Becoming Organ-ized: The Creativity of Organization, Dis-Organization and Re-Organization in Scientific and Artistic Experiments

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While turbulent motion appears as irregular or chaotic on the macroscopic scale, it is, on the contrary, highly organized in the microscopic scale. The multiple space and time scales involved in turbulence correspond to the coherent behaviour of millions and millions of molecules.

—Ilya Prigogine and Isabelle Stengers [1]

Unlike wires and transistors, E. coli’s molecules are floppy, twitchy, and unpredictable. They work in fits and starts.

—Carl Zimmer [2]

In Carl Zimmer’s book Microcosm: E. Coli and the New Science of Life [3], he describes an experiment conducted by Michael Elowitz at the California Institute of Technology [4]. The experiment incited genetically identical E. coli to produce a protein for feeding on lactose. Elowitz and his colleagues then added extra genes to the bacteria so that they glowed when producing the protein for digesting the lactose. One would expect that, as the E. coli were genetically identical, they would produce identical proteins and all glow with the same intensity for the same amount of time. However, this was not the case. Instead, some glowed, some did not; some flickered; some were bright and some were dim. In short, there was no apparent uniformity among the genetically identical E. coli. Rather than achieving a constant and predictable production of protein at intervals in time, the E. coli produced what Zimmmer describes as “noisy bursts.” The unpredictable “noisiness” in E. coli’s structure is used by Zimmer to muse on the conditions that differentiate us as individuals, showing that at the genetic level, whether it be that of E. coli’s 4,000 genes or our roughly 20,000 genes, nothing is determined by the genetic network alone. What we commonly consider life rather becomes through a productive process, as a set of potentials is organized.

I would like to use Zimmer’s extrapolation of Elowitz’s experiment as a starting point to begin to think about the productiveness of organization, in biological, cultural and technological networks, and the way that forms or assemblages may arise as apparently random information becomes organized. This paper outlines several different scales of organization, operating in different domains. This includes the organization of artistic content, the organization of swarms, the technological re-organization of the human body and the organization of information. I bind these examples together—organizing them—with a reformulation of Gilles Deleuze and Felix Guattari’s concept of the Body without Organs (BwO), using this philosophical approach to understand the broad concept of organization as illustrated in a set of scientific and artistic experiments.

The term organization is used in this paper across very different domains to refer to a process whereby individual entities relate to one another, synchronize and work together. In this sense, the paper enters into the discourse around networks, a discussion that now seems to be unfolding into an ever-expanding network of disciplines. Valuable works such as that of Geert Lovink [5], Mark Nunes [6] and McKenzie Wark [7] have shown how networks exist as a cultural form of organization, attaching themselves to and affecting large portions of our daily lives. This paper does not necessarily follow in these long-cast shadows; rather than exploring the concept of networking, it instead focuses on the concept of organization as a way of structuring the entities within the network. To this end I explore how networks might be thought to overlay or organize disparate information and chaotic flows into a becoming of unity, however unstable or unpredictable it may be. As Zimmer concludes from the E. coli experiment, we are built on a foundation of chaos, with nothing determined by genetics alone. However, when these chaotic flows are organized, a set of structures and protocols emerges, as life, however chaotic it may appear, is coded and directed toward specific ways of becoming [8]. Philosophically, this may be how...
we get from a messy, noisy and unpredictable foundation, as embodied by E. coli’s floppy, twitchy and unpredictable molecules, to the organization that the human represents: the ordering of our body, heartbeat, nervous system as well as our thoughts, emotions and desires.

