

Bioengineered Living Entities in Art

Aliveness, Duration, and Movement in Bricolage

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ABSTRACT

Bricolage is a kinetic biological artwork first exhibited at the Perth International Arts Festival in 2020. The artists used stem cell technologies to create bioengineered living entities from donated human heart muscle cells. These living entities are suspended in an incubator from the ceiling and are made visible to gallerygoers, who watch the performance of cells generating and moving independently. This paper considers how the assemblage, animation, and performance of cells embedded in *Bricolage* highlight questions around the conceptualizations and perceptions of life, duration, animation, and aliveness.

BRICOLAGE

Bricolage is a biological kinetic installation created by Nathan Thompson, Guy Ben-Ary, and Sebastian Diecke that was first exhibited 5 February 2020 at the Fremantle Arts Centre in Western Australia as part of the Perth International Arts Festival. The artists' choice of materials such as clay, silk, and glass situate the work within ancient traditions, while novel uses of cutting-edge bioengineering processes posit scenarios of what is possible now and what could occur in the years ahead. The artwork involves the creation and growth of autonomous, animated, living biological entities that have the ability to self-assemble, move, and mobilize. These living automatons are made from bioengineered human heart muscle cells (cardiomyocytes) that grow onto and into scaffolds made of silk (Fig. 1) [1]. The cardiomyocytes

beat in real time, manipulating the automatons' movement, and at times self-assemble to create a larger structure visible to the naked eye of gallery attendees.

The cardiomyocytes were bioengineered from harvested white blood cells (anonymously donated) using pluripotent stem cell (iPSC) technology. This process allows the cells' genome to be reprogrammed and coaxed into their embryonic state, in which they then have the potential to grow and become any other type of cell in the body (skin, liver, muscle, neuron, etc.) [2,3]. The iPSC technology enables the deconstruction, manipulation, and reassemblage of cells in completely new ways. This is the case in *Bricolage*, where the material was extracted from a human body and then transformed and manipulated to create a new life form.

These bioengineered living entities were housed inside a custom-made toroidally shaped ceramic incubator suspended from the gallery ceiling. The incubator that hosted the automatons had three illuminated openings that revealed the cells' movement. Viewers often clustered underneath these openings and looked upward to the illuminated Petri dishes to witness the cellular performance (Fig. 2). Viewers could perceive the continual movement of the living entities growing and expiring without any visual modification such as projection, magnification, or screen representation.

The term *bricolage* is commonly credited as one coined by Claude Lévi-Strauss to describe "mythical thought," whereby societies combine and recombine symbols to produce recurring narrative structures [4]. With Lévi-Strauss in mind, the title *Bricolage* emerged during the early stages of production, when Thompson, Ben-Ary, and Diecke were working with diverse biotechnological materials in SymbioticA's lab at the University of Western Australia. The artists experimented with how cellular matter could be harvested, assembled, deconstructed, and reassembled in unconventional ways to challenge assumptions around aliveness, animation, movement, and vitality, thereby constructing new questions and meanings and paying homage to Lévi-Strauss's bricolage [5].

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Fig. 1. *Bricolage's Automaton* [45]. (© Nathan Thompson, Guy Ben-Ary, and Sebastian Diecke. Photo © Guy Ben-Ary.)

MICROPERFORMATIVITY AND ALIEN ALIVENESS

Bricolage emerged from transformed familiar and organic materials (human blood, heart cells, and silk) into something that is uncommonly witnessed, rendered unfamiliar, and constantly reconfiguring. *Bricolage* is simultaneously familiar and unfamiliar: organic and of us (or at least of donated human blood), as well as transformed into animated, independent entities that are partially, but not wholly, human. The biological alchemy that enables the conversion of a drop of blood into a living animated entity is intriguing, challenging, and, frankly, for many quite disturbing. This combination of effects that *Bricolage* has on viewers connects with what many would describe as “uncanny.” As Sigmund Freud highlighted in his seminal essay “The ‘Uncanny,’” this term pinpoints moments when people are confronted with an experience that is disturbing precisely because it “is that class of the terrifying which leads back to something long known to us, once familiar” [6].

When individuals are met with radically different situations that violate expectations about the world, such as an artificial world, this can create a perceptual shock. This shock can also occur when one encounters an agent that moves in a way that is radically different from one’s expectations. Indeed, neuroscientists have found that when an agent’s movement violates expectations, the brain generates an error signal [7–9]. These

violations can create the sensation of shock, strangeness or the feeling that something is not quite right [10]. We suggest that these sensations can also occur when one encounters an agent that violates existing concepts of aliveness (i.e. animacy and agency [11,12]), and will use the term *alien* to refer to an agent, artifact, or situation that violates expectations about the world, an agent’s actions, or the concept of aliveness.

