OTHER THEMES

Thinking about Technologies from Gilbert Simondon and Yuk Hui

Andréia Machado Oliveira[I, II]

[I]Universidade Federal de Santa Maria (UFSM), Santa Maria/RS – Brazil
[II]University of the Witwatersrand (WITS), Johannesburg – South Africa

ABSTRACT – Thinking about Technologies from Gilbert Simondon and Yuk Hui. In this paper, we point out the importance of problematizing current technologies from the philosophers Gilbert Simondon and Yuk Hui who alert us to the urgency of a technological thinking that is directed towards an education of technology against alienations that arises from positions that dissociate culture, technology and nature. With the aim of thinking about other alternatives against technological alienation, we approach some ideas about technological education, technical culture and post-human. Simondon makes us think about the operationalities of how machines work and the values they allude, Hui urges us on a new program of technological knowledge based on his concepts of cosmotechnics and technodiversity.
Keywords: **Technology. Alienation. Education. Gilbert Simondon. Yuk Hui.**

RESUMO – Pensar as Tecnologias a partir de Gilbert Simondon e Yuk Hui. Neste artigo, apontamos a importância de problematizarmos as tecnologias atuais a partir dos filósofos Gilbert Simondon e Yuk Hui, que alertam sobre a urgência de um pensamento tecnológico contra alienações que decorrem de posturas que dissociam cultura, tecnologia e natureza. Com o objetivo de se pensar outras alternativas contra a alienação tecnológica, o texto aborda algumas ideias sobre educação tecnológica, cultura técnica e pós-humano. Simondon faz pensar sobre os funcionamentos das máquinas e dos valores que elas aludem; Hui, sobre um novo programa de conhecimento tecnológico a partir dos seus conceitos de cosmotécnica e tecnodiversidade.
Palavras-chave: **Tecnologia. Alienação. Educação. Gilbert Simondon. Yuk Hui.**

Introduction

In this paper, we point to the need to problematize current technologies in the face of the complexity of the world we live in. What is the reason for the need for so much technological innovation focused on technological accelerationism, wanting to dictate our future under a solid capitalist basis? Recently, Facebook, with its history of disrespecting data privacy, launched its Ray-Ban Smart Glasses with Virtual Reality with the purpose of replacing mobile phones and installing the Metaverse in our everyday lives, merging virtual reality, augmented reality, and the Internet.

With investments from Google, Baidu, and Tesla, there is an increase in the development of self-driving cars driven by artificial intelligence; chatbots present in social networks and platforms mediate our choices and may promote parallel worlds with fake news and deep fakes; not to mention the space exploration that presents itself with spatial tourism, promoted primarily by the private American economy, or the dispute of lunar territory and informational power about space among the great nations. Stories that circulate more and more in our daily media, boosting a technological reality that needs to be critically questioned by various areas of knowledge in the sense of what we need to learn from and be cautious with these technologies.

These examples do not disqualify current technologies since, as technology philosopher Yuk Hui (2016; 2019; 2020) has mentioned in his speeches, there is no capitalist technology but rather capitalist uses of technology. When we speak of technology, we choose to mention it broadly, thinking of technological practices that include analogical, mechanical, electronic, digital, and quantum practices, and others to come, not reducing only to digital technologies. Currently, we observe the attempt to unify technologies as being only digital, as if we were all hostages to artificial intelligence and its robots, being led and determined by a superintelligence that appears on our horizons. We have heard discourses in the media that somehow, intentionally, generate fear regarding the technological domination that can probabilistically predict our behaviors and future choices. Discourses that somehow subjugate local cultures and diversities of technological practice to promote the strengthening of universalizing technologies.

However, we understand that such discourses of technological dominance need to be deconstructed, given that they seem to be outdated distorted views of technology that position technology contra culture or vice-versa, sometimes as technophilic idolization, other times as technophobic repudiation. In other words, technology is sometimes subjugated to humans as a mere tool and instrument, and other times is idolized as a perfect model of existence, such as robots, to which souls and separate, autonomous existence are attributed, with their own desires, against lazy, idle, and obsolete humans. Such collocations are no longer supported and lose their discussion value at the moment humans and non-humans are implicated and agencies in

the same individuation process, constituting collective computational bodies. We know that technologies have never been good, evil, or neutral; for example, the discovery of the potential of maritime technology at the time of the Great Navigations of the 15th through 17th centuries caused the expansion of continental communications and cultural and economic exchanges; however, at the same time, it led to the increase in slave systems and the extermination of native peoples, extermination that, unfortunately, still remains, as we see in the current attempt of the Brazilian government (2018-2022) to approve the Temporal Framework (*Marco Temporal*) on indigenous land rights (Oliveira, 2020).

