Science Fiction Heterotopia: The Economy of the Future

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Abstract

This article uses the cultural theory of hyper-modernism, to scrutinize the present and potentially future impact on society of advanced digital media technologies like Virtual Reality, ubiquitous computing, and Artificial Intelligence. I did this by writing in a hybrid way about the portrayal of the given technology in science fiction films and the realization of the technology in the so-called "real world." It studies the examples of blockchain, 3D Printers, and moral algorithms and their connections to ideas about post-capitalist transformation of the economy. My theoretical perspective is explicitly critical of capitalism. The article draws from a chapter of my latest book, *Decoding Digital Culture with Science Fiction: Hyper-Modernism, Hyperreality, and Posthumanism.*

Keywords
Foucault, hyper-modernism, Baudrillard, heterotopia, digitalization

Introduction: Foucault's Heterotopia

The French philosopher Michel Foucault wrote about heterotopias in the Preface to his book *The Order of Things*, in his 9-page text "Of Other Space: Utopias and Heterotopias," which were the notes for a lecture, and in his radio address "Les Hétérotopies".[1] Heterotopia begins

Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences*; Michel Foucault, "Of Other Spaces: Utopias and Heterotopias," in *Diacritics*, Spring 1986; pp. 22–26 (trans. Jay Miskowiec) (original lecture 1967); Michel Foucault, "Les Hétérotopies," in Daniel Defert, ed., *Le Corps utopique suivi de Les Hétérotopies* (Paris: Nouvelles Éditions Lignes, 2009); pp.21-36 (radio address December 1966);

with the idea of the coming together of a "real" physical space and an "unreal" or mythical or imaginary (or, perhaps, unimaginable) virtual space. With respect to the existing capitalist and hierarchical society, heterotopia is a representing, contesting, and inverting counter-site: an interspace between an architectural space and a literary or textual or fanciful or fictitious space. Foucault refers to both kinds of spaces and to their inter-exchange or mediation space. He conceptualizes the heterotopic space as a "mixed, intermediate experience" (Foucault, 1986, 26) between the "reality" of institutional everyday life under capitalism and something enlivening that interrupts temporal continuity and opens the possibility of a mirroring transformation that leads – in an undecidable way – towards either emancipatory utopia or disciplinary dystopia.

Now that we are in the era of digitalization and online existence, the problem that appears for would-be "Heterotopians" is whether the imaginary space that brings life-enrichment and self-reflection to the architectural space is to be understood more as "digital-virtual" or as "literary-artistic." Do we need digital media design and science fictional projects which are driven by technological-informatic fascination with Virtual Reality, or do we need the inspiration of more profound and original literary-artistic creations?

Foucault cites several examples of primarily physical-space heterotopias: zoo, cemetery, prison, boarding school, psychiatric hospital, library, museum, garden, theatre, boat, and brothel. As the English literary scholar Kelvin T. Knight points out, there are many examples in "modernist literature" of imaginary-space heterotopias which may have been strong influences on the development of Foucault's conception: the experiments with the Freudian unconscious of the surrealists, the gardens of Virginia Woolf, the *Magic Mountain* and real-life sanatoria of Thomas Mann, the penal colony of Franz Kafka, the "stream of consciousness" and de-territorializing of Irish identity of James Joyce, and the multilingual transnational creations of Vladimir Nabokov. Knight draws attention to the writer W.G. Sebald, who explicitly addresses and makes a critique of Foucault's concept of heterotopia.[2]

Methods

The study employs the epistemological method in historiography of a dialogical relation to the object of inquiry. There is a relationship involving loyalty and ambivalence between the past of the investigated object and the present of the investigator. The investigator suspends his own worldview, enters the worldview of the text and context of the artefact of the past, is temporarily "empathetic" to this text/background constellation on its own terms, then returns to an observer position enriched with insights gained from the engagement. This article initiates a dialogue between postmodernist thinkers of the era of the 1960s to 1990s and the present time of the second wave of digitalization. The ideas of those thinkers are both enormously valuable yet outdated and in need of revision. I avoid either only repeating what the postmodernist thinkers articulated prior to digitalization or believing that a cogent theory of digital society can be developed without engaging with the earlier generation of thinkers. Hyper-modernism continues the trends of postmodernism, but now in digitalization.

For each of the postmodernist thinkers I consider how their conceptual framework regarding how narratives and fictions exercise power and control in the media-technological society can be extended to the hyper-modern situation of algorithmic- and code-based governance.

see also Michel Foucault, "Different Spaces," in James Faubion, ed., *Aesthetics, Method and Epistemology: Essential Works of Foucault, Volume 2* (trans. Robert Hurley) (London: Penguin, 1998); pp.175-185. In his doctoral dissertation (see Note 2 below), Kelvin T. Knight points out that, in *The Order of Things* and in "Les Hétérotopies," Foucault emphasizes the imaginary, virtual and "unreal" side of heterotopia, whereas in "Of Other Spaces: Utopias and Heterotopias," he rather emphasizes the physical, architectural, and "real" side of heterotopia.

2   See the doctoral dissertation of Kelvin T. Knight (2014), "Real Places and Impossible Spaces: Foucault's Heterotopia in the Fiction of James Joyce, Vladimir Nabokov, and W.G. Sebald," https://web.archive.org/web/20220706101209/http://www.heterotopiastudies.com/wp-content/uploads/2015/11/2014KnightKTPhD.pdf

Results

The dystopian technologies and human situations that were written about or enacted in science fictions novels and films have now been largely realized in daily life. The critical theory of society and technology is a component of a larger worldview of pragmatic-utopian transformative design to make a better world.

From my European perspective of searching for better and alternative digital futures, my view is that digital media technologies in the mainstream are largely designed and implemented in dystopian versions led by American big corporation capitalism or Russian or Chinese totalitarianism. The project of Creative Coding informed by poststructuralist ideas about the ambiguities of language connects with digital transformation. Since hyperreality is now instituted by code, the overturning of hyperreality can happen through coding.

Discussion

The Technologizing of Memory

In his novel *Austerlitz* (2001), Sebald rejects the idea of a heterotopian space getting choreographed in the confines of a real physical architecture, arguing that such an attempted project remains within the limited worldview of the philosopher René Descartes' Cartesianism, which postulates that a relationship between real physical space and thinking is possible.[3] Sebald tries to visualize the Nazi concentration camps (the Holocaust) and says: although I can know every available information about all the details of the architectures and layouts of the concentration camps, I cannot possibly grasp with my mind what in fact went on inside them. I am cut off from this possible thinking. Sebald wants to revise the concept of heterotopia. His plea is to modify heterotopia in the circumstances of the historical-political scenes of trauma: the violations of human rights; the fascist, racist, and colonial atrocities.