The concept of organization has previously been bifurcated into two separate fields of study, which conceive it in either biological or social terms. On one hand, we use the tools provided by science to consider the genetic organization of, for instance, a human person. On the other hand, we use the tools of social theory to consider the human person as produced and organized by a history of social interactions. Genetic organization is traditionally designated as that which exists in reality, outside human minds, and the latter is usually relegated to a mind-dependent existence—one real but relatively meaningless and one meaningful but relatively unreal [9]. This split is beginning to be overcome by the work of thinkers such as Melinda Cooper [10] and Kate O’Riordan [11], who explore new ways to understand the grafting of socially conceived technology onto biologically conceived nature. It is also being overcome in a new type of network theory, which binds biology and technology together in its investigation of the structure and power of networks. As Alexander Galloway and Eugene Thacker state, “Networks can be technological, yes, but they are also biological, social and political. . . . Networks structure our experience of the world in a number of ways, and what is required is a way of understanding how networks are related to the aggregate of singularities—both human and non-human—that are implicated in the network” [12]. Networks for Galloway and Thacker involve a connection between many different actors or singularities, which may be biological, social or technological, all of which are overlaid by the organizing protocols that govern the network.

This contemporary thought can be seen as following on from the philosophy of Georges Canguilhem [13], who posited that the life of an organism is irreducible to a technical set of biological internalities. Instead, the organism is presented as radically open, as part of a network where external forces cross the threshold customarily set up between the internal organs and the outside world. Canguilhem states, “Machines can be considered as organs of the human species. A tool or a machine is an organ and organs are tools or machines” [14]. Biological life, for Canguilhem, is in this way an ongoing process of mechanical production, involving the relationship between biologically and socially conceived processes. In other words, life can only be understood as biological forces in constant contact with their milieu, which acts as a structuring or individuating force, as something that an organism attaches to and by which it becomes organized.

The process of mechanical production can be seen in an emerging tradition of artists who focus on the relationship between the social environment and biological life. For instance, Natalie Jeremijenko in *Tree Balance* (2005–2010) (Fig. 1)—exploring a similar concept to that which Zimmer sees in E. coli—balanced two cloned trees in a gallery. In this artistically motivated experiment, Jeremijenko shows how the two trees, conventionally thought of as two identical copies, are continuously differentiated by the environment that they extend into, including sunlight and airflow, along with the way they have been tended, causing them to grow in different ways and achieve different weights. Jeremijenko developed this work from her *One Trees* project (2000), in which she planted one thousand fruitless walnut trees, each cloned from a single tree, around the San Francisco Bay Area. As the genetically identical trees grow they exhibit different traits depending upon environmental and social surroundings. Branches grow differently on each tree, the trees have varying leaf cover and some appear healthier than

others. They are mechanistically produced by the causal efficacy of material and social forces, with the interaction between their milieu and genetic structure being inscribed on their appearance.

**THE BODY WITHOUT ORGANS (BWO)**

One way to understand organization, beyond its bifurcation into biological and social realms and following its experimental emergence in Jeremijenko’s trees and Elowitz’s E. coli, is provided by Deleuze and Guattari. Their concept of the Body without Organs (BWO) provides a step toward conceiving organization as a relational process established between genetic and environmental forces. The BWO has been used frequently in discussions of electronic art and digital culture, particularly in the discussions of “virtual” bodies that took place following the proliferation of cyberculture in the mid-1990s. My use of the BWO, however, is quite different from this, using the concept to understand the function of organs in the broad sense, as any components in a system, rather than attempting to conceptualize a human body without them.

In order to conceptualize the BWO, a number of definitions are first required. The BWO does not refer literally to a human body without internal organs. Instead the terms body and organs are used in a distinctly non-medical sense. “Body” refers to a whole, or an organism, that is made up of different parts, and “organs” refers to these individual parts, which are in effect tools or instruments for constructing the organism. Thus the BWO refers to a body, which includes but is not limited to a human body, outside of its “organ-ized” state, beyond the limits and constraints of its organs.

Traditionally our concepts of reality are based on ideas of stable and material objects or bodies. Deleuze and Guattari argue, however, that at the foundation of reality is the BWO, a non-organized space of flows, which is sedimented into actual objects as it becomes organ-ized.

Deleuze and Guattari commonly use the BWO to oppose organizational structures and to argue for a move toward a body that is not organized by the organs and thus not weighed down or encumbered by its own organization [16]. I would like to use the term in a somewhat different fashion, to begin to think about the process of organization as a creative process. I use the concept of the BWO not as an opposition to organization, but rather to try and understand and provide some examples of the individuating and productive movement of organization [17].

