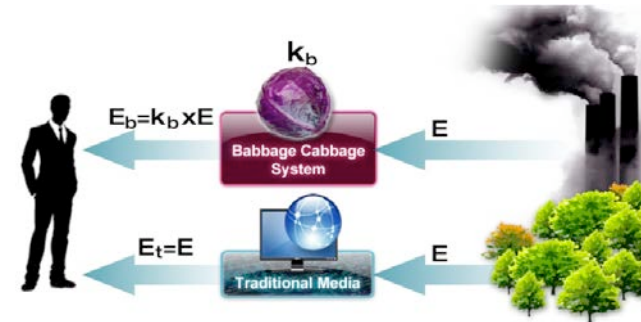
Intended as a slow ambient interactive system to enhance empathy for world issues in the ubiquitous environment, this system provides a plant based display with a refresh rate in the Millihertz (mHz) range. The system focuses on human issues and is suited for a social setting [9]. The system is



**figure 2:** a) single pixel system b) Babbage Cabbage garden system

comprised of a reconfigurable array of single pixel systems as shown in Figure 2a. Figure 2b shows the full garden system in which a small grid of the single pixel systems is arranged in an aesthetically pleasing way, blending into the landscape architecture. The aim

of this system is to provide an empathy transfer for environmental issues through the semantics and iconic nature of the living plant as shown in Figure 3.



**figure 3:** Empathy transfer of the Babbage Cabbage system compared to traditional media.

**Vision For the Future**

There are two key areas that biological media can be applied to make a clear positive impact; saving the environment, and improving human communication.

*Environmentally friendly technology*

The world's resources are being consumed more quickly than ever and the impact humans have made on the climate is also having its negative repercussions. The field of digital technology is responsible for the creation of huge amounts of toxic materials in the [6]. The promise of biological media is that organic and degradable materials can be circuits and media during their useful life cycle and gently return to the earth because it can be truly biodegradable. As an example, there are numerous works illustrating the circuitry found in plants [8], which could, in the future, be used as environmentally friendly wires and sensors that can

be used and then retired to the compost pile when it comes time to upgrade. Better still, a plant-based system could grow into the qualities and meet the ever-changing demands of the user. Just as our muscles become stronger with use, the biological circuit could continue to replenish itself and adapt to meet the needs of the future.

#### *Human Communication*

The coldness of traditional digital media limits the concept of telepresence. Even the precise modulation of the human voice into signals passed between telephones does not share all of the warmth and emotion of being present in a face-to-face conversation. By activating some of the deeply wired circuitry of human psychology and by appealing to human emotions, the role of biological media in the progress of human communication is assured to be positive and significant. For the empathy transfer effect, we will work to better understand the effects and underlying causes.

#### **Conclusion**

The work of boat builders in ancient times involved the softening and bending of wood to create a new object with advanced properties enabling the crossing of the world's oceans. We consider biological media to be a similar repurposing and bending of natural materials into advanced communication media elements which can make new emotionally deep connections among humans and reducing the negative impact on the environment of interactive digital media. There are many new biological media systems around the corner including an ant interface, cuttlefish phone, display systems using plant motion, food communication and many others. These radically new interfaces will help establish and maintain meaningful human relationships

and reduce the negative impact of technology in the environment as our human communication media continues to circle the globe.

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