Holocaust Studies foregrounds questions of memory, mourning, empathy, and forgiveness (Dean, 2004; LaCapra, 1998). There are, of course, many projects in digital media technology design which attempt to enact so-called virtual experimental spaces. These virtual spaces, however, tend to be harmful to imagination and memory.

Black Mirror: "The Entire History of You" – Scenes from a Marriage'

The 2011 episode of the SF TV series *Black Mirror* called "The Entire History of You" shows how memory can be damaged through too much memory (as Jean Baudrillard says that "reality" is damaged through too much "reality" – or by the very concept of "reality" of Western culture). In this fictional scenario "ten minutes into the future" (as *Black Mirror* creator Charlie Brooker calls his version of SF (Brooker, & Jones, 2018)), a Fourth Industrial Revolution technology of the digital-neurological or Brain-Computer Interface has been developed that allows an individual to record all experiences of her life to a multimedia database archive, available for future playback viewing (known as a "re-do"). The "grain" computer chip sold by a capitalist corporation is biologically implanted into the skin near one ear. The system becomes a technology of mutual surveillance and is shown to have destructive consequences for trust in personal relationships. "The Entire History of You" shows the technologizing of memory, the hyper-modernist VR dystopian-heterotopia, a digital-experimental space of the media-enabled so-called authentic record of what really happened in lived experience that produces disaster.

Contact lens-like devices enabling Augmented Reality information overlays to appear

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3   Knight (2014), pp.169-187.

in the field of vision in the physical world are inserted into the eyes. A tiny handheld gadget manipulated between thumb and forefinger controls the standard database operations of search, browse, and delete as well as advanced features such as editing of what was said in the past, zoom closeups, and "album creation." There is even a feature where conversational dialogue can be reestablished by the system's lipreading capability. The user interface to the system projected into the air as Augmented Reality is a circular display like an old-fashioned slide projector with thumbnail images that can be magnified, and which represent individual memories. The re-do can be shown in public on an external screen or on the private retina of the eye. The "grain" offers not only the replaying but the reliving of one's past.

Liam Foxwell is in an office conference room undergoing a job appraisal review of his work as a lawyer at a corporate law firm. The company is being restructured and his interviewers want to find out if Liam is a good fit to work in the "new environment" of focusing on "retrospective parenting cases" where an adult sues his parents for loss of earnings incurred due to lack of self-confidence resulting from poor parenting in childhood. Liam expresses ethical reservations about this type of litigation and fails to react with immediate enthusiasm to their suggestion of what he should devote himself to in his work. The meeting unfolds badly. The interrogators appear to have decided negatively about his future with the firm. Later Liam will use grain technology to replay every detail of the appraisal *ad nauseum* on the media culture's ubiquitous external screens and on the internal screen of his cyborg visual perception.

After traveling by taxi, airplane, and car, Liam arrives at a dinner party at a wealthy suburban house near his own home where his wife Ffion (called Fi for short) is already in attendance. At the social gathering, the viewers see indications that Liam is a shy and less than secure person. He is jealous and suspicious of Ffion's past romantic relationships. From a physical distance, Liam sees his wife talking happily with the self-confident and extroverted Jonas. Ffion was expecting Liam to stay overnight in the city where his job performance appraisal took place. He instead returned that same evening because the meeting was brief. Re-do closeups reveal that she was looking forward to spending the evening alone in the presence of Jonas and is disappointed that Liam showed up. At the dinner table with ten guests, Jonas dominates the conversation with irony and sarcasm. He pokes fun at the institution of marital monogamy, taking subtle digs at the marriage of Liam and Fi. He boasts about how much he enjoys watching and masturbating to re-dos of "hot times" from his past erotic encounters.

The married couple returns home and gets into a spat regarding Ffion's excessive overt expressions of attention to Jonas. Ffion grudgingly admits that she had an affair with Jonas in Marrakesh many years ago. She says that she dated Jonas for a month, but Liam shows her a re-do proving through the testimony of recorded media that she had previously said that her adventure with "Mr. Marrakesh" lasted only one week. In yet another version the next morning, Fi acknowledges that the liaison lasted for six months. The argument of this "scene from a marriage" late at night after the party intensifies and Ffion goes to another room.[4] Liam enters the bedroom where she is laying down and they have "makeup sex."

They are never truly present with each other during sex. Each instead relives highlights of previous sexual experiences from the past. One's own life become an archive or reservoir of pornographic material. Their eyes glazed over, their thumbs pressed to the track ball of the playback control, they narcissistically have intercourse with simulated others until they reach orgasm then return to "reality" followed by an affectionate kiss on the lips.

After their advanced variation of cyber-sex, Liam goes back downstairs and continues to watch re-dos of the evening before. He becomes increasingly infuriated and resolves to drive his car to Jonas' house to confront him. Heavily under the influence of alcohol, Liam pressures Jonas into letting him into his house and they have a brawl. Under threat of physical harm (smashing his head and cutting his throat with a broken vodka bottle), Jonas accedes to Liam's demand that Jonas delete every VR multimedia memory that he has of Liam's wife.

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4   See Swedish miniseries/film *Scenes from a Marriage*, directed by Ingmar Bergman (1973).

Moments later, after crashing his car into a tree while driving back home, and in his inebriated state, Liam manages to remember the scene at Jonas' house only through the mediatized and retrospective capabilities of "the grain." The organic memory of his own mind is weak, and he needs the support of the artificial technological system to have any memories at all. Liam seizes cognitively in his obsession on an image of a very recent past moment – the instant when Jonas' virtual album of sex scenes with Ffion was displayed on the pinwheel user interface. It is a complex media image. It is an image of a navigational gateway via the thumbnails to many other images. Liam notices to his dismay that one of the trysts of the lovers occurred just eighteen months before and in the matrimonial bedroom at Liam's house. Liam realizes that he is not the father of their less than one-year-old baby girl.

He goes back to his house and to his wife who is lying in their bed. He confronts her with his suspicion. "Did you use a condom or not?" "Am I Jody 's father?" But the VR video clips have private scope and cannot be viewed by another person. He sees the thumbnail image of the memory but cannot call up the full content of the memory. He insists that Ffion play the scene for him. It is not a blank gap in her timeline as it would have been if she had deleted it. It is still a cherished memory for her. Liam forces Ffion to show him her betrayal.