Orit Halpern argues that organization has come to be a dominant feature in contemporary culture as we become increasingly concerned with the organization of data rather than its creation [18]. Since the development of the first microprocessors, the ability of users to easily tailor data queries to their own needs and the exponential growth of market research companies that detect and log consumer data—to name only a few cultural developments—the way data is organized has been put in direct correlation with the meaningfulness of that data. In the digital arts, this can be seen most clearly in the “database aesthetics” that emerged in the late 1990s.

An artwork that exemplifies this paradigm is George Legrady’s Slippery Traces (1995) (Fig. 2) [19]. Rather than creating artistic content, Legrady in this work provides users with the opportunity to reorganize a database of images. Undertaken during the period when the development and widespread use of web search engines began to redefine the relationship between users and information, Slippery Traces provides users with the opportunity to navigate a database of over 200 postcard images, which were intended to provide a visual overview of the history of the 20th century. Users move from one image to another by targeting “hot spots” within each image, organizing a temporal montage of images and creating conceptual links between images. The order in which the postcards are assembled in this work is not fixed or programmed into the system but rather is based on an algorithm that takes into account past events of interaction [20]. Thus, clicking on the same hot spot in the same image may, at different times, trigger a different image. The postcards and their relationship to one another in terms of a montage of images are thus organized and reorganized, in an ongoing sense, not only by the actions of a user, but also by the internal programming of the machine.

**SWARMS**

On a different scale from Elowitz’s E. coli, Jeremijenko’s trees and the organization of artistic archives, we can see another illustration of organization as mechanical production provided by the swarming locust. A recent cross-institutional study, involving the Universities of Sydney, Cambridge and Oxford, examined the tendency of the locust to form swarms and for many individual locusts to operate as a larger composite organism [21]. The study found that locusts initially interact in a group as individual entities, moving around autonomously. At one point, however, due to the stimulation provided by crowding, involving the sight and smell of other locusts, the agitation of sensors on their hind legs and, importantly, the production of serotonin in response, the locusts begin to form a swarm. When the number of locusts reaches a critical threshold, the swarm begins operating as a singular organism, completely organized. In this example, the milieu, which is made up of locusts and their relationship to one another, exhibits structuring traits, prompting certain actions from the entities that make up its parts. The movement of the swarm, just like the movement of a school of fish or a flock of birds, although appearing quite random, as it changes direction at unpredictable intervals, is in fact highly organized and based upon the single locust responding to information that it gathers from its surroundings. The “body” of the swarm is thus constituted by the way the “organs” relate to one another and are organ-ized.

This concept of swarm organization has been illustrated by Craig Reynolds’s computer model Boids (1987), which uses an artificial life program to simulate the behavior of flocking birds [22]. This widely used simulation technique is based on three steering behaviors: separation, directing boids to steer to avoid local flockmates; alignment, directing boids to steer toward the average heading of local flockmates; and cohesion, directing boids to steer toward average position of local flockmates. The behaviors of the flock emerge as each boid gathers information from a small neighborhood around itself, which involves many other boids, and responds to this based on the three commands. The flock is thus organized toward certain traits, which are at once quite chaotic and unpredictable at the
scale of the flock while highly organized at the smaller scale of each individual boid. The locusts and the boids are mobilized in all directions, but at some point, through an act of structuration—as the locusts’ legs are agitated and the boids are programmed—they become highly organized and their behavior within the flock or the swarm becomes relatively predictable. The appearance of chaos at the macro scale is thus determined by a highly organized structure at the micro scale.