Just as such distortions do not exist, it must also be understood that neutrality does not exist. Some theorists are already alerting us in this regard: Nestor Canclini (2003), when posing that the informatization processes of the hybrid culture we live in also generate excluded people; Félix Guattari (1992), when explaining that information and communication technologies are evidently a mix of enrichment and impoverishment, singularization and massification, deterritorialization and reterritorialization, potentiation and depotentiation of subjectivities; and Gilbert Simondon (1989), when alerting that, in every techno-aesthetic object, there is an adaptation to the environment that, when directed at an augmented specialization, arising from the use or manufacturing conditions, causes what he terms hypertely.

With that said, in this article, we avoid both denialist and salvationist positions regarding technologies, addressing some ideas about technological education, technical culture, and the post-human, in order to contemplate other alternatives against technological alienation, especially in education. Thus, our objective is to show that there are risks in either of the polarized and exclusionary stances in education. The technophilic idolization can lead us to adopt positions that affirm an ideology of technological singularity, understanding it in a universal and hegemonic manner. On the other hand, technophobic rejection can make us hostages of technological programs by ignoring the workings and modus operandi of machines. We emphasize that both stances generate technological and cultural alienation, particularly in the current moment with algorithmic technologies that aim for universalization and present themselves as highly complex, sealed black boxes.

From this perspective, we inquire about the modes of use, application, and functioning of the technologies at each time, with them being in the tension between trends that are deterministic or not. Simondon (1989) discusses the indetermination of machines as inventive possibilities that escape the conditioned automation and alienation, given that

> [...] each piece in a concrete object is not only what it has, in essence, to correspond to the execution of a function desired by the builder, but is a part of a system in which a multitude of forces are exerted, and effects are produced regardless of the manufacturer's intention (Simondon, 1989, p. 35, author translation).

Currently, with artificial intelligence, technological automatism is at a threshold between the optimization of computational functions in the presence of a large number of data, bringing significant benefits to various fields, and the programming of control and surveillance algorithms with perceptive, cognitive, affective, aesthetic, and behavioral manipulations, leading to systems that are more and more homogeneous, exclusive, and obscure, becoming virtually inviolable black boxes.

Instead of thinking that technologies threaten us, in catastrophic views, or save us as if they were the only alternative to solve our problems, we need to assume that technologies are replicating, with great acceleration, including and excluding patterns that historically we already bring, i.e., one's automation is not part of their autonomy as a technical individual. Hence, we ask: what is our social and pedagogical responsibility within this latifundium of technological information and productions?

Our reflections and problematizations will be guided primarily by the thinking of two technology philosophers: Gilbert Simondon and Yuk Hui. French philosopher Gilbert Simondon (1924-1989) was a philosophy, engineering, psychology, ethology, and cybernetics scholar, a pupil of Georges Canguilhem and Maurice Merleau-Ponty. His main works are based on the ontogenesis of relation that address individuation processes and revisits the concepts of image, environment, perception, information, technology, and aesthetics. At present, Simondon is considered a theorist of great relevance in interdisciplinary studies on digital media. Chinese philosopher Yuk Hui is trained in computer engineering and philosophy, with studies on the contemporary discourses and practices directed especially towards cybernetics and artificial intelligence, addressing concepts such as cosmotechnics and technodiversity. He is also renowned for his expertise on the thought of Martin Heidegger, Gilbert Simondon, and Bernard Stiegler. Simondon (2008, 2015, 2017) drives us to study, in detail, the operationalities of the functioning of machines and the values they allude to, while Hui (2016, 2019, 2020) instigates us to explore a new technological knowledge program from his concepts of cosmotechnics and technodiversity.

Therefore, we seek to define the theoretical convergence between Gilbert Simondon and Yuk Hui to address technological thought directed toward technological education against alienations that stem from stances that dissociate culture, technology, and nature. A form of technological thought that fosters technological education that, on the one hand, questions the humanists (substantialists) that exclude technology from knowledge production, and, on the other hand, with the radical transhumanists who position technology as universal and as redeemer of humanity. In this sense, both philosophers redeem the human – technology – nature relation, looking to explain human existence in terms of the technical reality surrounding it.