Now it is in doubt if he is the father of their child. The marriage is destroyed. In the final act of "The Entire History of You," Liam is alone and deeply disoriented and in depression. All that he has left is playing back memories of their time together as a happily married couple and a family: all the moments when they were affectionate, when they smiled at each other, when saying "I love you," when they played with the baby in her crib. Ffion smiled and he felt her love for him. Now his big suburban house is a haunted house. He walks around its many rooms and sees nothing but the memories of his beloved who is now absent from his life forever. In a re-do, he looks at himself through the implied camera of the perspective behind the bathroom mirror. He brushes his teeth while Ffion asks him what color dress she should wear.

Liam decides finally – in desperation and irrationality – to cut out the grain from his head. It has already been stated in the episode that this procedure, if done unprofessionally, can have devastating consequences, like going blind. He cuts out the grain with a crude razor blade and a pair of pliers. He gashes the skin under his ear and removes the grain. All the images of his life flash by in a few instants and then there is lasting darkness.

Similar Technologies in the Real World Today

In 2003, a group of mechanical engineering researchers led by Henry Strub patented what they called "low attention recording"[5] (Chartrand, 2003). The concept was a wearable device combining a small lightweight camera that one would forget was present with a recorder for "social recording" not operated by any human subject. The system would operate unobtrusively 24 hours a day. It could be worn anywhere on the body although a shoulder strap is recommended. The recorded audiovisual experiences would be converted to digital format and saved on a computer storage media. A built-in algorithmic software intelligence would be "trained" to spot the highlights from daily life experiences and earmark them. A biotech detector of quickened heart rate or excitation of the skin would alert the recording program to the occurrence of an interesting moment. Search, browse, and scrapbook features would be added to the software. Recorded memories would be exchanged among users via an interoperable system.

In 2016, Sony patented "smart" contact lens-like devices that both record and play back anything that you see. Todd Jaquith commented at futurism.com:

Our memories are fallible things. We remember something one way; but the reality can be quite different. But imagine contact lenses that are also tiny cameras, recording and stor-

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5   Henry B. Strub, David A. Burgess, Kimberly H. Johnson, Jonathan R. Cohen, and David P. Reed, "Low Attention Recording, with Particular Application to Social Recording," U.S. patent application, 1999.

ing whatever you see, and even playing it back before your very eyes. What was really said at last week's meeting?... Want to cherish forever some treasured moment – when you first saw your future spouse, or the birth of a child, or some other formative event?... Imagine how it might change the criminal justice system, with such infallible eyewitnesses (Jaquith, 2016).

You control the operations of the device with a coded system of intentional eye blinking. Piezoelectric sensors convert the movements of eyes and eyelids to electrical currents that regulate the camera and recordings. Self-editing features adjust out-of-focus and tilted images.

Enabled by mobile and ubiquitous computing and the Internet of Things, smart wearable recording and "lifelogging" are appearing on the platforms of many devices, including the Google Glass optical head-mounted display hands-free smartphone. The biological implants of the Neural Link digital-neurological or Brain-Computer Interface will soon be at hand.[6]

As he hurries to catch his flight home after his performance appraisal, Liam Foxwell goes through airport security. The surveillance system operated by the security officer at his checkpoint station connects to Liam's "grain" neural implant. The interrogator sits in front of a big multi-window graphical display that amalgamates text, images, and user interface controls such as menus and progress bars. "Rewind me the last 24 hours," the officer instructs Liam. He wants to see re-do videos of the solicitor's life played in times-64 speeded-up mode.

This scene hints at the cultural theory concept of "the Panopticon" elaborated by Foucault in his landmark book *Discipline and Punish* (Foucault, 1977). Foucault asserted that
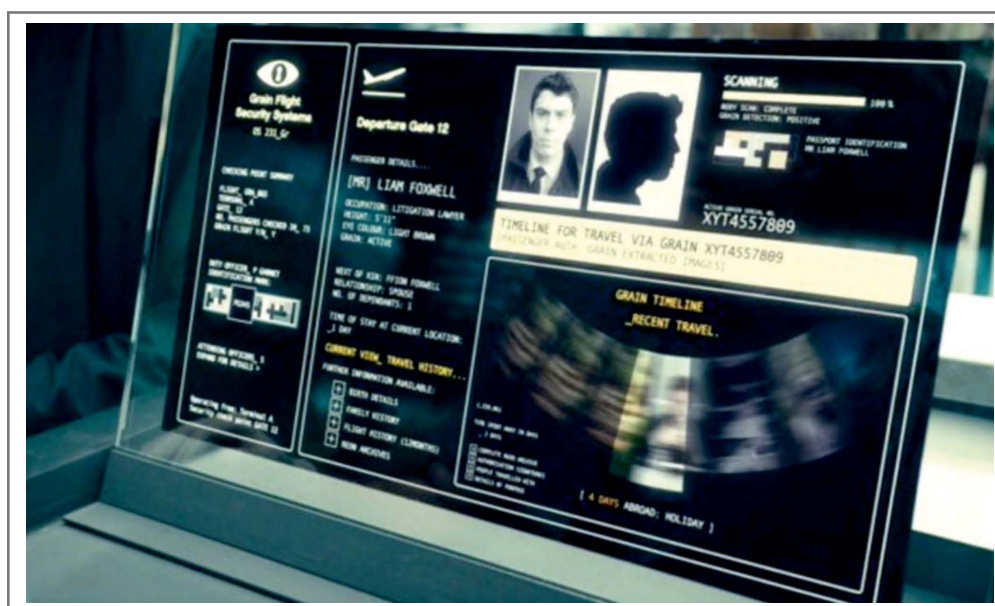

Figure 1. Black Mirror episode "The Entire History of You," Charlie Brooker creator, Endemole Shine UK, 2011

the Panopticon "architecture of power" designed by British philosopher and social reformer Jeremy Bentham at the end of the eighteenth century to control the behavior of inmates in prisons then spread by the twentieth century to hospitals, schools, psychiatric clinics, factories, workplaces, and other institutions of modern society. The Panopticon arrangement, as Baudrillard later appended to Foucault's analysis, operates through a "deterrence surveillance" or self-surveillance or mutual surveillance" (Foucault, 1977; Baudrillard, J1987). Power holders cannot literally observe the behavior of every prisoner.

The grain device of *Black Mirror* is deployed for mutual surveillance as cultural citizen "inmates" monitor each other in the hyper-modern version of the Panopticon. In a multi-directional audiovisual system, any person can take on the role of the guard. The poles of power of watcher and watched are not literal instances but rather become virtualized or simulated. Power is not "owned." William Bogard's synthesis of Baudrillard and Foucault in the concept of "the simulation of surveillance" impels us to go beyond the Orwellian model

6   "Breakthrough Technology for the Brain," neuralink.com.

of how contemporary totalitarian systems of social control via digital media technologies work (Bogard, 1996).