A similar process of organization, as AI entities are put in contact with their surroundings, occurs in Jon McCormack’s *Eden* (Article Frontispiece) (2000–2004). In *Eden* two-dimensional AI creatures, which are in effect blue circular shapes projected onto four intersecting translucent screens, assemble into patterns and produce sounds at varying frequencies and volumes. The AI creatures move around their habitat, eating, mating, resting and “singing,” with their actions based upon a set of rules that direct them to react in specific ways to their environmental conditions [23]. The viewers also enact agency in the development of the AI organisms, as the presence of viewers produces food in the AI environment. McCormack reports that the organisms learn about the correlation between the presence of viewers and the production of food and increasingly make “interesting” sounds to keep viewers in the room [24]. Creatures that are unable to attract viewers die off. As with the swarm of locusts and the flock of boids, the complex behavior of the work as a whole, which appears quite unpredictable, emerges from a very specific set of programmed rules that instruct the smaller organisms how to behave in relation to their environment.

**Bodies with Organs**

As set out above, the traits of a body emerge based on the way its organs relate to one another. This includes both the organs in the conventional sense, as an internal set of biological organs, but also organs in Canguilhem’s sense, as the external organs that connect to and influence the body. The human body itself is an assemblage made up of diverse organs. These involve what we conventionally consider the internal organs, such as the heart, lungs, spleen and liver, but also other organs that we customarily consider external, such as technology, our social relationships and our history. In the case of human experience, the eyes are implicated in sight, likewise the ears in hearing, the palate in taste and the nerves in touch [25]. However, the human is also organized by those other organs not conventionally thought of as part of the body. As David Oswell points out, a nearsighted man requires glasses as an organ; a woman who is unable to walk unassisted requires a wheelchair as an organ. Neither the glasses nor the wheelchair are peripheral to the human body; rather they are central to it, as they help to define its existence [26]. Extending this point, we could say that the hu-
man body becomes organized by layers of technology [27].

Stelarc demonstrates this in his well-known experimental performances by extending or augmenting his body via technological means. In *Pong Body* (1996), Stelarc placed on his body a series of muscle-stimulating electrodes that were connected to the World Wide Web. The muscle stimulators responded to Internet users logging into the performance website and selecting various body parts on a graphical representation of Stelarc’s body. The stimulators did not respond to the selections made by users per se but rather to the pings gathered from their collective values. Stelarc’s body was thus not simply manipulated by other users. His body did not simply react to other human bodies. Instead, his body was forced to move by the Internet itself, by the data conveyed by ping values, which measure the density of Internet use. The body here is not merely constituted by its set of internal organs but also made up of the technological environment—as a set of external organs—that it extends into.

Stelarc’s performances show how the human body may be removed from its organic organization to be re-organized via the supplement of new arms, new nervous systems and new computer chips. In 1896, in a precursor to Stelarc's augmentation of the body and the emerging tradition of Augmented Reality (AR), George Stratton designed a technology that intervened between the eyes and the world. While researching perception, Stratton bound to each of his eyes a tube that contained two convex lenses separated by a distance equal to the sum of their focal lengths. By this means, he invented eyeglasses that presented an inverted world to their wearer [28]. Not only this, but initially the glasses caused a certain type of movement in the world, what Stratton describes as “awkward,” “uncertain” and “full of surprise,” as a kind of short circuit occurs between felt movement and the feedback that the brain receives via sight. However, after a period of several days, the wearer adapted to the glasses, becoming accustomed to the re-organization of vision, seeing “naturally” through the new supplemented eyes and being able to move much less awkwardly. Stratton, describing this reordering of perception, stated:

> The seen images thus became real things just as in normal sight. I could at length feel my feet strike against the seen floor, although the floor was seen on the opposite side of the field of vision from that to which at the beginning of the experiment I had referred these tactual sensations. I could likewise at times feel that my arms lay between my head and this new position of the feet; shoulders and head, however, which under the circumstances could never be directly seen, kept the localization they had had in normal vision, in spite of the logical difficulty that the shape of the body and the localization of hands and feet just mentioned made such a localization of the shoulders absurd [29].

In Stratton’s experiments a technological apparatus is attached to the organs of the eyes and reorganizes perception. In both Stratton’s and Stelarc’s experiments, there is an attempt to explore what the body can do when put in constant contact with technology, which reorganizes it, yielding it new boundaries and new potentials.

