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FROM A BIOSIGNAL TO XENOTEXT: THE AFFECTIVE DIMENSION OF TEXTUALITY IN POSTDIGITAL ART PROJECTS¹

Abstract: With reference to the categories of affectivity and intentionality, the Author considers some of the various research perspectives that can be brought to bear upon the category of literariness in biotextual projects. She therefore introduces the concepts of “technotext” (Hayles), “physio-cybertext” and “biopoetry” (Kac), and “partly non-discursive affectivity” (Knudsen and Stage). The author primarily considers the role of non-human actors in constructing biotextual projects; this includes bacteria and other living cells that display the kinds of goal-oriented behavior (or intentionality) that bring about causal changes in biotextual works. Moreover, non-human actors are considered to be a physiological, affective force capable of altering the physical shape of such works. Introducing her own concept of “inside-body actors” (meaning the functioning of the body’s organs, hormones and other biochemical changes in the organism), the Author demonstrates how these “actors” are crucial to the medium. Her article presents three examples of (trans)literary works that were created in a corporal, affective and biological context: *The Breathing Wall* by Kate Pullinger (with Stefan Schemat and Chris Joseph); Diane Gromala’s *BioMorphic Typography* (part of a larger scientific and artistic initiative entitled “Design for the Senses”); and Christian Bök’s *Xenotext*. This last example is one of the most recent works to combine digital text with the biological functioning of microorganisms in a constantly evolving process.

Keywords: inside-body actors, intentionality, materiality, biotextuality, affectivity

In her well-known 2002 book *Writing Machines*, which included graphic designs by Anne Burdick, N. Katherine Hayles introduced the category of “technotext.”² When *Writing Machines* appeared, an awareness of the physical and material aspect of textuality was beginning to be more and more intensely developed by theorists and explored in artistic projects. The term “technotext” clearly indicates a technological process of text creation (by means of the eponymous “writing machines”) which,

¹ The article is the result of a research project (No. 2014/15/N/HS2/03926) that was founded by the National Science Centre, to run from 2015 to 2018.

² N.K. Hayles, *Writing Machines*, Cambridge–London: MIT Press, 2002.

according to Hayles, in the (post)digital era became an immanent part of the written language. Such “technotexts” not only generate representations of phonemes and create design; the process also determines the connection between literature understood as the art of words and its material forms.³ As Hayles puts it: “*Writing Machines* is also what technotexts do when they bring into view the machinery that gives their verbal constructions physical reality.”⁴ The essential idea underpinning the concept of the technotext is, therefore, the process of giving words physical reality.⁵

As Hayles herself rightly notes, the materiality of new literary forms does not only belong to analog media, nor is it synonymous only with the tactility of things (in this case, e.g. a printed book). Material concerns also arise from the manner in which digital media functions, and, in this regard, it is worthwhile to compare Hayles’s view with Lev Manovich’s opinions about the problematic materiality of new media, published only one year before, in 2001.⁶ In fact, even the most complex computing operations have their foundations in the real world and are based on the functioning of physical machines and objects.⁷ Moreover, as Hayles emphasizes in a series of considerations that also deal with the question of the media specificity of given literary messages, in order to exist, text must be embodied. Technotext has a body, or numerous bodies, shaped by means of mutual influences between its material properties, its semantic content, and the relationship of both with the recipient, who gives meaning to them.⁸

Hayles therefore understands this body not only in terms of a relationship between text and a biologically defined body, but also—as she herself writes—in terms of a relationship with two further elements: firstly, the “mindbody” of the recipient,⁹ and secondly, the environment that provides the basis for the text’s material endowment. Hayles characterizes this environment in a special way, consolidating her concept of the materiality of digital text: “Computers are much more than hardware and software. In their general form, computers are simulation machines producing *environments*, from objects that sit on desktops to networks spanning the globe.”¹⁰ The concept of embodiment, to which the theorist refers, is not synonymous with the radical, extremely antirepresentationalist enactivism, but refers to the so-called second-generation cognitivism, in which importance is attached to the bodily aspect of cognition, with reference to the relationship with the environment.¹¹ As Hayles

³ Ibidem, p. 25.

⁴ Ibidem, p. 26.

⁵ Ibidem.

⁶ L. Manovich, *The Language of New Media*, Cambridge–London: MIT Press, 2002.

⁷ Ibidem, ex. pp. 6, 22.

⁸ Ibidem, pp. 31–33.

⁹ Ibidem, pp. 48–49.

¹⁰ Ibidem, p. 49.

¹¹ On this topic, see also: D. Hutto, E. Myin, *Radicalizing Enactivism: Basic Minds without Content*, Cambridge: MIT Press, 2013; M. Caracciolo, *The Experientiality of Narrative: An Enactivist Approach*, Berlin–Boston: Walter de Gruyter GmbH, 2014.

suggests, the bodily aspect of intertextuality develops in two ways: in the relationship with the mind and body of the recipient, and in one with its physical, technological, material form.

In his essay-manifesto *Biopoetry*, published a few years later in 2007,¹² Eduardo Kac called attention to another aspect of textual matter and the process of text creation; namely, he pointed to the biological, affective dimension of written language. His approach, which was closely bound up with skills and abilities possessed only by human beings, encroached on the borders of an anthropocentric perspective. Such “biologicality” is, however, no longer understood by Kac as a component that functions by means of the interaction with the recipient; rather, it is now understood as the very medium of the text (let us add here: a medium strictly defined as organic matter). When asked by Monika Górską-Olesińska if biopoetry was a return to what is material, Kac put the matter as follows:

Biopoetry uses a new type of material—biomaterial. It is a *novum*, a perspective previously unknown. In the biological material, life pulsates, and along with it, processes unlike those we know from the world of inanimate matter occur. Life is governed by its own logic, which means that we can control it if we want to, but always only to a certain degree, and we must accept it.¹³

Referring specifically to biomaterial, the Brazilian artist has identified twenty ways in which peculiar poetic “genres” are implemented in a manner that, importantly, arises from “the use of biotechnology and living organisms in poetry as a new realm of verbal, paraverbal, and non-verbal creation.”¹⁴ In this way, Kac emphasizes the fact that biopoetry is not only based on the verbal dominant. Instead, it combines verbal and paraverbal components, as well as components that go beyond the verbal sphere. At the same time, it shifts the boundaries of what we traditionally understand as “literariness.”

The concepts developed by Hayles and Kac, albeit written from different perspectives, are similarly concerned with the *creation* of texts and the media materiality of the process. In the work of both theorists I do, however, find few considerations that are crucial to my own approach. For both Hayles and Kac, the distinctive characteristic of text is its *processuality*, something which contradicts the traditional identification of text or literature as passive artifact. In both “technotext” and “biopoetry,” text functions as a process, regardless of whether it is embedded in organic media matter (or, in other words, in so-called wetware¹⁵) or in non-organic media matter. There is

¹² E. Kac, “Biopoetry”, in: E. Kac (ed.), *Media Poetry: An International Anthology*, Chicago: Intellect Books, University of Chicago Press, 2007, pp. 191-196.

¹³ M. Górską-Olesińska, “Rozmowa z Eduardo Kacem – rozmawia Monika Górską-Olesińska” [“Interview with Eduardo Kac conducted by Monika Górską-Olesińska”], *Przegląd Kulturoznawczy* 2011, no. 1(9), pp. 173-174 [translation mine].

¹⁴ E. Kac, “Biopoetry”, op. cit., p. 191.