Standing under *Bricolage* and looking upward to see living matter moving in a gallery is a different experience than observing biological matter in a medical or laboratory setting. In these latter settings, individuals typically look down at the living matter through microscopes. Part of the sense of strangeness one feels when observing *Bricolage* comes from the alienness of seeing living automatons outside of a medical laboratory setting alongside the abnormality of being positioned submissively underneath them. These aspects of alienness provoke feelings of uncertainty and challenge audiences to reflect on traditional power relations of human superiority and control over other life forms.

Indeed, as the gallery attendees observed the alien aliveness, animated and twitching stochastically in real time, there were diverse reactions to the cellular performance that ranged from shock and excitement to wonder and horror. These conflicting reactions are articulated in one viewer’s reflection of *Bricolage*:

The larger thing, the human, is positioned to apprehend a group of kinetic and performing smaller things that enjoy an ambiguous agency despite their modest material form. Moving itinerantly through environments of living and dying, we encounter systems that rouse us; we are troubled, scared yet energised and validated all in the same movement [13].

This description keys into the performative element of the cells moving in real time visibly above viewers, which often produces senses of ambiguity and strangeness. The animation of the cells has a quality of ambiguous agency, which could challenge preexisting concepts of agency, aliveness, and animacy that viewers might possess. Indeed, “agency,” “aliveness,” and “animacy,” without embodied representation, are already complex and abstract notions, let alone observing living material that moves and evolves independently in an incubator.

Understanding the performativity of biotechnological art is helpful for unpacking the nuances of how viewers perceive



Fig. 2. A gallerygoer looking through the incubator at *Bricolage's automaton*. (© Nathan Thompson, Guy Ben-Ary, and Sebastian Diecke. Photo © Simon Thompson.)

agency, aliveness, and animacy. As Polona Tratnik has argued, works of biotechnological art (such as *Bricolage*) with in vitro cultures “are marks of life, marks of cultures or tissues they were taken from” [14], as they contain familiar traces of the body yet are moving and alive entirely beyond the body. Hence, the microperformativity of the cells in *Bricolage* presents to viewers a situation where the cells are alive and familiar, yet intervened with to perform outside of their hosts.

The microperformativity of *Bricolage* also triggers dissonance between concepts of animacy that appear early in development and concepts of aliveness that are developed through experience. A growing body of literature suggests that the concept of “animate object” (constructed from the ability to distinguish between animate and inanimate objects) may be universally represented. For example, infants as young as six months old are able to detect animacy from the appearance of self-propelled movement, where the movement of an entity appears to arise from an internal rather than an external force (i.e. gravity) [15–21]. In contrast, the concept of a “living thing” is thought to be developed later in life and to be strongly influenced by experience [22]. One type of experience thought to influence how individuals categorize objects into their concept of aliveness (i.e. living/not living) is the quantity and quality of interaction they have with the biological environment [23–26]. *Bricolage* oscillates between these concepts of animacy and aliveness; although it exhibits self-propelled movement that could trigger familiar animacy detection mechanisms, viewers might not have had much experience witnessing the performance of cellular material, which could challenge them to incorporate the unfamiliar alienness into their familiar concepts of aliveness.

The animistic-anthropocentric model of life status claims that our concept of what we consider alive overlaps with our concept of movement and is shaped by the similarities we perceive between the entity and ourselves [27]. According to Sara Dellantonio et al., this is not a novel idea, as we detect “different degrees of ‘vitality’ according to the degree of similarity [we] recognise between the considered instance and [ourselves]” [28]. However, although the concepts of aliveness and movement overlap, some living things, such as plants, do not always move at a scale that is perceptible to the human eye. Consequently, plants are often perceived as less human-like and less alive than animals or humans [29,30]. Thus, people may consider certain entities as alive, but the degree of aliveness we attribute to them is constrained by our ability to perceive their human-like properties with the naked eye (i.e. whether its time scale is at a tempo that is detectable) [31]. Typically, living cellular material is at a microscopic scale, and as such its time scale is not perceptible to the naked eye. When viewing *Bricolage*, people might not have many opportunities to witness or conceive of its human-like properties, let alone to conceptualize its agency and aliveness. However, due to the macroscopic scale and type of cells used for *Bricolage*, both form and movement of the bioengineered living entities are visible to the naked eye. This scale provides the audience with an unfamiliar visualization of cellular structures, which could challenge audi-

ences to perceive cellular structures as more human-like and compel them to consider agency and aliveness in new ways.

When viewers who might have had little experience and exposure to microperformativity in biotechnological art are confronted by *Bricolage*, experiencing the artwork provides them with an unfamiliar visualization of cell formation and unknown cellular structures that have been manipulated, moved, and grown while outside the human body. *Bricolage* oscillates between strangeness and familiarity because it involves the real-time movement of cells that are from us but have transformed and are living autonomously without our bodies. The alien aliveness of *Bricolage* creates a dissonance between the familiar and the unfamiliar and challenges viewers to reconsider their assumptions around aliveness.