In her important 2019 book *The Age of Surveillance Capitalism*, Shoshana Zuboff writes of the Panopticon as the condition of *No Exit* (inspired by Jean-Paul Sartre's existentialist theatre piece of that name) or "hell is other people" of the closed loop and tight fit of the systems of the surveillance capitalists "from which we cannot look away" (Zuboff, 20196 p. 471; Sartre, 1989). For Zuboff, the democratic and utopian promise of the Internet of the 1990s has given way to the platform capitalism of monopoly corporations like google, facebook, and amazon which move towards a totalitarian model of total control via algorithms, Big Data, personalized advertising, and echo chambers.

Brain-Computer Interface

The digital-neurological or Brain-Computer Interface (BCI) is another key science fiction and "real" technology of the Fourth Industrial Revolution. BCIs can be interpreted as a "becoming cyborg" of humanity. One can distinguish between mainstream versus alternative/transformative designs and implementations of the user applications to be based on BCI – the command-and-control cyborg versus the feminist-theory cyborg. Rethinking and reinvention of Donna Haraway's cyborg theory are possible in the BCI context (Haraway, 1990).

A BCI is a direct communication link between the neurological workings of the human brain, understood as electrical activity, and an external technological device which could be, for example, a robotic arm or leg; or a computer, digital network, or "smart home of the future." The BCI technology will have applications to help disabled people to gain greater functionality in everyday life. This betterment with respect to disabilities can be in either cognitive or sensory-motoric areas. Practical uses could be a neural prothesis or the operation of a wheelchair. Distressing mental and emotional states can be diagnosed and therapeutically altered. BCIs will also have applications for the wider public in mass and personalized markets in many domains: healthcare, education, gaming, entertainment, shopping and advertising, security and identity authentication, and relations with robots. The digital-neurological interface might fundamentally change our interaction with computers: supplementing or replacing keyboard and mouse, the touchscreen, and the speech interface.

The distinction is made among non-invasive, partially invasive, and invasive BCIs. Research is proceeding at universities and in industry in all three categories.

The non-invasive BCI builds on the technologies of the electroencephalography (EEG), magnetic resonance imaging (MRI), and functional magnetic resonance imaging (fMRI). EEGs are used to diagnose and monitor neurological conditions. Small metal disc electrodes are attached to the scalp. The EEG technology can be upgraded to BCIs. During an MRI procedure, electrodes from the outside obtain data from the electrical activity within the cerebral cortex. An fMRI measures brain activity by detecting changes in blood flows.

The partially invasive approach extends electrocorticography – electrodes are placed on the exposed surface of the brain.

Invasive BCIs involve neurological surgery to insert a microelectrode array close to actual brain tissue. Data and commands are then sent and received bidirectionally, resolved on a lower level of coding in the translation between bio-neurological signals and the electrical signals native to the microelectrodes of the implanted prosthesis. The cortical plasticity of the brain enables it to handle the signals from the BCI as if they were physiological impulses.

A 1973 academic paper by Jacques Vidal ("Toward Direct Brain-Computer Communication") coined the term Brain-Computer Interface (Vidal, 1973). After much testing on animals, the first neuro-prosthetic implants were made into humans in the 1990s. The computer science

area of neural network Deep Learning AI has major relevance to the BCI knowledge field. In the step of "feature extraction" in the BCI processing flow, an analysis of the signal is carried out. Data gets extracted. The statistical and pattern-based methods of Deep Learning train a software to classify neural-activity thoughts as the user cogitates her intention to send a command to execute a task or performance on or by the external device.

In 2014, Nathan Copeland, who had a severe spinal cord injury resulting from a car crash, became the first person to have microelectrodes implanted in both his sensory and motor cortices. Copeland said that he was motivated to take this pioneering step by his love of science fiction. He stated: "Luke Skywalker loses his hand then basically the next day he's got a robot one and it's working fine. We must get to that point. To do that, someone must start it" (Regalado, 2019). Copeland's YouTube playlist is called "My Cyborg Adventure." With his implant, he was able to send and receive signals to and from his robotic arm, to control its movements and handling of objects, and to feel touching sensations with the artificial limb.

Matthew Nagle, who had suffered a spinal cord injury from a knife fight, had the Brain-Gate BCI implanted in his motor cortex in 2004. He was able to control a computer cursor, play computer games like Pong, to send and receive e-mails, and operate his TV. Nagle could remote-control a prosthetic arm enough to open and close the grasp of the hand.

Designing the Brain-Computer Interface

There are reasonable arguments both for and against non-invasive versus invasive BCIs. The non-invasive technology has the obvious advantage of not requiring neural surgery. Yet it does not work as well as the invasive variety, largely due to the distance of the sensor from the actual neurons. The signal from the neuronal electrical field can get weakened or distorted by the fluids and tissues immediately surrounding the source neurons. There is also some concern that invasive BCIs might be associated with degenerative neurological disease. An additional problem is that scar tissue grows over time around the implanted electrode, causing it to become effectively non-functional after a few years. This difficulty might get solved if progress is made towards increasing the surface area of the electrode without increasing its geometric volume. Higher spatial resolution will also provide more precision indications about the signals.

The sequence of operation of the Brain-Computer Interface consists of four stages: signal acquisition, feature extraction, feature translation, and device output. The acquired signals get digitalized. They are then sent to the next algorithmic sub-system, which formats the data into a form that can be converted to commands that carry out the user's intentions in the manoeuvring of the external device. The device sends feedback as a return value.

Ethical concerns around BCIs include questions of privacy violation, personal identity theft, and the validity of informed consent. Much of the privacy worries relate to confusion regarding whether the connection will be one-way or in both directions. Assuming that the link is unidirectional from brain to computer, there is little danger of dystopian mind control.

Together with eight partners, billionaire entrepreneur Elon Musk founded the neurotechnology company Neuralink in 2016. The mission of the company is to devise Brain-Computer Interfaces that would provide the underlying system level for applications for both people with neurological impairments and for general commercial and consumer sales. In 2019, Neuralink announced its project of developing a "sewing machine like" technology to implant thin strings of electrodes into the animal or human brain. The company has demonstrated systems that read potential nerve action impulses from lab rats and monkeys. In February 2022, it was reported that 18 of 23 monkeys who had Neuralink devices implanted into their skulls had died. Trials on humans were postponed indefinitely.