¹⁵ R. Ascott, *Reframing Consciousness: Art, Mind and Technology*, Exeter–Portland: Intellect Books, 2001, p. 188.

a performative aspect to this approach, in which performativity does not arise exclusively from the reader's reception, understood as a cognitive process.¹⁶ Instead, performativity exists above all in the mediality and materiality of text. This is related to the problem of self-agency that both Hayles and Kac gesture towards by focusing on the actions of non-human actors. Written text, for centuries perceived only as the result of human work, is in both approaches depicted as a process generated by objects (e.g. computers), procedures (e.g. algorithms), or the not-entirely-conscious, automatic or autonomous reactions of (an) organism(s).

Another important question is the reference that both theorists make to the theory of affectivity, something which problematizes the issue of representation and which I explore further in this paper. There are a number of projects in which textual narratives include an affective component. In his work *La Cura*, Salvatore Iaconesi "illustrates" a verbal narrative about his illness using MRI and CAT scans—visual forms created from the biometric information that is generated when an organism is subject to biomedical procedures.¹⁷ Similarly, in her *Inside Terrorism*, Diane Covert created a series of collages in which she combined actual scans of injuries suffered by victims of terrorist attacks with sentences commenting on the situation of a given person at the moment of the tragedy (e.g. someone was riding a bus or eating pizza with friends).¹⁸ In both cases, digital text is closely related to the effects of neuroimaging, the visualization of biological processes taking place inside the body. However, this relationship was established intentionally by the author, not automatically and simultaneously.

My article focuses on works that test the limits of textuality and literariness, radicalizing the relationship between the written word and affectively understood corporeality. These are *Breathing Wall* by Kate Pullinger, Stefan Schemat and Chris Joseph; *BioMorphic Typography* by Diane Gromala; and *Xenotext* by Christian Bök. As in Kac's experiments, these projects translate one semiotic system into another. But this is not all they do. In these projects, a literary work is created, transformed, or narrativized as a result of an immediate, direct (although technologically mediated) response to biosignals from human and non-human creatures. Biosignals—biochemical processes and changes occurring in living organisms that can be measured and monitored—function here as both the reason for the existence of a textual message and the underlying stimulus that initiates its generation. In these works, biosignals— affective reactions—function very differently than is the case with traditional literary projects, where this might be seen as part of the organism's response to, or experience

¹⁶ It is therefore different to the notions that dominate literary theory, e.g. Derek Attridge's concept of the "singularity of literature" or Magdalena Rembowska-Pluciennik's concept of the reader's emotional involvement in the reading process. See: D. Attridge, *The Singularity of Literature*, London–New York: Routledge, 2004; M. Rembowska-Pluciennik, "Wizualne efekty i afekty: Obrazowanie mentalne a emocjonalne zaangażowanie czytelnika", *Teksty Drugie* 2009, no. 6.

¹⁷ Project website: <http://opensourcecureforcancer.com> [accessed 2016-07-29].

¹⁸ Project website: <http://www.x-rayproject.org> [accessed 2016-07-29].

of, the work. For these artists, the final piece itself emerges as an actual kind of bio-text, a processual combination of digital and biological matter that fully executes the assumptions of postdigital art.¹⁹

Words emerging from biosignals: Around affective narratives

As it is used in my own reflections, the meaning of the category of affect refers to the typology proposed by Britta Timm Knudsen and Carsten Stage,²⁰ a result of the scholars' confrontation with the two trends that have dominated the manner in which affect has been described. The first of these, developed by Patrick C. Hogan among others, has its origin in the field of narratology. This model relies on equating biological processes with emotions, meaning that affective experiences are not precognitive; they are, conversely, closely related to feelings that are subject to rationalization—otherwise, emotions. For Hogan, it is extremely difficult to establish a boundary between biological processes and emotions, as the former usually provides the basis for the latter, with the two functioning in close connection. On the other hand, emotions are not separated from the discursive sphere, although they of course go beyond language.²¹

The second trend is advocated by theorists such as Brian Massumi, Nigel Thrift, Teresa Brennan, and Patricia Ticineto Clough. This alternate trend is generally based on the assumption that affectivity denotes a sphere of corporeality that is, in essence, not subject to rationalization and conscious control. Therefore, it remains autonomous in relation to the sphere of reflections, and is based on dynamic biological changes and energy flows. Thus, it is expressed mainly through movement, especially inside the body, consisting of a variety of biochemical processes.²²

Knudsen and Stage's typology proposes a more nuanced version of the various forms of affect, negotiating the meaning of these forms in relation to the category of discourse. The authors present three types of affect: pre-discursive, partly discursive, and partly non-discursive.²³ In their opinion, while affectivity can be excluded from

¹⁹ As defined by Melvin L. Alexenberg, I understand postdigital art to refer to artistic projects that are created as a result of the interaction between the digital, biological, cultural, and social, between virtuality and reality, between embodied media and augmented space, between sensual experiences, community narratives, and network practices. See: M.L. Alexenberg, *The Future of Art in a Postdigital Age: From Hellenistic to Hebraic Consciousness*, Bristol: Intellect Books, 2011, pp. 33-96.

²⁰ Presented in: B.T. Knudsen, C. Stage, *Global Media, Biopolitics, and Affect: Politicizing Bodily Vulnerability*, New York: Routledge, 2015, pp. 14-15.

²¹ See: P.C. Hogan, *Affective Narratology: The Emotional Structure of Stories*, Lincoln: University of Nebraska Press, 2011, pp. 1-16.

²² For examples see: B. Massumi, *Parables for the Virtual: Movement, Affect, Sensation*, Durham: Duke University Press, 2002; P.T. Clough, J. Halley (eds.), *The Affective Turn: Theorizing the Social*, Durham: Duke University Press, 2007.

²³ B.T. Knudsen, C. Stage, *Global Media, Biopolitics, and Affect...*, op. cit., pp. 14-19.

discourse, it is never absolutely precognitive. It means that it would be extremely difficult to separate it completely from a conscious cognitive process.

For the purposes of my own reflections, the most important category in the Knudsen–Stage typology is the third: “partly non-discursive affectivity.” Based on Maurice Merleau-Ponty’s concept of chiasm, this category is, moreover, referenced by one of the abovementioned artists, Diane Gromala.²⁴ The “partial non-discursivity” of affect assumes the existence of physiological experiences that are originally purely biological and non-representational but that do, with time, take on a rational, discursive dimension. The non-discursivity of certain bodily experiences is strongly emphasized here; in Merleau-Ponty’s work this is achieved via analogy with experiences from the inside of the body.²⁵ Importantly, this is a concept of affectivity that does not sever the relationship between the bodily sphere and cognitive processes based on representation. Equally, it simultaneously indicates the problematic, complex nature of this relationship. Such a model of affectivity will be helpful for an analysis of *The Breathing Wall* and *BioMorphic Typography*, because it allows to problematize the issue of the processual connection between digital textuality and affective reactions taking place in the recipient’s body, and of *Xenotext*, where affectivity is expressed via the biological involvement of microorganisms.

The Breathing Wall was created in association with Stefan Schemat and Chris Joseph, who were responsible for the multimedia aspects of the project: advanced animations, graphics, videos made with the use of Flash software.²⁶ Kate Pullinger is a professor at Bath Spa University in Great Britain and an author of novels published in the form of traditional, printed books, as well as of various forms of digital fiction, where she goes beyond classic hypertextual novels. Premiering in 2017, her latest work is the “smartphone novel” entitled “Jellybone.”²⁷ Pullinger mainly writes crime novels, and her 2004 project *The Breathing Wall* is also a peculiar kind of crime fiction. By navigating particular sections of the novel, the “reader” or “listener”—or more accurately, the “recipient”—learns of the murder of a young girl named Lana. Her boyfriend Michael is accused of the crime and incarcerated. Exploiting the kind of hauntological motif that is very popular in contemporary game-like projects, and which here controls the development of the story, with the help of Lana’s ghost he tries to discover who really committed the crime. The whole is divided into so-called day-dreams and night-dreams, as experienced by Michael.