PERCEIVING KINETIC MOVEMENT

Contemporary audiences are familiar with artworks in motion more generally [32,33] and are increasingly accustomed to the incorporation of organic materials in artistic practices [34]. While *Bricolage* participates in the broader histories and investigations of kinetic sculpture and biological artistic practices, what is specifically unique about *Bricolage* is that Thompson, Ben-Ary, and Diecke’s installation and manipulation of cardiomyocytes perform, generate, and animate independently and in real time with the viewer.

To further explore the microperformativity in *Bricolage*, we turn to Henri Bergson’s philosophical engagements with movement and time. In *Time and Free Will* (1889), *Matter and Memory* (1896), and *Creative Evolution* (1907), Bergson articulated the dominant ways in which “Western” cultures rationalized and mediated movement and time with visual media and technology, which inevitably distorts how we experience duration [35–37]. Bergson emphasizes that perceiving movement in film, photography, and painting is only achieved when inferring it based on static images: through what happens *between* these static images moving in quick succession in front of the viewer.

For Bergson, Western rationalizations of time oversimplify how duration is experienced subjectively [38]. Duration is not simply the passing of time; it involves the interweaving of awareness of the past (memory) existing as the present unfolds [39]. More recently, Leonard Lawlor (through Bergson) highlights that the present is inherently a creative act because as it unfolds, it is entirely unpredictable and unforeseeable even though the past lives within it: “It is unforeseeable because, on the one hand, the past is *spontaneously* adding memory-images to the perceptual image, and, on the other, the coming moment is always adding *different* perceptual images to the whole of memory” [40]. Hence, when an artist is making an artwork, the process of creation “is like duration,” even if the artist has an acquired style and has created similar works before (the present repeats the past). The process of making that artwork in the present also simultaneously creates new perceptual images to be generated even if the present only differs by degree from the past [41].

When standing under the incubator and witnessing the movement of the automatons in *Bricolage*, viewers become

acutely aware of multiple temporal tensions playing out simultaneously, because they perform rather than distort duration. While the cells have been transformed and reprogrammed in the lab prior to the installation of *Bricolage* in the gallery, their stochastic twitching seems repetitive; however, their movement and behavior is unpredictable and brings the viewers' attention to the palpable qualities of the past and present as they unfold. For Tratnik, biotechnological artworks that use cellular movement are unique because they are not performing fictional or representational discourses. Their microperformativity "produces" it. It "does" it" [42]. Hence, the living entities in *Bricolage* are performing and bringing attention to duration as it is actualized in the present.

For Lawlor, to think in terms of Bergson's duration involves understanding three key principles: "First, the past survives. Second, because the past survives, each coming moment cannot be a mere rearrangement of the old moments. Third, not being a rearrangement of the old, each coming moment must therefore be new" [43]. It is easy to think that because kinetic biotechnological art involves movement, it therefore simply exists in duration. This assumption does not necessarily suggest that all biological-based artwork expresses the concept of duration, even if it exists in duration with viewers. However, the idea of the present as an act of creation in duration is specifically articulated through the nature of the cells and materials used in *Bricolage*. The human cells in the artwork were manipulated using stem cell technologies that hold potent cultural baggage in current popular culture and discourse. Stem cells are the raw materials or building blocks of life and are capable of generating specialized cells to perform specific biological tasks. Therefore, the stem cell occupies full potentiality to become or produce any type of cell in the body. Following Lawlor's principles, *Bricolage's* raw materials were blood cells (the past) that were transformed or rearranged into twitching heart muscle cells and then further

assembled into a new beating entity—the real-time performing automatons. Installing cardiomyocytes specifically rather than a different type of cell, *Bricolage* brings attention not only to the experience of the present unfolding and the impassability of the past but also to the unpredictability of the future as it is actualized in the present.

CONCLUSION

Bricolage is a "prepared" living entity that embodies a new kind of performative action—an entity physically removed from the human, almost alien, but linked through lab-based processes in which biopsied material is grown outside of the donor's body (in vitro) but is still very much alive. *Bricolage* is considered a hybridized entity or a "surrogate performer" [44].

For *Bricolage*, Thompson, Ben-Ary, and Diecke bioengineered cellular material that performs their development in front of viewers in the gallery to consider new ways of perceiving life, time, and duration. The alienness and movement of the automatons call attention to the complexity of duration in kinetic art and to the constraints of anthropocentric bias on our perception of aliveness. Viewers who might be inclined to observe artifacts through an anthropocentric bias are confronted by the anomaly that is *Bricolage* and the fact that a drop of blood could be converted into a living animated physical entity. This ambiguity of agency, animacy, and aliveness contributes to a sense of alienness akin to the uncanny. *Bricolage* nurtures possibilities and visceral reactions to encourage the audience to consider its automatons as actual examples of aliveness. Furthermore, it encourages us to reflect on what cognitive bias we have toward "alien" life-forms and how this influences how we value life as a whole. *Bricolage* challenges viewers' perceptions of the taxonomy of living material and invites questions around agency, animacy, and duration, as well as a reevaluation of the common conceptions of life.

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