Technological education against alienation

Upon observing that we are increasingly submerged in digital technologies and that ever more ignorance about them persists, we ask: what justifies this continuous technological alienation? We know that technological alienation is sustained in the dichotomies between humans and nature, culture and technique; a revision of such dichotomies is necessary. To Simondon, the technology humans bring is not against nature, but in its favor, in case this technology is in the mediation of humans and the natural[1]. As the author poses, "the most stable and universal mix in the natural world with the human world is the set of technical beings" (Simondon, 2017, p. 237, author translation), and which simultaneously humanizes us and links us to the natural world. As pointed out by Bruno Latour (2012), human existence is intrinsically tied to the existence of technical objects, with there being no human essence or nature, given that we humanize ourselves together with technical beings. The process of humanization is artificial.

However, although inseparable from human existence, we need to analyze the relations mediating the natural and human worlds. For mediation to be beneficial, the technical beings must interfere collaboratively with the natural world from the understanding and respect for its own dynamics, given that, in this interference, "the technique is typically an acceleration of natural processes" (Simondon, 2017, p. 163, author translation). In contrast to collaborative interventions, we also observe predatory interventions, which occur in opposition between nature and technology, positioning the natural world as an object to be excessively exploited, as we have seen throughout the Anthropocene. That is, not only does the acceleration of natural processes incur, but, more drastically, an alteration and transformation of the natural processes at the physical, chemical, and biotechnological levels. There is an explicit desire for human sovereignty over the natural world, where technology ceases to be a mediator and becomes sovereign over nature. In this sense, faced with the complexity of contemporary technologies, we need to consider how to steer ourselves towards actions that entail collaborative intervention and question predatory interventions with nature.

According to Simondon, "humans are not the masters of nature" (Simondon, 2017, p. 197, author translation); on the contrary, nature is the great master that leads us. He goes against Cartesian thought that places humans as sovereign and superior to nature. In his books, Simondon brings countless examples of collaborative interventions with nature, such as the implementation of solar and wind energy or the construction of transmission antennas that expand the natural landscape; he also brings concerns regarding excessive consumption and uncontrolled exploitation through predatory interventions that lead to environmental problems such as pollution and the development of destruction techniques such as nuclear weapons. Therefore, in the mediation of the natural and human worlds, technologies must be conceived from

the psychosocial agency with nature, given that "[...] the technique, the operation of humans with nature – *art et nature* – engenders itself and is reborn from itself [...]" (Simondon, 2017, p. 155, author translation).

Currently, the functionings of digital machines show us that they are not disconnected from nature: for a data cloud to be able to operate, it requires a lot of physical space and water to cool it, and we know that such computational agglomerates cause a significant emission of carbon gas; also, there is intensive extraction of mineral resources to manufacture computational machines, and we require a large amount of "human resources" for the creation of data characterized in neural network datasets. In other words, technique and nature are indissociably tied, and humans are not exempt from the responsibility of intervention, given that "humans are capable of assuming the relation between the living beings they are and the machines they manufacture; the technical operation requires a technical and natural life" (Simondon, 2008, p. 143, author translation). Simondon does not exclude the human responsibility for the techniques humans manufacture, as he puts it:

> We accuse the technical object of rendering humans slaves: this is perfectly true, but humans, in reality, are slaves to themselves because they accept it when they surrender themselves to technical objects; they surrender to them as a soul surrenders to the devil due to desires for power, glory, or wealth; the temptation does not come from the object but from what individuals believe they see in the object they mediate (Simondon, 2017, p. 349, author translation).

Thus, technological alienation primarily involves the alienation of humans from themselves, from their desires and behaviors manufactured and arising with/from the technical objects that surround them, becoming a slave to the same desires and behaviors. From this perspective, Simondon highlights in his writings the importance of education for technologies from school education onwards, which we could think of nowadays as literacy for digital technologies since the elementary level. When speaking about education for technology, he differentiates learning and training, alerting that "an education that replaced true learning with professional training would encase each individual in a social fatalism" (Simondon, 2017, p. 236, author translation) or that "early professional training, the fruit of abusive specialization, provokes an overadaptation and, consequently, social rigidity" (Simondon, 2017, p. 234, author translation). In contrast, technological learning leads to understanding technical and natural, technical and psychosocial, engagements, and, consequently, dynamism and cultural and social transformation.

When he would teach students in the twelve to thirteen-year-old range, Simondon would emphasize such engagements and mutual respect among humans, nature, and machines; in his words:

> I stated that machines are not slaves or utility instruments, valid only for their results. I taught them to respect

> those beings that machines are, substantial intermediaries between nature and humans; I taught them to treat them not as servants but as children. I defined their dignity and demanded uninterested respect for their imperfect existence (Simondon, 2017, p. 202, author translation).