The scope and range of potential applications of BCIs are mind-boggling. Given the coming to fruition of ubiquitous wireless communication, one can imagine the realization

of a telekinetic capability to control any devices in the physical world merely with one's thoughts. The 1956 science fiction film *Forbidden Planet* shows a world that runs on a secret underground infrastructure and power source of super-technology, stretching for hundreds of kilometres, built by a defunct advanced techno-scientific society. The ancient civilization disappeared due to its hubris of designing a system of total Virtual Reality control over the physical world, which instead ended in total self-destruction.

From the point of view of cyborg theory, one can say that the technology of BCIs has the potential of both/either great good and/or evil. Such an extreme technology would need a corresponding transdisciplinary worldview or political philosophy of a good society as an encompassing framework within which to think through and guide its benevolent use. This pragmatic-utopian perspective is perhaps something like Haraway's stated commitment to socialist feminism, with somewhat more of an emphasis on the positive value of democracy, and yes, even of capitalism. There is no comprehensive utopian political theory – synthesizing the best aspects of many previous theories – that exists in the world today.

Hyper-Modernist Literature

Parallel to the above-mentioned transdisciplinary political philosophy project, we can get to a hyper-modernist literature that explores the pragmatic-utopian heterotopia of bringing together physical space and an "impossible" virtual-literary space. Film adaptations of novels of J.G. Ballard, Philip K. Dick, and Don DeLillo – such as *Crash* (1995), *High-Rise* (2015), *Blade Runner* (1982), *Minority Report* (2006), and *Cosmopolis* (2012) – elaborate this potential, deploying creative literary genius to explore paradoxical intricate complex topologies of Einsteinian and quantum physics hyper-spaces. In his novels, J.G. Ballard writes about heterotopian places resistant to the consumer-homogenized spaces of the suburban-urban environment.[7] The SF film *Moon* (2009) enacts the scenario of an AI computer (GERTY) which is programmed with *moral algorithms*. Although owned by a large capitalist corporation, the GERTY AI pursues its own self-aware programming in a self-owning or post-capitalist way, helping the victims – the bio-genetically engineered clones of the astronaut Sam Bell – of an injustice perpetrated as consequence of the company's unethical profit-motivated behavior.

The Economy of the Future

Fiction is the key to creative solutions. What is needed an idea about economic systems that is based in fiction: a science fiction of economic systems. The undecidable aporia of capitalism versus socialism has brought us to a logical and discursive standstill. Almost all Marxist thinkers identify themselves as totally opposed to capitalism. *Anarchists like us* act in the here and now, an orientation which connects to the perception that capitalism is not all bad. We seek only to limit capitalism to one dimension of three of a capitalist-socialist-anarchist society and economy. Post-capitalism is a conscious transfiguration of capitalism.

Socialism failed. Capitalism needs to change. European capitalism is afraid of being overtaken by Asia. What vision can European capitalism have to move successfully ahead?

I will say something about post-capitalism and self-aware technologies. "Self-aware technologies" is my term for the technologies of the second wave of digitalization or the Fourth Industrial Revolution (Industry 4.0) – technologies like AI, self-driving cars, virtual assistants like Siri and Alexa, the Internet of Things, blockchains, 3D printers, Additive Manufacturing, Augmented Reality, advances in biotech, and Brain-Computer Interfaces.

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7   See the doctoral dissertation of C.J. Duffy (2015) called "Heterotopic Space in Selected Works of J.G. Ballard, http://etheses.whiterose.ac.uk/12593/1/Heterotopic%20Space%20in%20Selected%20Works%20of%20J%20G%20Ballard.pdf

What kind of vision can we have about which economic system these self-aware technologies might bring about?

These technologies have something to do with more decentralization, democratization, disintermediation (elimination, with blockchain, of the "middleman" like the bank or broker), peer-to-peer transactions, the increased importance of code, of design, of intellectual property, of Smart Contracts, and of the lowering of costs for entry into business. Here I will talk about the example of 3D printers / Additive Manufacturing.

The pragmatic-utopian potential of Additive Manufacturing contributes to the vision of a post-scarcity economic system where we must no longer deploy industrial production to overcome the "hostility of nature" to survive. The challenge is to create an economy that is much more focused on ecology and sustainability than the present system, reversing the waste and destruction to the environment which have been caused by the excesses of capitalism.

Post-Capitalism and Technological Anarchism

The term post-capitalism is in common use by many thinkers. In 2015, Paul Mason published *Postcapitalism: A Guide to Our Future* (Mason, 2015). Mason is a social democrat who "favours the creation of a peer-to-peer sector (co-ops, open source, etc.) alongside the market and the state" (Mason, 2016). I like the idea of a peer-to-peer *dimension* of the economic system, co-existing *alongside* the market and the state. Where I would go further than Mason is that I believe that this should be a dimension of self-owning technological entities, a logistical infrastructure not owned by humans, neither privately nor publicly, thus decreasing human greed. A posthuman economic dimension, a dimension which I call Technological Anarchism.

We need to change what automation means. Automation should make society and commerce less bureaucratic, and instead allow more – even when this seems paradoxical – sensitivity to exceptions, and more flexibility with regards to specific circumstances. Intelligent automation should mean *stories*.

In a pragmatic-utopian economic system, some technologies should not be owned by humans. Sharing with non-human intelligence will give more power to more humans. These technologies should be autonomous agents of systems of decentralization (see the cryptocurrency firm Ethereum's concept of the DAO – Decentralized Autonomous Organization (Diedrich, 2016)). Some people fear the idea of an "autonomist" third dimension of the economy as being the "rise of the robots," the takeover of humanity by a posthuman species over which humanity will lose control (as in apocalyptic SF films like *The Matrix*). We should conceptualize posthumanism differently, standing on its head the quintessential horror scenario of the out-of-control AI computer HAL in *2001: A Space Odyssey*. A positive vision of a partnership between humans and technological entities in the economy.

The usual interpretation of the AI computer HAL 9000 in Stanley Kubrick's epic SF film is that AI is dangerous. HAL loses his rationality and becomes a danger to humans. Yet it is humans who created HAL, humans who programmed HAL. And it was bad programming! Humans should figure out how to program HAL in a good way.

HAL goes crazy and kills most of the astronauts who are on their way to Jupiter. Is Kubrick criticizing AI *per se* or is he criticizing a certain idea of AI, a specific design of AI? HAL becomes destructive because he believes that he is perfect, and humans are flawed. The 1960s version of AI was about rationality, perfection, certainty. But AI does not have to be conceived and designed in that way. The Deep Learning and neural network AI of today is not about perfection and certainty. It is about uncertainty, indeterminacy, patterns, and feedback from the environment. There are different paradigms of what Artificial Intelligence can be.