²⁴ D. Gromala, *Towards a Phenomenological Theory of the Visceral in the Interactive Arts*, 2007, available online at: https://www.google.pl/url?sa=t&rcct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiZPDLzezOAhVJD5oKHYu4Ap0QFggsMAE&url=https%3A%2F%2Fpearl.plymouth.ac.uk%2Fbitstream%2Fhandle%2F10026.1%2F2319%2FDIANE%2520J%2520GRO-MALA.PDF%3Fsequence%3D1&usq=AFQjCNGeZEaJ7MpKzEbqs_ko_gsdCmFcw&bvm=bv.131286987,d.bGs [accessed 2016-07-25].

²⁵ B.T. Knudsen, C. Stage, *Global Media, Biopolitics, and Affect...*, op. cit., pp. 19-20.

²⁶ Project website: <http://www.thebreathingwall.com>.

²⁷ Author’s website: <http://www.katepullinger.com>.

Thanks to experimental programming (referred to as a Hyper Trans Fiction Matrix), the hypertextually-planned story was immediately connected with a system for monitoring and measuring the recipient's (reader's, listener's) respiration rate: each recipient should have worn a headset that included a microphone. As Astrid Ensslin rightly notes, the recipient is an interactor who comes to resemble a computer gamer.²⁸ The system is designed so that the recipient's navigation of the story takes place in response to variations in the pace and depth of their breathing.²⁹ Shallow breathing may prevent the recipient from moving on to the next part, whereas quick, deep breaths may take him or her a few steps further into the story. In sum, *The Breathing Wall* combines a mechanism for measuring breathing (i.e. the body's affective reactions), a text that is immersed in the digital space, and a story that demands interactivity: the decision about how the story will progress depends upon choices made by the recipient. The result is a dynamic, circular mechanism, a playable artifact.³⁰

Ensslin calls the Pullinger, Schemat, and Joseph's experiment a "physio-cyber-text," something that is analogous to a "text-driven digital «performance»" where it is the digital text that powers the story.³¹ With "classic" or traditional examples of hypertext—or, indeed, computer games and e-literary works in a broader sense—interaction with the work could be described as carnal: the recipient uses the keyboard, a mouse, or a touchpad in order to touch the screen faster or more slowly, more often or less often. The things that he or she observes are answers to a given motion or gesture. In the case of *The Breathing Wall*, the situation is particularly interesting because the work does not only rely on an embodied interaction; the recipient's journey through the story is also based on an affective foundation. Breathing is a biological process that, while partially conscious, may be controlled and rationalized only to a certain extent; a living organism cannot hold its breath for more than a few minutes. This affective reaction—the circular movement of air around the body—determines the pace, length, and effectiveness of the project, functioning as a biological means of linking and connecting individual parts of the story. For this reason, the term "physio-cybertext" proposed by Ensslin seems relevant, although the author herself rightly

²⁸ However, the recipient of this kind of digital fiction is not synonymous with the player, as the player must have a representation of his or her subjectivity in the game (usually an avatar). The reception of digital plots does not require such representations. See: A. Ensslin, "From W(reader) to Breather: Cybertextual De-intentionalization and Kate Pullinger's *Breathing Wall*", in: R. Page, B. Thomas (eds.), *New Narratives: Stories and Storytelling in the Digital Age*, Lincoln–London: University of Nebraska Press, 2011, p. 142.

²⁹ *Ibidem*, p. 144.

³⁰ As defined by O.T. Leino, "[p]layable artifacts can be distinguished from games by the inseparability of process and materiality, and, can be identified as a subset of all technological artifacts based on their ability to evaluate the user's choices and open up or delimit freedom of choice accordingly, in other words by their ability to impose the gameplay condition on their users"; see: O.T. Leino, "Death Loop as a Feature", *Games Studies* 2012, vol. 12, no. 2, available online at: http://gamestudies.org/1202/articles/death_loop_as_a_feature Accessed [accessed 2016-09-24].

³¹ A. Ensslin, "From W(reader) to Breather...", *op. cit.*, p. 138.

complements Ensslin's descriptor by proffering the category of the "cybersomatic."³² This latter term reflects the combination of the two environments in which the project functions: somatic and digital. "The Breathing Wall" therefore giving rise to a new kind of transliterary project, which can be called "cybersomatic fiction," a "cybersomatic playable artifact," or a "physiologically augmented text" (this last term should, of course, be read in relation to the category of augmented reality).

Embodiment, a topic that Hayles considered in relation to this kind of work, thus takes on an interesting dimension here. As Ensslin states:

[U]ser-readers are "embodied" as direct receivers whose bodies interact with the hardware and software of a computer. [...] That said, every narrative assumes an implied reader, and it is a major achievement of cyberfiction that this implied reader or "breather", as in our example, shares his or her phenomenological physicality with the narrator and/or hero of the story.³³

In this case, embodiment does not only concern the material environment of the text and the embodied perception of the recipient in the cognitive process. In *The Breathing Wall*, the material-technological mechanism is closely related to the "additional" medium—the biological body. This combination exists at the level of software and hardware, including the special apparatus needed to monitor breathing. It is also observable at the level of narrative (i.e. the development of the work) and remains clear at the level of the plot. In this respect, the most representative moment is when Lana's ghost completely abandons the world, described by Ensslin as the moment when "the reader reaches a maximum level of psychosomatic «union» with the text machine and the character within it."³⁴ This occurs when the recipient takes a deeper breath and exhales intensely: Lana transforms into steam and rises as a ball of air, leaving her boyfriend behind. An evocative moment in the story is therefore precisely connected with the affective activity of the user. This moment not only represents the recipient's emotional identification with the observed character; this is also a special moment in which the physiological materiality of the recipient (in the form of exhaled air) and a graphic representation of this act (with an additional semantic quality) combine. The technological environment is thus a material foundation not only of digital text as in Hayles's analysis, but also as McLuhan's classic notion of a prosthetic, medial extension of the body. The difference consists in the fact that this extension has the nature of feedback: the biological body is an additional material basis for the text and for the whole multimedia content of the project. This corporeality is not only cognitive in nature, as Hayles says, but is also manifested on the affective level.

More clearly than in any other project I discuss, in *The Breathing Wall* the problematic status of affectivity is emphasized. This is a result of the close combination of an organism's purely biological functions with those that are instantly transformed

³² Ibidem, p. 149.

³³ Ibidem, p. 142.

³⁴ Ibidem, p. 147.

into emotional reactions. As Knudsen and Stage note, when it comes to the behavior of conscious beings, it is difficult to think about absolute biological affectivity; however, there are instances in which the rational dimension—conscious actions—can be dramatically minimized.³⁵ In *The Breathing Wall*, the recipient's multisensory cognitive involvement—especially as this relates to emotions like anger, frustration or boredom—is translated into different biological reactions, for example, rapid, jagged, or deeper breathing as an unconscious response to the narrative. Conversely, breathing might be intentionally controlled (for example, by a deliberate acceleration of respiration that does not have a natural cause) in order to move to another level of the story, provoking analogous responses in terms of the feelings experienced. Because of this interdependency, it is difficult to draw a line between these types of reactions. The mechanism underpinning Pullinger's project is particularly interesting for another reason: *The Breathing Wall* is a crime story, and it preserves the main features of this genre. Here, suspense, the basic element of crime fiction, takes on another dimension—a physiological dimension in which the narrative of the crime develops very literally. The reader-breather's emotional involvement is not external to the project. Rather, this is the work's immanent feature, determining the dynamics of a processual story.

