

BODY AS A BIOTIC INSTRUMENT

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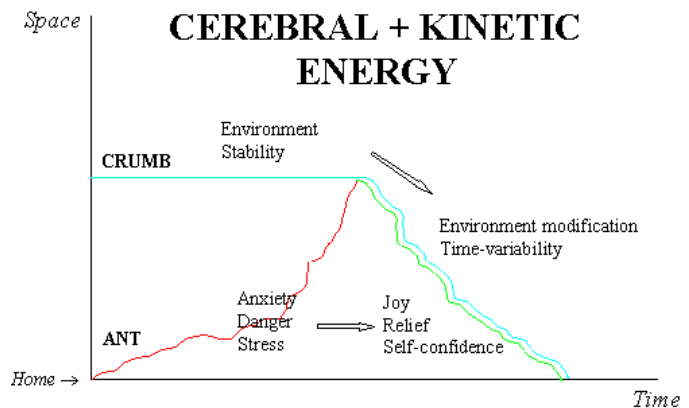
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(Living) bodies are physical entities embedded in a space-time continuum, i.e. a mathematical model defined by three spatial dimensions plus the time variable that determines their evolution (or, in more common terms, aging). This four-dimensional space constitutes the body environment, a sort of realm in which its biological or geological activity takes place.

In general terms, the interaction between a given body and its environment is bi-directional. Let us concentrate from now on living bodies, although many of the remarks can also apply to non-living bodies. It is part of our daily experience the knowledge that environment can induce emotions and impulses in the mind/body system. Similarly, though, we note that virtually in all occasions the system latter reacts back modifying the surrounding conditions according to rules based on past experience. This feedback interaction is modulated and conveyed by the production of *biotic material*, i.e. signals related to either the brain (*cerebral energy*) or body (*kinetic energy*) activity.

To better clarify this important point, we resort to a simple example. Let us

consider a minimal world made by an ant and a crumble. We can conveniently describe this world in a plane defined by time on the horizontal axis and spatial coordinate measured along the vertical one (see Fig. 1). At some initial time the ant is sitting at the origin (we can think it as its home) and the crumble is located



in a different position on the y-axis. The ant becomes hungry and decides to go out in search of food, thus starting its interaction with the environment. This interaction induces a number of different emotional states, like anxiety, feeling of danger, stress. On the contrary, the crumb and the environment (everything different from the ant) are in a stable, static configuration. As the ant finds the crumb at some later time, its feelings are now turned into those of joy, relief and self-confidence. The ant brings the crumb back home, thus modifying the

environment, which is becoming dynamic and time-variable. The interaction between the environment and the living body has implied the production of *biotic material*. These materials are of two types: cerebral (related to the brain-induced emotions) and kinetic (kinetic energy released by the ant body to drag the crumb). This simple example shows that biotic materials are tightly connected with perception and experience, and in general with the complexity of life.

To make progress we need to define more clearly what can be considered as biotic. What's biotic ? In general, any natural material that is originated from living organisms can be classified as biotic; they are usually biodegradable, renewable, and have minimal environmental impact. Living organisms in the Earth biosphere are numerous: plants, animals, fungi, protists (eukariotic micro-organisms), bacteria, archea (bacteria with no cell nucleus). Thanks to their complex organization and heritable genetic information they can support metabolism, possess a capacity to grow, respond to stimuli, reproduce and adapt to their environment on short and long (through natural selection) timescales. Further examples of biotic materials are wood, humus, chitin, fibrin and bone.

Technologically-mediated extraction and use of biotic materials rooted in the deepest and most significant life indicators (neuronal and muscular) allows to explore the liquid borders between self-perception and environmental influences in a novel and potentially very rich manner. In addition, the use of biotic materials in arts might open conceptually new windows on the creative landscape. In digitally-based artistic forms, which are closer to my expertise, biotic materials can solve what I define the "Composer dilemma". This is stated as follows.