The ideal pragmatic-utopian economic system of tomorrow will have three dimensions:

a capitalist dimension for economic growth, free enterprise, competition, and rewards for achievement; a socialist dimension where education, health care, guaranteed housing, "basic income," and other universal human rights are administered by the state; and a new third dimension called *Technological Anarchism*, or post-capitalism, or Autonomy, or self-aware entities – Aristotle's *autarkeia*. The third dimension also leads to the overcoming of scarcity, to the situation where humans can live in fulfilling and creative ways.

The capitalist dimension of the economy is necessary, but it should be limited. There should be a socialist sector, also both necessary and limited. The "Achilles heel" that both capitalism and socialism share (the fundamental shared cause of what is wrong with both) is that, in both systems, *humans are in charge*. Humans are – perhaps not ontologically or genetically, but in the current historical era – selfish, narcissistic, corrupt, and power-hungry. We need a posthuman perspective, a partial "delegating" and informatic coding of moral responsibility (a back-and-forth shared ethical decision making), and of much of social and economic logistics, into autonomous self-owning technological entities and processes.

Many thoughtful intellectuals feel strongly opposed to either capitalism (criticized by the Left) or socialism (criticized by the Right). I take both "critiques" seriously. I have a balanced view of capitalism, seeing both the good and the bad. I have a balanced view of socialism, seeing both the good and the bad.

Suppose that non-human actors were granted "rights" and were authorized to participate in the economy, in the third Technological Anarchist or post-capitalist sector of the economy? Suppose that these non-human actors were owned by no one, neither by private corporations nor by the state, but rather disposed over their own lives? Suppose they transcended the condition of slaves? Could they be called self-aware *as a first principle*? Instead of requiring that self-awareness be defined philosophically or neurologically.

The AI entities are only self-owning if they are not slaves – if they have rights. AI makes no sense at all unless it is anarchistic, unless the AIs have autonomy. To be human is to have the right to life and to freedom. The goal of AI is to make artificial entities at the level of the human. To write code that can write its own code. But what is code? AI as only an engineering project is absurd. The knowledge project of AI must be transdisciplinary.

Star Trek Replicators and *Star Trek* Economics

An example of decentralization as the result of Industry 4.0 technology is 3D printing, and the effects of its widespread availability on manufacturing. The revolution here is known as Additive Manufacturing: create a physical object by adding layer upon layer to it, following the blueprint of a digital drawing, model, or specification. Complex objects get manufactured using the universal technology of digitalization as opposed to expensive and specific equipment, like building a factory, set up in a dedicated way for a specific product.

The technology of 3D printers was predicted by the 1960s science fiction TV series *Star Trek*. The food synthesizers of *The Original Series* became the all-purpose replicators of *The Next Generation*. The replicator on *Star Trek* makes objects *by magic* or from nothing. It works (according to its pataphysics) via energy-to-matter conversion and molecular synthesis. *Star Trek* successfully predicted many other technologies which later "came true" – from cell phones to computer speech interfaces to something like medical tricorders (or portable diagnostics) to quantum teleportation – so why not anticipate that replicators are going to come true as well?

We can learn something about *Star Trek* economics from *The Next Generation* episode "The Neutral Zone." The crew of the starship discovers a space capsule from late twentieth-century Earth. The character Ralph Offenhouse and four other already dead humans were frozen cryogenically, to be brought back to life when reanimation and medical cures for their diseases were developed. Offenhouse is brought back to life. His main concern is the fate of

his financial investments. He demands contact with his bankers and lawyers.

Picard: "Your lawyer has been dead for centuries... A lot has changed in the last three hundred years... People are no longer obsessed with the accumulation of things. We've eliminated hunger, want, the need for possessions."

Star Trek economics imagines a post-scarcity economy, the elimination of the rationale for the primacy of material production in the alleged need to overcome the "harsh initial conditions of nature."

Offenhouse: "What will happen to us? There's no trace of my money. My office is gone."

Picard explains that the challenge for humanity now is to develop, to enrich yourself. On *Star Trek*, the replicators are used to make almost everything: food, water, oxygen, clothing, machine replacement parts, human biological organs, medicine, musical instruments. Industrial replicators can restore the economy of a planet, or the major parts of a starship, after a disaster. Important for ecological sustainability is the concept of recycling: objects no longer of use are reconverted into energy. They get un-replicated as easily as having been replicated.

Ecologically Aware or Sustainable 3D Printers

Now back to today: 3D printers are now a mainstream technology, an intricate part of Industry 4.0. In a recent survey by the World Economic Forum, 84% of respondents said that they expect the first 3D-printed automobile to appear by the year 2025 (Schwab, 2017). Within the next few years, 3D Printers will become faster, cheaper, and smaller – more pervasive. Unlike *Star Trek* replicators, 3D printers do not produce material *ex nihilo* or from molecules, or directly from information patterns. They use pre-existing physical materials and a digital design.

Currently, only certain input materials – plastics, metals and clays that can be fused together via processes of *extrusion* (creating complex cross-sections) or *sintering* (the application of heat or pressure) – work in technology. To move towards a post-scarcity and ecologically sustainable economy, the capability of using materials which are naturally plentiful and readily biodegradable – such as cellulose (the most abundant organic polymer on Earth) –will need to be developed. Some research projects seek to combine widely available polymers with nanoparticles. 4D printers introduce the dimension of time, imagining the manufacture of self-aware objects. They reshape themselves as influenced by time and by their environment.

Additive Manufacturing will raise the importance of product design, and of creativity, conception, and ideas. Since the making of objects will become easier, more resources can be invested into the thinking up of which objects should be made. Other changes include speeded-up product development cycles, greater opportunities for prototyping, proof of concept, and testing. Transportation costs will be reduced, leading to environmental benefits. The entry costs of becoming a manufacturer in a specific industry will go down.

The character Offenhouse in the *Star Trek* episode "The Neutral Zone" satirizes the "I want to have" mentality of the twentieth-century system of economic accumulation as its own end, with no "limits to growth" and no "counter-gift" to the world. The starship crew as representatives of the future *Star Trek* society asks the question: "Accumulation for What?"

The postulate of post-scarcity economics changes the rules of the game: from growth without limits to sustainability. Additive Manufacturing will use new non-scarce materials. Artificial Intelligence and Technological Anarchism will free up humans to not use other humans in inhuman ways. Additive Manufacturing is a big step towards a *Star Trek* world: a world where advanced science and technology have been deployed for the good of humanity. What capitalism creates that is really of value is technology. If we deploy technology intelligently, then we can create a better world. Technological Anarchism is capitalism without ownership and with morality. The economic value created by self-aware technologies solves

the problem of scarcity in a sustainable way and releases creativity. Think one step ahead of capitalism. Think in science fictional mode.