For these reasons, one could venture to say that, in the case of this project, we are dealing with a special type of affective interface—more specifically, a breathing interface. If the interface is defined in the most general way as a connection between man (the user) and machine, in Pullinger's project, this connection manifests itself by the creation of a direct link between the mechanics of execution and the affective area of corporeality. Concerning the nature of the interface, Alexander R. Galloway famously noted that “the interface becomes the point of transition between different mediatic layers within any nested system. The interface is an ‘agitation’ or generative friction between different formats.”³⁶ In *The Breathing Wall*, the interface above all comprises the structural dimension of the project, organizing its dynamics. However, Pullinger also managed to create the impression that the viewer's breath permeates the very structure of the work. In this sense, the recipient together with the software and the technical devices used constitutes an inseparable whole.

This interpretation leads us back to the title of the work itself: *The Breathing Wall* is a breathing framework within which the software and devices are placed. Its operability and functionality arises from the deployment of appropriate sensors and software, but the whole mechanism is determined by the biological component. As Galloway notes, “[t]he notion of the interface becomes very important for example in the science of cybernetics, for it is the place where flesh meets metal or, in the case of systems theory, the interface is the place where information moves from one entity

³⁵ B.T. Knudsen, C. Stage, *Global Media, Biopolitics, and Affect...*, op. cit., pp. 15-16.

³⁶ A.R. Galloway, *The Interface Effect*, Cambridge: Polity Press, 2012, p. 31.

to another, from one node to another within the system.”³⁷ The biological elements of the project do not have their direct representations; therefore, they are the affective element of the interactive, processual connection between the body and the machine.

A professor at the School of Interactive Arts and Technology (SIAT) at Simon Fraser University in British Columbia, Canada and the founding director of the Transforming Pain Research Group,³⁸ Diane Gromala is the creator of *BioMorphic Typography*. The project is part of a larger scientific and artistic initiative entitled *Design for the Senses*, which is an attempt at developing experimental types of design focused on the senses, on the biological dimension of corporeality.³⁹ In her interdisciplinary research, Gromala combines her interests in design, media art, computer technologies, and the problematic relationship between technology, the body, and health. *BioMorphic Typography* was first presented in 2000 at the SIGGRAPH conference and in 2002 at the TechnoPoetry festival in Atlanta, as well as at the Georgia Institute of Technology.⁴⁰ According to Gromala, the title of the project also functions as separate theoretical category: “biomorphic typography” refers to fonts that continuously, in real time, react to changes in the user’s physical condition. The artist designed them on the basis of the Adobe Garamond font family, a set of typefaces originally designed by the French painter Claude Garamond in the 16th century.⁴¹ Physiological processes are constantly monitored and measured with the use of appropriate biomedical equipment. In the case of Gromala’s project, the biofeedback equipment allows a person to receive feedback about the state of his or her body.⁴²

BioMorphic Typography uses this method, including neurofeedback, which was rejected in subsequent versions of the project⁴³, linking the monitoring of biochemical processes occurring in the recipient’s (user’s) body with the movement of reactive fonts, whose visual transformations can be watched on the screen. Letters arranged to form different words, visualized in different fonts, change (their size, width, shape, sharpness) and move in response to the rate and depth of the user’s breathing, his or her galvanic and skin reactions (e.g. perspiration), his or her heartbeat, brain activity (brainwave monitoring), or muscular tension.⁴⁴ As Gromala notes: “*BioMorphic Typography* is distinguished from other technological experiments with typography because it is the first form of typography driven by the physiological states of its

³⁷ Ibidem.

³⁸ See: <http://gromala.iat.sfu.ca/New/index.html> [accessed 2016-07-30].

³⁹ See the information on the project’s website: <http://gromala.iat.sfu.ca/New/biomorphic.html> [accessed 2016-07-29].

⁴⁰ See <http://gromala.iat.sfu.ca/artdesign.html> [accessed 2016-07-30].

⁴¹ D. Gromala, *Towards a Phenomenological Theory...*, op. cit., p. 110.

⁴² See: <http://gromala.iat.sfu.ca/New/index.html>.

⁴³ D. Gromala, *Towards a Phenomenological Theory...*, op. cit., p. 115.

⁴⁴ See: N. Blake, *Research in the Technological Social, and Cultural Practices of Online Reading*, available online at: <http://transliterations.english.ucsb.edu/post/research-project/research-clearing-house-individual/research-reports/biomorphic-type™-2> [accessed 2016-08-02].

users.”⁴⁵ Particular functions are measured by special equipment, whose basis is the biofeedback device Procomp+ (a chest band collects information about the rate of respiration; special Velcro sensors are placed on the recipient’s fingers in order to collect information about his or her perspiration and pulse). The pieces of information collected are biosignals given out by the organism; these are the affective reactions of the user who is working with the keyboard and connected to the device. In order to read the biometric data collected by the Procomp+ and transform this data into the typographic series, a special program was developed, bioFontMorph.exe.⁴⁶ The visual transformations of letters (which occurs in a symbolic but recognizable way) does then simulate the vital functions that are being measured: letters expand when the user breathes in, and move or bend to illustrate the flow of brain waves. Within a few seconds, the letters fill the whole screen, reflecting actual biochemical processes occurring inside the user’s body.⁴⁷ The sequences generated are digital, graphic representations designed by the artist. They imitate the basic patterns that govern movement, on which affects are based: circulation, pulsation, expansion, vertical and horizontal movements. As the artist herself says, the extent to which users could actually recognize physiological changes in their own bodies by looking at the display is questionable. Interestingly enough, however, after observing the connection between their body and the typographic animations for a while, users *were* able to partially manipulate the process (especially their breathing). Users tended to get lost, all the same, when the typographical animation presented more than two different pieces of biometric information at the same time (e.g. breathing and pulse).⁴⁸

When compared with Pullinger’s project, Gromala expanded the scope of possibilities by taking into consideration many different sensory experiences. There are numerous analogies between the two pieces, the most important being the manner in which biological functions are fed back via multimedia representations and visualized in digital form. There are also clear points of divergence. Pullinger based her biomorphic project on the affective process, which may be controlled and conscious to some extent. By contrast, Gromala included in her experiment bodily processes that are usually unconscious and that as a result we cannot freely control. Her project is mostly concerned with monitoring cycles of bioelectrical activity in the brain (brain waves), which, without more advanced knowledge about the functioning of the brain, remains unavailable to the user (such knowledge might include, for example, the fact that even when we consciously go into a trance state mainly theta waves are activated; during deep sleep it is mainly delta waves).⁴⁹ The same applies to skin reac-

⁴⁵ D. Gromala, *Towards a Phenomenological Theory...*, op. cit., p. 107.

⁴⁶ *Ibidem*, p. 108.

⁴⁷ See: *ibidem*.

⁴⁸ *Ibidem*, pp. 108-109.