**Networks**

Another example of the technological organization of bodies, in this case a body of information rather than a human body, can be seen in the social and informational networking facilitated by the Internet. The Internet itself is a networking infrastructure that connects millions of computers together, so that any one computer can potentially communicate with any other. At this level the Internet exhibits a large body of flows, charting a vast amount of potential relationships. However, the network becomes highly organized by a technical code as it is overlaid by the World Wide Web, which imposes rules and protocols on the relationships established between computers and frames the way they are able to communicate.

Artworks such as *The Messenger* (1998/2005) by Paul DeMarinis scale the Internet’s organization—as a designed piece of technology—to our experience of information. The installation is based on an early proposal for the electric telegraph made by Catalan scientist Francesc Salvá [30]. Salvá proposed a system wherein one wire would be used for each letter of the alphabet to transmit static electricity across distances. A Leyden jar was to be used at one end of the wire to send a spark that would give an electric shock to a person standing at the other end. As the person at the end of the wire received a shock that person would call out a designated letter of the alphabet, which would then be written down by a scribe [31].

Following Salvá’s proposal, in DeMarinis’s work e-mails are re-read letter by letter by various automated devices, such as 26 singing washbasins, each able to pronounce one letter in a variety of singing voices. There are also skeleton puppets dressed in ponchos that are embroidered with letters and arranged from A to Z, which jump automatically in the sequencing provided by the message, and 26 electrolytic jars that bubble when electricity is passed through them. As with the overlay of control structures and the technical code of the Internet, this work makes it abundantly clear that the experience of e-mails read by either of these three receiving devices is significantly different from, firstly, the original intention of the sender and, secondly, its usual context on the computer screen. What is clear here, following Marshall McLuhan’s oft-cited adage [32], is that the technology that mediates information, whether this be the structuring of the Internet or the programmed routines of performing objects, by intervening in the communication channel and reorganizing the information, is itself fundamentally involved in the message, both in its structuring and in the way that it is received. Media thus reorganizes the message in DeMarinis’s work into a type of mechanical production, as a technological process re-orders information.

In this article I have given four examples of the creativity of organization as a type of mechanical production. We have firstly seen how biological entities become organized, in an ongoing sense, by a set of environmental and genetic processes. As seen in the example of E. coli and Jeremijenko’s trees, a set of biological processes are continually organized and re-organized by their environment. A process of mechanical production can also be seen in the example of the swarm, where individual entities synchronize their activities with surrounding entities in order to produce a larger organism. We have also seen this in the technological organization of the human body, which involves a set of biological, technological and social organs that connect to the human body. Finally, it has been shown how a set of organs, in the form of social and technological protocols, may overlay and organize a body of flows of information, such as Web 2.0’s overlay of the Internet or *The Messenger’s* overlay of e-mails. In this sense, machines may be seen as an extension of living and non-living organisms, something that they attach to and are composed by, valued for the way they organize and re-organize, or compose and recompose, a set of capabilities or restrictions, just as Stratton’s experiment reorganized his perception of his own body.

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*Barker, Becoming Organ-ized* 267
References and Notes

Unedited references as provided by the author:


5. See McKenzie Wark, A Hacker Manifesto (Cambridge: MIT Press, 2002), which explores questions of Internet freedom in the face of corporate and state control mechanisms.

6. See Mark Nunes, Cyberspaces of Everyday Life (Minneapolis: University of Minnesota Press, 2006), which explores historical and philosophical concepts of space in relation to the World Wide Web and everyday life.


11. Kate O’Riordan, The Genome Incorporated: Constructing Biigital Identity (Surrey: Ashgate, 2010).


16. Deleuze and Guattari state, “The body without organs is opposed less to organs as such than to the organization of the organs insomuch as it composes an organism. The body without organs is not a dead body but a living body all the more alive once it has blown apart the organism and its organization.” Deleuze and Guattari [8] p. 34.


19. A basic interactive version of the work is available on-line at <www.fondation-langlois.org/legrady/>.


24. See McCormack [25].


32. I refer here to McLuhan’s statement in Understanding Media (McGraw-Hill, 1964) that “the medium is the message.”

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