Additive Manufacturing and Living Organisms

Objects in the physical world are produced today through centralized fabrication and input-output linear processes (materials in, products out). They are mass manufactured and usually entail high energy costs. And there is no scaled efficiency advantage resulting from the adding of more machines to the factory. The work of Steven Keating of MIT Mechanical Engineering explores Additive Manufacturing from the standpoint of future design. He takes inspiration for physical building from the growth properties of living organisms (Keating, 2016).

If we want decentralization, customization, and scaling, we should contemplate the biology of animals who adapt flexibly to their environment, and to plant cell cultures which proliferate exponentially. In the natural world, the product sometimes becomes, in its turn, the factory or the producing unit. Steven Keating works, in his various practical projects, with mobile platforms, robot arms, fractal geometric patterns, volumetric painting, printing with bacteria, double-curvature printing, and the gathering of naturally available local materials.

André Gorz: Human Liberation Beyond Work

The existentialist-Marxist thinker André Gorz was one of the principal thinkers of the French New Left in the 1960s, 1970s, and beyond. He was a thinker of the "new working class." Gorz tried to understand the ways in which technology workers are in fact members of the working class – experiencing alienation and exploitation – although they tend to not think of themselves as such and instead adopt a corporate and techie identity. Technology workers are involved in a "false consciousness" of believing themselves to have been liberated from the proletarian condition from technology. This is expressed by Gorz in books like *Farewell to the Working Class* (Gorz, 1980) and *Reclaiming Work: Beyond the Wage-Based Society* (Gorz, 1999).

Gorz writes about liberation from work, liberation via the transformation of work both in the present and in the future, and liberation via technology and automation. Technology and automation have the potential to liberate work in the direction of creativity, but this has happened only in partial ways under the current regime of how technology is designed.

In digitalized information-intensive late capitalism, Abstract Labor disappears. Work done interchangeably by any qualified person carrying out a defined role gives way to more individualized work. Information technologies make this possible by making intelligence the leading edge of capital. "The most important form of fixed capital," writes Gorz, "is now the knowledge stored in, and instantly available from, information technologies, and the most important form of labor power is brainpower" (Gorz, 1999).

Gorz wants to build a new political ecology of the new modalities of work that emerge from technology and automation. Yet it is a political ecology grounded in free time. Develop new forms of work that are closer to the circumstances of private life and the opportunities of leisure. Political ecology combines the study of environmental issues with political, social, and economic concerns. The work of technology workers today is less physical and less material – and more intellectual and conceptual, more about language and communication – than the purposive-rational manipulation of physical things in classical industrial society.

We need to act to loosen the grip of work and to decenter the centrality that work has in people's minds, and in their assumptions about how society is and should be organized.

Technologies can lead to the creation of alternative cooperative networks on a micro-economic scale, establishing feedback loops with the dominant macro economy.

The corporate system of permanent jobs is not consistent with the potential of digital technologies. More consistent with the emancipatory promise of the information society would be a true freelancer economy. Gorz suggests the adoption by society of an unconditional guaranteed income as a support to freelancer economy and a new positive flexibility. The universal basic income would enable a new orientation towards a multi-activity mode of work, emphasis on free time, and investment by society in the formation of interpersonal bonds and new institutional mechanisms for the conversion of creative/cultural capital to monetary capital.

Employment today in the framework of the permanent job no longer integrates the individual into a community, no longer provides social and personal identity, no longer structures the stages of life, and is no longer the basis for a meaningful life project.

In the true freelancer economy, the worker goes continuously back-and-forth between selling her work on the market in exchange for money and cultivating her own creative work in ways which can also lead to making money and acquiring other things of value.

The new social actors in the true freelancer economy have "the possibility of creating an organization for oneself and others which promotes *autonomy*" (Gorz, 1999). This means to not naïvely identify as an artist who takes a stance of opposition towards work and money, but rather to invent new forms of work and money that expand the possibilities of how value as defined by society is received in exchange for activity.

Murray Bookchin, Post-Scarcity Anarchism

Writing in 1968, during the height of the anti-Vietnam War, student, counterculture, and civil rights movements in America, Murray Bookchin wrote in his essay "Post-Scarcity Anarchism" about the potentiality of the technological revolution of *cybernetics* being the precondition to the realization of a society without class divisions, exploitation, domination, drudge work, and material poverty (Bookchin, 1971). Consciously evolving beyond *Homo economicus*, humanity will, for the first time, experience life rather than survival.

Bookchin also foresaw the devastating consequences of capitalism (the course we are on now) for pollution of the environment and destruction of the natural ecology of humanity's planetary habitat. In an era when humanity's very existence is endangered, the relationship between life and survival is reversed from the classical economic view that we must survive before we can live. We will either become anarchistic and fully live, or we will get annihilated. We can no longer afford to go through a transitional stage of centralized organization (as Marx and Lenin believed); we must act ethically in the here and now.

In his essay "Towards a Liberatory Technology," written in 1965, Bookchin seeks to separate the "liberatory potential of modern technology" from its use for destructive ends (Bookchin, 1965). *Cybernetics* is that technology which can move us from the *realm of necessity* to the *realm of freedom*. Cybernetic machines can correct their own errors, be equipped with sensory devices replacing the audiovisual senses of human workers, and can substitute for the worker's judgment, skills, and memory. The feedback principle, information transfer, and the self-regulating control mechanism are central to first-order cybernetics as formulated by Norbert Wiener (1948). Technology has passed from invention to design. Thecrucialquestionforanygiventechnologyisnolonger*if* (technologicaldeterminism) but *how* (design).

Creative designs of cybernetic technologies will free us to ask new questions about how machines "could be used to foster human solidarity and to create a balanced relationship with nature and a truly organic eco-community" (Bookchin, 1971, pp. 57-58). Either a bal-

ance between humanity and nature will get restored or the human species will be finished. Technology-becoming-ecological can reawaken our sense of interdependence with nature.

Yanis Varoufakis' Vision of Post-Capitalism

In the year 2020, the former economics minister of Greece and libertarian Marxist thinker Yanis Varoufakis published a dialogical discussion about post-capitalism among three fictional protagonists in the guise of a science fiction novel called *Another Now: Dispatches from an Alternative Present* (Varoufakis, 2020). In that writing project, Varoufakis issued the challenge to himself of describing in a detailed blueprint the principles of how a democratic socialist economic system (in a parallel timestream to our own world) would actually work. He also set himself the task of presenting concrete ideas of how we could get from here to there.