⁴⁹ See: T. Egner, J.H. Gruzelier, “EEG Biofeedback of Low Beta Band Components: Frequency-specific Effects on Variables of Attention and Event-related Brain Potentials”, *Clinical Neurophysiology* 2004, no. 115(1), pp. 131-139; M.E. Sabourin, S.D. Cutcomb, H.J. Crawford, K. Pribram, “EEG Correlates

tions, which can be manipulated to a certain degree, but only when we have advanced knowledge of physiology (e.g. we consciously panic or become stressed out, which changes the biochemistry of our skin). In *BioMorphic Typography*, the intentionality that significantly “programmed” affective reactions in Pullinger’s project becomes radically weakened. By manipulating his or her breathing or influencing his or her heartbeat, the user might be able to obtain the desired visualization on the screen, but a number of reactions (reflecting unconscious biosignals) appear independently of his or her will.⁵⁰ The mechanism is therefore largely in line with the basic diagnostic assumptions underpinning the biofeedback method. The initial aim is to monitor vital functions, only later is there an attempt to introduce therapeutic changes (e.g. breathing more deeply).

Out of her intense exploration of the biological realm of living creatures, Gromala developed her concept of the visceral sense. The artist developed this theory in her doctoral dissertation, entitled *Towards a Phenomenological Theory of the Visceral in the Interactive Arts*.⁵¹ She focuses on the participation of the biological or—more precisely—visceral component in interactive projects (that is the participation of the internal organs of the abdomen and chest areas). The visceral sense entails shaping an awareness of the processes occurring in one’s own viscera, and this is a question that Gromala reflects on and examines in her numerous artistic projects. Monika Górską-Olesińska has written about the concept of the visceral sense in the context of Gromala’s works.⁵² Describing this concept, Górską-Olesińska pays attention to Gromala’s personal experiences, particularly her observation of a surgical procedure conducted on her own body under anesthesia. This caused her to question the famous Cartesian division between psyche and soma, and consequently provoked a recourse to the Merleau-Ponty’s theory of chiasmic reversibility between the world and the flesh.⁵³ In fact, the somatic performances that Gromala noticed in her abdomen (albeit invisible to her and impossible to feel consciously) made the artist perceive her viscera as the source of myriad sensations directly affecting her emotions.⁵⁴ Therefore, fonts were designed which directly opposed the traditional, European perception of writing as a tool for mediating reality. These fonts were instead inseparably connected with the artist and inseparably related to images.⁵⁵

of Hypnotic Susceptibility and Hypnotic Trance: Spectral Analysis and Coherence”, *International Journal of Psychophysiology* 1990, no. 10(2), pp. 125-142.

⁵⁰ D. Gromala, *Towards a Phenomenological Theory...*, op. cit., pp. 114-115.

⁵¹ See: *ibidem*.

⁵² M. Górską-Olesińska, “Bioobrazy w funkcji terapeutycznej w projektach Diane Gromali i Georga Khuta”, in: R.W. Kluszczyński, D. Rode (eds.), *Trajektorie obrazów. Strategie wizualne w sztuce współczesnej*, Łódź: Wydawnictwo Uniwersytetu Łódzkiego, 2015, pp. 106-107.

⁵³ *Ibidem*, p. 107.

⁵⁴ Compare: *ibidem*, p. 106.

⁵⁵ See: D. Gromala, *Towards a Phenomenological Theory...*, op. cit., pp. 119-120.

The visualizations used in the project are not taken from diagnostic imaging procedures, nor are they a mimetic reflection of the somatic dimension of the body, such as projects using MRI or CAT scans. Therefore, to a certain degree, they function as representations.⁵⁶ In many respects, however, the images are all the more interesting because of this fact; they are connected with the affective sphere by means of a processual, generative relationship. They are continually developing, not only as visualizations of affective processes, but as factors that co-create these same processes. Transforming in sync with the changes that are occurring within the body, they are at once ephemeral (they are not permanently inscribed or archived—they disappear from the screen) and possibly a tool for control and manipulation. To give the desired shape to the typography, the user controls, for example, his or her breathing until the visualization changes. As Gromala summarizes her project: “This is a slightly different form of perception, because what is usually in the background of our sensibility are the autonomic senses that the biofeedback device allows to be brought into conscious awareness. They are, ironically, our pre-linguistic, primordial, ‘brute’ or ‘wild’ sense.”⁵⁷

With reference to both of the projects discussed thus far, I would now like to introduce the concept of “inside-body actors.” This is linked to the term “non-human actors,” which has been developed by a number of post-humanist philosophers, for example, Rosie Braidotti and Carry Wolfe. This in turn was inspired by actor-network theory (ANT), a theory that is discussed in more detail below. Expanding and developing Gromala’s concept of the “visceral sense” with reference to the affective theory of corporeality, I understand “inside-body actors” to be biological factors or objects that control or direct bodily process, thus participating as “actors” in a project that is based on an affective component. Examples could therefore be the respiratory or endocrine system (and, of course, every single hormone affecting the functioning of the body), the circulatory system, and the functioning of individual organs (in the works just discussed, this would be the lungs or the heart). Just as technological or environmental factors influence political, social, and cultural processes,⁵⁸ “body actors,” via a special kind of agency, affect the functions of the body, its work as well as its affective and emotional reactions. Functioning in the special space inside of the body, in these projects such actors remain in close contact with the digital environment. These actors are, of course, closely related to one another, forming a complex, multidimensional system of influences. As elements of the body, they are part of physiological processes rather than isolated objects; their form is dynamic and

⁵⁶ As is the case in works by Benedetta Bonichi, Angela Palmer, and Diane Covert.

⁵⁷ D. Gromala, *Towards a Phenomenological Theory...*, op. cit., p. 129.

⁵⁸ See: J. Parikka, *A Geology of Media*, Minneapolis–London: University of Minnesota Press, 2015, p. 20: “This humanities approach is now also recognizing the importance of biological and geological contributions as part of the social collective. This includes the realization that humans are also biological and geological agents but also that, to understand the wider patterns of the social, we need to resist the old-fashioned methodological dualisms haunting disciplinary thinking of the past.”

variable. The hormonal system determines the functioning of the majority of organs, and the circulatory system provides a basis for the functioning of tissues and organs; therefore, inside-body actors exist in the form of (actual, not metaphorical) energy flows, transformations (e.g. spontaneous tissue death and regeneration), and multi-dimensional relationships. Regardless of the technology employed, it is extremely difficult to “program” the affective realm of corporeality. It can be influenced and manipulated to a certain extent, but one can never absolutely predict the reaction of the body, or even that of a single organ. The aforementioned actors are driven by their internal dynamics and volatility, revealing their agency both within the body and within the realm of artistic experimentation. In artistic projects, inside-body actors introduce continuous potentiality, volatility, and uncertainty. They also introduce an important processual dimension because, as Massumi notes, the body is constantly on the move.⁵⁹ Movement in this sense does not only refer to the mobility of muscles, but also to the constant metabolic transformations of cells and tissues.

The actions of inside-body actors may be understood as a specific type of intentionality, as goal-oriented behavior (I will elaborate on this idea below). Here, goal-orientation refers to the fulfilment of biological operations that ensure the proper functioning of the body, including protection from threats (pain or fear) and preparation for necessary extra activity. Defined in this way, physiological objectives (which will take place regardless of the artist’s intentions) translate into changes within the whole project, turning inside-body actors into co-authors. Inside-body actors therefore possess a specific type of agency, which arises from the natural metabolic functioning of animate matter (energy flow, cellular and tissue transformations). This process can be just as human as it is non-human, going beyond conscious cognition. This is why I initially define it as “affective agency” that goes beyond representation as well as the anthropocentric perspective. It can be found, in another way, also basing on the principle of the influence of specific intentionality on transliterary projects, in the projects analyzed in the next section as well.