A very interesting current trend in digital composition is to use generative processes. These are best applied to disciplines as music, video, video-dance and affine ones which rely on a temporally ordered events; their application can be also extended to the creation of usually static artistic products (paintings, photographs, sculptures). In generative creation rather than specifying in detail all stages of the time evolution of the artistic object, the composer (a term used here as a proxy for artist) defines a *compositional strategy*. In practice, this is achieved by defining rules or algorithms through which the material can self-evolve once the process is started, requiring only a moderate- to no-control by the composer. The interesting feature of algorithms is that they can map any data set into e.g. visual/audio data; however, they always contain free parameters whose initial values and subsequent evolution need to be assigned somewhat arbitrarily.

The dilemma of how to assign these numerical quantities strongly influencing the final compositional outcome has been puzzling composers essentially since the beginning of digital arts. Several solutions have been proposed. One could adopt a purely random choice of parameter values; more sophisticated techniques based on Game Theory have also been explored. The Greek-French composer Iannis Xenakis (see for example his “classical” 1994 composition GENDY3) suggested the extraction of parameter values from probabilistic distribution functions, thus somewhat shifting the problem to the choice of functions rather than numbers. Biotic composition allows to solve the dilemma mainly because it introduces the concept of *necessity* in the compositional process. What do we mean by that?

According to what discussed above, biotic material is produced by and associated to activities related to living organisms. Thus the starting, raw material used for compositional purposes comes from *necessary* life activities. This implies that the sequence of information quanta extracted by some technological means from a living activity will be self-consistent and logically coherent with no need for further decisions to be taken. In addition due to life processes complexity, such raw data will be intrinsically non-repetitive, non-linear, and highly structured, thus making it a very rich starting material. Its use can foster self-consistent and environment-integrated composition techniques, which involve a strong feedback between the sonic/visual landscape and the biotic system. It is worth noticing that composition strategies based on biotic material can rely on and are applicable to all sorts of living systems (animals, plants, bacteria, etc.). Finally, a very interesting aspect of biotic composition consists of its novelty, as the new territories of complexity can be studied.

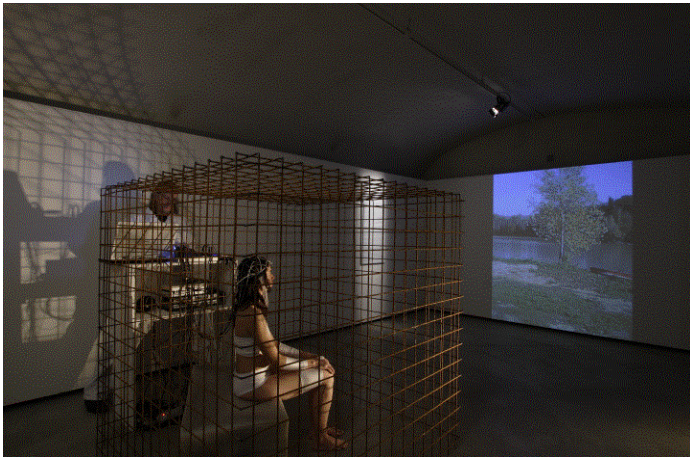
I will discuss in the followign a specific example, to elucidate how in practice such concepts are increasingly becoming part of a new stream of contemporary, multi-media, highly interactive tendency of art in the digital age, which uses the body as a biotic instrument.

*Nomadic Time*¹ is a biotic multimedia installation devised by Andrea Ferrara a.k.a. Ongakuaw. It has been premiered on Nov. 29, 2007 for the Opening of the Exhibition *Sistemi Emotivi* at the Centro di Cultura Contemporanea, Palazzo Strozzi, Firenze, Italy. The set-up of the installation is seen in Fig. 2: it is constituted by a cage in which a performer/cavy is confined, a sequence of video images projected on a wall of the space, a control deck, and an audio

¹ http://www.strozzina.org/sistemi_emotivi/e_af.htm

system. As we will see in more detail later, the performer is connected to an electro-encephalogram (EEG) machine that extracts the relevant biotic material, i.e. cerebral waves, produced as the performer/cavy is “forced” to watch the projected images and be affected by them.

The installation is periodically set into motion by the performer/cavy, who leaves a record of the event that spectators can experience the days following the action. A video sequence of 257 individual images of a tree on the bank of the River Arno, photographed by the artist during the year, is shown in the room.