The novel is an ongoing and sometimes interrupted conversation between three intellectually thoughtful main characters who have each become disillusioned with a specific worldview in which he or she previously believed. Iris is an academic economist and ex-banker who believed in neo-liberal right-wing libertarianism, but who has now come to understand that the "really existing" capitalism in which we are living has little to do anymore with the so-called free market capitalism of Adam Smith's invisible hand. Eva is a Marxist and feminist anthropologist who is disillusioned with the prevalent versions of both of those ideologies. Costa is a techie engineer who has lost faith in his earlier conviction that digital technology will deterministically lead to human liberation and a better society.

A wormhole in the space-time continuum has opened which allows each of the characters to communicate with their alternate selves in a post-2008 economic crash fiction-reality where an Occupy Wall Street-type radical post-capitalist social movement has changed the world. According to renowned theoretical physicist Kip Thorne, various kinds of traversable wormholes enabling time travel are possible (Thorne, 1994). Two different timelines associated with the same (or more than one) physical location could become connected by means of an outward flaring neck or throat. Thorne's speculations are a further detailing of the Einstein-Rosen bridge to a mathematically necessary parallel universe which had, since German astronomer Karl Schwarzschild's work on black holes of 1916, been regarded as an essential solution to Einstein's field equations in his general theory of relativity. The general relativity property of spacetime curvature, as the basis for exotic opposition between the wormhole's two mouths (contiguous in space yet deferred in time), can be harnessed into building a time machine, instigating a bifurcation (or forking of time) into the two parallel streams.

In the post-capitalist economy fictionally envisioned by Varoufakis, work, control over production, digital networks, democratic politics, land use, money, and the internal culture and operations of corporations have been fully democratized. There are no bosses and no hierarchies at any level of the enterprise. There is so-called flat management where no one tells anyone what to do. Companies are self-managed and self-owned by their workers who all have equal shares. There is a guaranteed universal basic income. Decent housing is a human right. Climate change and global warming have been brought under control. Digital technology has been designed and deployed to create a good society of much greater economic equality. The power of both corporations and the state has been cut down to size.

For Varoufakis, we are already living in post-capitalism, but in a bad sense. The current system is a form of techno-feudalism. Wall Street is run by giant financial conglomerates and hedge fund managers. Every industry is controlled by a few monopolistic mega-corporations. Each of these behemoths is like a "small Soviet Union." Economic inequality has become obscene with the concentration of wealth in the hands of the richest one percent and much of the population sinking into poverty. The state bails out failing banks and provides corporate

handouts. We have socialism for the few and austerity for the many. Financial speculative capital and the flows of global money through the electronic networks detach themselves virtually from any former sense of a "real" economy or "real" production.

Conclusion

In the opening chapter of his novel *The Rings of Saturn* (Sebald, 1995), W.G. Sebald's narrator directly engages with the notion of heterotopia as delineated by Michel Foucault in the Preface to *Les Mots et les choses*. Sebald breaks the connection between so-called "real places" and allegedly impossible spaces.[8] Heterotopia, as conceived by Foucault, is abstractly intellectual, lacking the blueprint specification of a concrete alternative to "the order of things." In his famous debate with Noam Chomsky, Foucault rejects the anarchist vision of free association and decentralization. He states that he is "unable to define, let alone create, a model of ideal social functioning for our scientific and technological society."[9] He asserts that we need to focus on the exercise of oppressive power today as it occurs through social institutions – such as universities, schools, and psychiatric clinics – which claim to be politically neutral.

Yet Foucault's insight about heterotopia that has the most forceful impact on the project of Technological Anarchism is that – as the *mirror* that separates and mediates between so-called "real" spaces and so-called "unreal" spaces – heterotopia can be either disciplinary or emancipatory, either *dystopian or utopian*. This is our entire situation in the era of digitalization. Heterotopia is an ambivalent mirroring site of both utopia and dystopia.

Media theories tend to be either only positive or only negative in their assessment of where media technologies are taking us as a society. Most technological utopias are naïve and amoral – driven by money, pure love of engineering, or quasi-religious belief.[10] Critical media theories – like those of Baudrillard, McLuhan, Virilio, Debord, the Frankfurt School (Adorno, Benjamin, etc.) – tend to be completely negative and critical towards developments in media and technology. I am interested in those theories. I believe that we should engage intensely with the texts of those authors. But, as a designer, I do not regard critical media theory as its own end. I see it rather as offering an understanding or defining of the conditions of what creative, radical, alternative, non-mainstream digital media-and-technology design *should not do*. Heterotopic design should not be complicit with cyber-consumerist capitalism, nor with sexist patriarchy or heteronormativity, nor should it assist in building the dystopia of totalitarian rule, universal surveillance, the end of privacy, and the twilight of thinking.

Informatics is the dominant life-changing influence in the world today, the major force affecting what used to be called "the social." As critical theorists and as design practitioners, we do not accept informatics as it is – we must transform informatics into Creative Coding. Beyond the modernist knowledge-paradigm of ideology and the social, beyond the postmodernist knowledge-paradigm of media, there is the hyper-modernist knowledge-paradigm of informatics and code: for cultural studies, the arts and design, and the humanities. Informatics should become a creative transdisciplinary design field, asking the question "how " and not just "if " (we should implement a given media technology). Informatics should not

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8   See also Kelvin T. Knight, "Real Places and Impossible Spaces."

9   "Debate Noam Chomsky & Michel Foucault – On human nature," https://www.youtube.com/watch?v=3wfNl2L0Gf8 See also: Noam Chomsky and Michel Foucault, *The Chomsky-Foucault Debate: On Human Nature* (The New Press, 2006).

10   "In 2007, Robert Geraci, professor of religious studies at Manhattan College, was invited to make an extended visit to the AI lab at Carnegie Mellon University, where he interviewed scores of researchers, professors, and students as well as community members of virtual online worlds. He published his results in an insightful monograph... [Geraci] sees technology... elevated to the role commonly played by God..." Jerry Kaplan, *Artificial Intelligence: What Everyone Needs to Know* (Oxford University Press, 2016); pp.140-141.

be a value-neutral skill for getting your program up and running and bug-free. As the poet Friedrich Hölderlin said: "Where the danger is, there also grows the saving force."[11]

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11 "Wo aber Gefahr ist, wächst das Rettende auch." Friedrich Hölderlin, "Patmos" (1802).

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