Text generated in DNA: Looking for communication with micro-organisms or for non-human agency?

In his concept of biopoetry, Eduardo Kac notes a few important issues that influence the creation and existence of bioliterariness. At the same time, these also verify the meaning of certain crucial issues defining verbal narratives, such as time and intentionality. Kac does realize the existence of these concepts, describing what metabolic metaphors are:

They are works emerging as a result of exercising partial control over the metabolic processes of microorganisms—these can be prokaryotic organisms, such as bacteria or archaea—whose

⁵⁹ B. Massumi, *Parables for the Virtual...*, op. cit., pp. 4-5.

appropriately large population is placed within a selected medium (this medium might be a thin layer of water or earth, or some other biological material). The reaction of these microorganisms to specific environmental conditions—for instance, solar exposure, changing humidity, etc.—makes ephemeral words appear on the surface of this medium. As a result of the natural development of microorganisms, after a while these words are scattered, and the shapes of individual letters are transformed and gradually effaced. The idea of metabolic metaphors consists in an attempt at controlling the processes of this appearance and disappearance in time (regulating their pace and duration).⁶⁰

This kind of work deals with organic matter, microorganisms that are very important for the ecosystem but which are, at the same time, invisible non-human actors. Kac's words reveal that such work only assumes the author's agency to a certain extent: the "emerging" text is determined not only by the rational concept of the whole, but—above all—by automatic metabolic processes occurring within microorganisms. One may influence them, but the manipulation can never be complete. The narrativity of the project depends on the course of the natural development of non-human actors; intentional changes occur at specific times, which leads to the particular events that make up the entire process,⁶¹ but these changes are, naturally, dependent on non-human actors. Moreover, to a certain extent, both elements (narrativity and the natural development of non-human actors) can be viewed as identical: the dynamics of the project arise directly from the behavior of goal-oriented living organisms, the aforementioned goal-oriented behavior.⁶² The goal might be, for instance, to achieve the next level of metabolic development, e.g. that of bacteria. In this case, it is difficult to speak of traditionally defined intentionality, which assumes the existence of conscious and rational concepts. Nevertheless, we undoubtedly find here a negotiation of the meaning of agency in the process of creation.

Another vital aspect of Kac's conceit is the notion of time; the temporality of exposure is determined by the minutes, hours, and days that are necessary for a given biological process to take place. As the artist puts it:

Moreover, every life has a unique rhythm called its "biological time". The inevitability and strength of its impact is realized when we look in the mirror and compare what we see with our own photography from 10 years earlier. Biopoetry inevitably works with biological time; therefore, when, as a creator-writer, you try to introduce certain patterns and rhythms to the

⁶⁰ M. Górską-Olesińska, "Rozmowa z Eduardo Kacem...", op. cit., p. 174 [translation mine].

⁶¹ Here, I refer to the general definition of narration that is proposed in the following book, which was edited by Todd Wilkens: *The Role of Narrative in Understanding Digital Video: An Exploratory Analysis*, available online at: https://open-video.org/papers/Wilkens_Assist_2003.pdf [accessed 2016-07-29].

⁶² A commentary on this type of behavior among mobile animal groups appears here: C.C. Ioannou, M. Singh, I.D. Couzin, "Potential Leaders Trade Off Goal-oriented and Socially Behavior in Mobile Animal Groups", *The American Naturalist* 2015, no. 186(2), pp. 284-293.

substratum being the basis of the emerging signs of the language, your actions collide with life processes occurring in this *substratum*.⁶³

Time is a category that is vital to literature and indeed any other type of narration, including those which are extraverbal. In biopoems, however, the category of time does not arise from semiotic limitations but from factors generated by organic matter. Time is also inextricably linked to notions of volatility and motion, which, according to Massumi, are the foundation of all affective processes and reactions.⁶⁴ In the case of biopoetry, the time frame of the project is influenced by the affective transformations that occur in the bodies of non-human actors. This indicates the instability of narratological categories structuring verbal messages.

The merits of Kac's opinions can be discerned in his own works of biopoetry; among these few works, the most emblematic of the "trend" seems to be *Genesis* (introduced 1998-1999). In this project, the most important element is synthetic DNA, grown purposefully by the artist. *Genesis* was primarily based on "the cloning of the synthetic gene into plasmids and their subsequent transformation into bacteria,"⁶⁵ and the complex procedure resulted in the creation of the JM101 bacterial chain. Kac used his system to translate a Biblical fragment first into Morse code, then into DNA code.⁶⁶ The sentence, which expresses the supremacy of man over nature, runs as follows: "Let man have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moves upon the earth" (Genesis 1:26). Audience participants were allowed to manipulate the microorganisms using UV radiation, which resulted in changes to the basic sentence. After the show, DNA was translated back into Morse code and from there back into English, and the results were displayed on a large screen on the gallery wall. According to the artist, in this way, metabolic processes occurring in artificially grown bacteria caused changes in the Bible fragment, symbolizing the primacy of nature over the dominant cultural vision of the creation of the world.⁶⁷ The experiment indicates the tangible ways in which biological processes may transform verbal messages. At the same time, however, Kac astutely notes that it would be an abuse to treat DNA as an actual linguistic system.⁶⁸ In this context, it would probably be more appropriate to understand DNA as a system of signs that represents certain biological operations and the proper functioning of living creatures.⁶⁹

⁶³ M. Górńska-Olesińska, "Rozmowa z Eduardo Kacem...", op. cit., p. 174 [translation mine].

⁶⁴ B. Massumi, *Parables for the Virtual...*, op. cit., pp. 1-2.

⁶⁵ Ibidem.

⁶⁶ See information on the project website: <http://www.ekac.org/geninfo.html> [accessed 2016-08-05].

⁶⁷ A detailed description of the procedure used to obtain the bacteria and conduct the process appears on the project website: <http://www.ekac.org/geninfo.html> [accessed 2016-08-05].

⁶⁸ M. Górńska-Olesińska, "Rozmowa z Eduardo Kacem...", op. cit., p. 178.

⁶⁹ This statement remains in accordance with Jesper Hoffmeyer's vision of the semiotics of nature. See: J. Hoffmeyer, "The Semiotics of Nature: Code-Duality", in: D. Favareau (ed.), *Essential Readings in Biosemiotics: Anthology and Commentary*, London–New York: Springer, 2009, pp. 583-584.

In her experimental project “The Romantic Disease: An Artistic Investigation of Tuberculosis”, Anna Dumitriu conducts an analogous procedure, which consists of the presentation of a well-known story that is important from a cultural point of view.⁷⁰ Therein, the artist tells the story of the spread of tuberculosis throughout Europe. The story is told from the perspective of *mycobacterium tuberculosis*, as well as various inanimate objects (furniture, fabrics, medical equipment), silent witnesses to man’s fight against the disease. Especially interesting is the manner in which the author included textiles in her project. By means of chromogenic nutrient solutions that change color according to the activity of bacteria, she made various patterns and stains appear on different fabrics—visible traces representing the vital processes of bacteria.⁷¹ At the same time, like Kac, she established a semiotic code that is material in nature and that is processually connected to changes occurring in the bodies of microorganisms. “The Romantic Disease...” forms part of Dumitriu’s greater artistic endeavor, the next element of which is entitled “Communicating Bacteria.” The title itself is especially significant because it can be considered a motto for all of the artist’s activities—an attempt at establishing contact with microorganisms.⁷² Especially interesting in the project devoted to tuberculosis is the way in which the author included textiles in it. By means of chromogenic nutrient solutions that change their color due to the activity of bacteria, she made various patterns and stains appear on different fabrics—visible traces representing the vital processes of bacteria.⁷³ At the same time, just as Kac, she established a semiotic code of material nature, processually connected with changes occurring in the bodies of microorganisms.