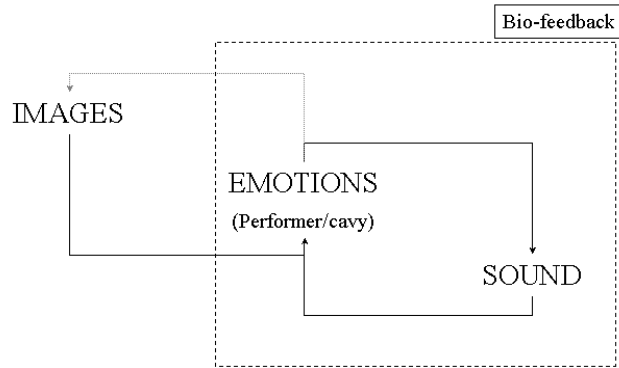
The number of images corresponds to the number of days on which the artist was present to photograph the tree. Each day of absence is symbolized by a single black image that appears for a fraction of a second on the screen. These images are of white signs on a black background, which are calligrams, which appear for a few tenths of a second and have only a subliminal impact on the spectator.

The images were designed and created specifically for *Nomadic Time* by the Greek artist Polytimi Patapi. Absence is evoked by the sporadic presence of a performer during the exhibition period. The time sequences in which no performance is taking place show an empty cage in which only the remaining objects witness human presence. The tree seems to remain unchanged during some sequences of the video, whereas in others the images document meteorological changes and dramatic events such as flooding or violent storms. The duration of the complete evolutionary cycle of the video was reduced from nine hours to two for practical reasons of usability.

As already mentioned the performer/cavy is connected to an EEG machine which records cerebral waves. The device is capable of monitoring four types of waves generated by the human brain: alpha waves (frequency 8-13 cycles a second), which come from the subconscious mind and are generated primarily in the upper parts of the brain, i.e. the region of the memory, upon which the subconscious is based; beta waves (15- 60 cycles a second), which are instead born in the conscious mind, and are related to all activities during the awake state when the person is concentrated on external stimuli; theta waves (4-17 cycles a second), which are normally located in the region of the temples, forming part of the centre of psychical power, and hence constitute waves of

psychical power together with delta waves; gamma waves (14 cycles a second), which are those of the deep psychical powers, like those of a medium in a trance. While the performer/cavy (closed in the cage like a laboratory animal is) connected to the machine watches the video, his or her emotional response in the form of waves emitted by the brain is recorded, codified and digitally sampled by computer. The coding is used as a control for an algorithmic compositional strategy of acoustic data. Software specifically designed by the artist translates the waves recorded into musical sounds and the sound thus generated represents a real-time mapping of the emotions felt by the performer.

As the biotic material is determining the production and evolution of the sonic material played over a multi-channel system in the performance space, a deep immersion feeling into the emotional experience is conveyed to the spectators. One of the noticeable features enabled by the use of biotic material in *Nomadic Time* is what I define *bio-feedback* (see Fig. 3). There are three basic constituents of the work: the tree + calligrams video/images, the emotions (generating the biotic cerebral material) and the sound. The images obviously are the driver and trigger of the biotic material. In turn this is used to control the sound production and its evolution. The sound is then diffused in space. However, this space is also the environment of the performer/cavy (in the same sense in which the crumb



represents the ant environment in the example above), which thereby gets modified. This modification induces yet another self-feeding stream of emotions in the performer/cavy, thus building up a bio-feedback loop. The emotions govern the sound, but the sound also feeds back onto emotions. The bio-feedback structure could in principle be made even more complex by activating the branch connecting the feedback of the emotions onto the visuals. Although technically feasible, this would imply the adoption of a generative compositional strategy also for the visual material, which of course would be part of a different esthetic choice.

To conclude, what discussed above and the specific implementation of *Nomadic Time* provide only a partial overview of the possibilities allowed by the use of biotic materials in the context of digital artworks creation. In particular, the human body and brain, together with those of other life forms, can be seen as a biotic instrument. Biotic materials, as we have seen, will help

overcoming the limits of composition trans-data isomorphisms, by providing a totally new way to think about algorithmic composition in visual, sonic (and perhaps many other) art fields. Hence through their use we can envisage novel compositional techniques for digitally-supported art forms. The final hope is that this approach will craft and enforce a new stream of contemporary, multi-media, highly interactive tendency of art in the digital age.