The question of post-anthropocentric agency, mentioned above, resonates strongly with both projects. For both Kac and Dumitriu, this agency arises from the affective expansion of the functioning of living organisms, as well as the problem of communicating with non-human actors engaged in the project. The role of metabolically generated agency cannot be denied here, in spite of the way in which artists and scientists exercise control over their projects. The problem of communication appears to be more serious. On the one hand, communication is the basic function of the written word, something that is emphasized by Magdalena Rembowska-Płuciennik with reference to narrativity.⁷⁴ On the other hand, as Knudsen and Stage state, through the

⁷⁰ Project website: <http://annadumitriu.tumblr.com/RomanticDisease> [accessed 2016-08-05].

⁷¹ E. Kekou, *Interview with Anna Dumitriu*, <http://4humanities.org/2013/01/dumitriu-interview/> [accessed 2016-08-05].

⁷² J. Stromberg, *An Artist Dyes Clothes and Quilts with Tuberculosis and Staph Bacteria*, <http://www.smithsonianmag.com/arts-culture/artist-dyes-clothes-quilts-tuberculosis-and-staph-bacteria-180949511/?no-ist> [accessed 2016-08-05].

⁷³ E. Kekou, *Interview with Anna Dumitriu*, op. cit.

⁷⁴ M. Rembowska-Płuciennik, *Poetyka intersubiektywności: Kognitywistyczna teoria narracji a proza XX wieku*, Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, 2012, pp. 98-102.

generation of their non-standard forms, it is affects that cause a certain instability and breakdowns in communication processes.⁷⁵

In the two projects just discussed it is, therefore, affects that prevent the semiotic dimension of communication from being completely achievable. An alternative mode in which communication is based on affective transformations of living matter is particularly clear in the works by Kac and Dumitriu, something that is additionally crystallized by Jussi Parikka: such works demand “an understanding of a story that is radically different from the usual meaning of storytelling with which we usually engage in the humanities. This story is more likely to contain fewer words and more a-signifying semiotic matter.”⁷⁶ This form of communication requires the application of different translation procedures and the establishment of new codes that take into consideration transformations of organic matter.

The characteristics and problems of biopoetry that Kac proposes (discussed above) might be found in Christian Bök’s *Xenotext*, one of the most recent works to combine digital text and the biological functioning of microorganisms into a constantly evolving process. Prior to *Xenotext*, Bök’s best-known work was his 2001 project *Eunoia*, which explored the creative possibilities of a fossilized linguistic system. Therein, the experimental Canadian poet created words, sentences and chapters where, alongside consonants, only one vowel was used, e.g. “e” or “a.”⁷⁷ *Xenotext* approached linguistic questions a little differently, and the aim was to create “living poetry.”⁷⁸ The product of 15 years of work, a major breakthrough in the creation of the poem for *Xenotext* was recorded by the artist as early as 2011.⁷⁹ The full result of the experiment was eventually published in book form in 2015.

In *Xenotext*, Bök made animate matter the medium of his artistic experiment, namely *Deinococcus radiodurans*, an extremophilic bacterium that is especially resistant to ionizing radiation. The project is based on the following idea: Bök designed what he himself called a “chemical alphabet.” Using this alphabet, he “translated” his poem into a DNA sequence (this was the first encryption) and then combined this with the genome of a selected bacterium. The cells reacted by transcribing the DNA into RNA, molecules that can be replicated and that serve as a matrix for protein synthesis. By means of a special encryption program written in Python, RNA was translated into letters of the alphabet (this was the second encryption) and combined into words and sequences. The unencrypted RNA that Bök considers an independent biopoem was named by the author *Eurydice*, and the encoded DNA sequence—

⁷⁵ B.T. Knudsen, C. Stage, *Global Media, Biopolitics, and Affect...*, op. cit., p. 15.

⁷⁶ J. Parikka, *A Geology of Media*, op. cit., p. 20.

⁷⁷ The archive website of the project is available here: http://archives.chbooks.com/online_books/eunoia/text.html [accessed 2016-08-04].

⁷⁸ Ch. Bök, *The Xenotext Works!*, Harriet. A poetry blog, available online: <https://www.poetryfoundation.org/harriet/2011/04/the-xenotext-works/> [accessed 2016-07-30].

⁷⁹ B. Aulicino, D. Timblin, “The Making of a Xenotext”, *American Scientist*, 22.06.2016, available online: <http://www.americanscientist.org/blog/pub/xenotext> [accessed 2016-08-02].

Orpheus.⁸⁰ Therefore, a Xenotext is always composed of two complementary poems. The experiment's greatest success was the fact that the program was able to encrypt DNA and RNA in such a way that, after decryption, the words obtained were semantically meaningful. Bök assigned each of the 26 letters of the alphabet to one of 26 codons (selected from amongst 64), RNA units that are composed of three nucleotides and which encode a specific amino-acid. With the help of an encryption program, he later reassigned letters of the alphabet to each codon, dealing with almost eight trillion possible combinations.⁸¹ This meant that, regardless of the codon combination, it was possible to obtain semantically meaningful words and phrases via a decoding process.⁸²

According to this procedure, when Bök writes something, another work is created simultaneously: a work that is created by microorganisms using their own corporeal matter. The first element in Bök's process involves encoding an existing fragment of text, but the sentences obtained in the final version are no longer a translation or even a transformation of the original. Instead we find a completely new work, created using a biodigital process. The biological transformations that occur with the microorganisms are reflected in a verbal message—a special kind of representation. The biological medium is not only an organic “container” for the existing text; the microorganisms become co-authors of the poem.⁸³ We can now comment on the final result of Bök's experiment using Kac's words: “biological processes are now writerly.”⁸⁴ Obtaining such a spectacular effect was preceded by hundreds of attempts, made with the use of advanced bioengineering techniques.

Darren Wershler describes the resulting *Xenotext* as a “border object.” Existing in a space between science and poetry, it reveals the new face of the process of poetic creation, renegotiating lines of communication between living creatures.⁸⁵ As Wershler indicates, Bök was inspired by William S. Burroughs's statement that language is like a virus transmitted from outer space. *Xenotext* then becomes an “alien text” project, created by an alien organism.⁸⁶ Looking again to the notion of *that which is* “alien,” the title of the poem also recalls “xenotransplantation,” the transplantation of tissues or organs between individuals of different species.⁸⁷ In a manner that mirrors the process of xenotransplantation, in Bök's project, the “transplanted tissue” is a text sequence that expands into a biomorphic semantic structure. The result is

⁸⁰ Ibidem.

⁸¹ D. Wershler, “The Xenotext Experiment, So Far”, *Canadian Journal of Communication* 2012, vol. 37, no. (1), p. 50.

⁸² Ibidem. B. Aulicino, D. Timblin, “The Making of a Xenotext”, op. cit.

⁸³ Compare ibidem, p. 49.

⁸⁴ 2005, p. 254.

⁸⁵ D. Wershler, “The Xenotext Experiment...”, op. cit., pp. 45-46.

⁸⁶ Ibidem, p. 47.

⁸⁷ Z. Smorań, R. Słomski, “Ksenotransplantacja – możliwości i ograniczenia”, *Nauka* 2005, no. 4, pp. 133-148, available online at: http://www.pan.poznan.pl/nauki/N_405_07_Slomski.pdf [accessed 2016-08-06].

a hybrid work that combines organic and inorganic matter in a constant process. The ongoing nature of the process is demonstrated by the fact that Bök is now planning to publish the second part of the poem.

Turning back to Kac's *Biopoetry* manifesto, Bök's project fulfills the criteria for as many as six of the twenty proposed variants of the genre, namely: "microbot performance" (no. 1), transgenic poetry (no. 4), bacterial poetics (no. 10), tissuetext (no. 12), proteopoetics (no. 13), and metabolic metaphors (no. 18).⁸⁸ In this sense, *Xenotext* could be described as the most advanced example of biopoetry created yet: it combines genetic procedures (the manipulation of the metabolic processes of microorganisms and the natural transformational processes of bacteria) with the practice of translating words into organic matter, and the process of implanting text into the tissues of alien organisms. *Xenotext* now affirms Kac's conceptual assumptions to a greater extent than is the case with Kac's own creative works.

As Wershler rightly summarizes, what is most important about Bök's experiment is "the shift in perspective" that the work provokes, "simultaneously forc[ing] a re-consideration of what we mean when we talk about 'biology,' 'media art,' 'poetry,' 'communication studies,' and culture itself."⁸⁹ Bök's idea undoubtedly advances the possibilities offered by poetry, or indeed language as a whole, in the context of advanced biotechnological experiments. At the same time, interestingly enough, his project negotiates the meaning of such categories as representation and agency in a manner that resonates with the category of embodiment proposed by Hayles with reference to text. For Bök, embodiment is also understood as a material context in the existence of text, and in *Xenotext* this gains a literal meaning: as we have seen, text is implanted into a biological organism that transforms it. The materiality of *Xenotext* therefore stems from both the possibilities and limitations of organic matter as well as from the digital environment into which it is finally transformed.

Jussi Parikka notes how "Biomedial art pieces might often work through the centrality of the algorithmic, which creates «natural forms» in digital environments. However, at least as interesting is how they are able to reframe life in its wet materiality."⁹⁰ In his reflections on the role of insects in the development of media, Parikka pays attention to two issues that are also significant when analyzing biotexts. The first issue he calls attention to is the power of non-human actors in the development of civilization, manifested in the affective processes of living organisms (here, Parikka writes about the "«bestial» media archaeology of animal affects").⁹¹ In the case of many organisms (with bacteria at the forefront), very often these processes also determine interspecies relationships (disease on the biological level) and acts of communication – usually affective, non-verbal communications, in natural conditions.

⁸⁸ E. Kac, "Biopoetry", op. cit., pp. 191-195.

⁸⁹ D. Wershler, "The Xenotext Experiment...", op. cit., p. 55.

⁹⁰ J. Parikka, *Insect Media: An Archaeology of Animals and Technology*, Minneapolis–London: University of Minnesota Press, 2010, pp. xviii-xix.

⁹¹ Ibidem, p. xxxiv.

The second issue Parikka calls attention to is the modulation and manipulation of an organism's natural metabolic processes on which the discussed projects are largely based. As Parikka says, “[t]hese forces mold our lived relations, which increasingly are characterized by the milieu of technology and nonhuman technological actors but also by new modulations of nature in the form of biodigital technologies, nanotechnologies, and biological computation, for example.”⁹² Expanding the point, in my view, the aforementioned concept of “inside-body actors” should also be included in this last category.

Drawing upon the findings and assumptions of Kac and Parikka, we may conclude that *Xenotext* is not a purely affective poem. Wershler notes that, in Bök's experiment, “[p]erhaps most crucially, the microorganism itself is an active collaborator, potentially writing—but currently redacting and editing—new poems itself through the process of RNA transcription,”⁹³ and, in this sense, we see that the poem *is* founded upon the biological functioning of organic matter. This does not however change the fact that, while an anthropocentric perspective is strongly compromised in the project, such a perspective is not entirely obliterated. In *Xenotext*, the work's conceptual assumptions and the intentions that underpin its means of communication belong to its human creator.

An exploration of the active potential of non-human actors, even if this is partially directed by the author-creator, undoubtedly underpins of all of the biotextual projects I have discussed. The question of whether or not it is possible to establish communication with microorganisms or one's own “viscera” remains debatable. However, in the examples discussed, a semantic code has been created that is supposed to indicate (using translation and cryptography) the role of inside-body actors and non-human actors in the creation of cultural messages. Such messages may appear in printed form or as part of interactive multimedia projects.

Transliteration: “affective agency” and negotiations with representationism

All of the projects discussed in this essay combine biosignals with modern technologies, generating different forms of textuality: kinetic typographies, digital fiction, or biopoetry. Miguel Ortiz describes these biosignals as follows:

In common practice, the term is used to refer to signals that are bio-electrical in nature, and that manifest as the change in electrical potential across a specialised tissue or organ in a living organism. They are an indicator of the subject's physiological state. Biosignals are not exclusive to humans, and can be measured in animals and plants. Excitable tissues can be roughly divided

⁹² Ibidem, p. xxiii.

⁹³ D. Wershler, “The Xenotext Experiment...”, op. cit., p. 55.

into tissues that generate electrical activity, such as nerves, skeletal muscles, cardiac muscle and soft muscles.⁹⁴

In the artistic projects presented here, biosignals produced by tissues, microorganisms, or human bodies generate a peculiar kind of agency, additional to the kind of agency one would ordinarily associate with a work of art. This agency cannot be totally controlled by the artist or the recipient, because it arises from metabolic transformations in organic matter. It is a force with an affective basis that exists in a feedback loop with the literary forms that are both generated and transformed by it.

The influence of non-human factors is emphasized in these projects, factors that have, in fact, always interfered with the materiality of text. For example, with traditional printed media, weather conditions (e.g. strong sunlight or rain) can cause type to fade or smear, and microorganisms are able to destroy the structure of a book or change its smell. The innovativeness of these projects lies in the fact that in these instances such factors determine the very creation of the text itself, including its semantic dimension. These are not simply forces that act upon an existing artifact (the significance of which should not be overlooked), but rather an element of a literary form that possess its own physical characteristics—processual, dynamic, changeable.

The projects by Pullinger, Gromala, and Bök also clash with traditional theories of representation, notably de Saussure's famous concept of the sign. This is not to say that these projects are not representative, or that they do not contain semiotic codes. Nevertheless, in these examples, representation works differently: it is not reduced here to a mere textual visualization, but instead it takes the form of a processual transformation of the semiotic code, generated by biosignals. Here, the sign does not possess a stable reference point for us to encounter. However, such works facilitate the flow of new relationships, involving codes from different media and different types of matter. The distinction between the *signifier* and the *signified* is thus not impossible to make here, but it loses its importance.

Works that could, conventionally, be labelled “transliteration” take on many different forms, exposing an increasingly distinct and multifaceted relationship between living organisms and technology. With the development of self-tracking (that is, the progressive possibility of monitoring biological vital functions) biotextuality can be seen as the most symptomatic form of transliteration, and as form that is vital for the development of such a concept. At the same time, such developments might cause us to call for the redefinition of established literary concepts.

⁹⁴ M. Ortiz, “A Brief History of Biosignal-Driven Art: From Biofeedback To Biophysical Performance”, *Econtact* 2012, no. 14(2), available online at: http://cec.sonus.ca/econtact/14_2/ortiz_biofeedback.html [accessed 2016-08-22].

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