To attribute dignity to machines is not to give them sovereignty but to provide the opportunity for a mode of horizontal relation between humans and machines, between humans and the reality that surrounds them. This education for technology designed by Simondon was based on practical and theoretical moments and on a division into progressive technological development steps according to the age range. According to him, culture and technique meet in mental contents that should be part of education: "[...] the learning of culture should extend until adulthood, and that of technicism must be addressed earlier; this way, a dualism that is largely an artifact of education could be attenuated" (Simondon, 2015, p. 29, author translation).

In mentioning Simondon, Hui poses that "technology is the concretion of mental schemes influenced by social and political structures contained in human society, but also because both are transformative by the technical reality" (Hui, 2020, p. 161). This dualistic attenuation often occurs in indigenous cultures, in which the culture remains active with its cosmologies until adulthood, and learning the techniques is part of children's lives early on. This differs from what we observe in our western culture, in which there is a lack of cosmological sense and cultural recognition in adult life and a lack of knowledge of techniques and technologies in children's lives as if everything is given and ready to be consumed.

In the direction toward a technological education that aims at an understanding of nature and technique relations, in the text *The Birth of Technology*, 1970 (Simondon, 2017, p. 164-173), Simondon pointed out four historical moments of technological development: pre-agricultural and pre-pastoral, agricultural and pastoral, industrial, and cybernetic. In the first moment are the pre-agricultural and pre-pastoral techniques such as hunting, fishing, and collecting, with the technique being "the art of happy encounters between humans and nature", in which nature produces according to its cycles, with calendars that regulate human labor. In the second moment, the production occurs mutually between humans and nature; there is a regular exchange between them with a collaborative technological intervention, with animal domestication, horticulture, and artificial irrigation appearing, interferences based on intuitive care for the land. As Simondon writes:

> We will allow ourselves to point in particular to the value of a culture based on the direct intuition of plants and animals. The knowledge of the seasons, the love for animals, and the folklore of all regions provide the small farmer with the awareness of a direct relation with the things of life (Simondon, 2017, p. 233, author translation).

In both cases, the tools expand human gestures, and there is a friendly relation with the techniques that do not clash with nature. Tools appear as technical elements that artisans/farmers regulate with their associated environment from transmitted technical knowledge. According to Simondon,

> Therefore, this is not about a technique as a means but as an act, as a phase of a relation activity between humans and their environment; during this phase, humans stimulate their environment, introducing modifications to it; these modifications develop, and the modified environment offers humans a new field of action that requires a new adaptation and elicits new needs (Simondon, 2015, p. 24, author translation).

There is a recursive activity between humans and nature caused by the technical act. However, in the third moment of the technique (beginning of the 17th century), tension starts to appear between technique and nature: a threat that technics will come to destroy nature, of replacing humans in their labor, i.e., there is a sense of exploitation of both nature and human labor, with the alienation of humans relative to the technique and the rule of the technique over nature appearing, as made explicit in the movie *Modern Times* (1937) by Charles Chaplin: a technical alienation incorporated into the body, causing a psychosomatic fabrication of docile and automated bodies, even in their leisure times. At this moment, there is a dissociated view between the mechanical and the organic; in factories, workers are organizers and supervisors of autonomous machines with their own paces and conditioning, which even condition and alienate the workers themselves.

Simondon criticizes Karl Marx (1818–1883) when he considers only the economic alienation of workers relative to capital. For Simondon, it is necessary to add the alienation to technology, to technical objects, which, according to him, is the worst of all. The machines in factories are technical individuals, with it being that now it is the industry that regulates the associated environments of these individuals. The craftsman becomes an alienated worker, no longer regulating tools or machines, because they lack the technical knowledge of these machines. Instead, this knowledge is centered on the engineers, who, in turn, are unfamiliar with the operation of the machines. Simondon poses that the alienation will only end "if humans intervene in the technical activity in their double title of workers and the object of the operation" (Simondon, 2017, p. 266, author translation), of workers who know the technology and are transformed by it, being in a different situation from that of engineers, who only know it theoretically, or factory owners, who prioritize the financial ends.

When based strictly on economic purposes, technological progress is reduced to overproduction and excessive consumption, a cycle aimed at the consumption, production, and use of technological objects in the psychosocial relations that extends to our days in a capitalistic consumption overdose. A fourth technological moment appears with information theory, communication theory, and, especially, cybernet-

ics and intelligibility models. Distinct from previous mechanical automation, where the factory regulates technical individuals, computers emerge as technical sets linked and self-regulated by human action in automation processes, which may or may not be at the service of intensifying progress, overproduction, and consumption. According to Simondon (2008, p. 142):

> An elementary enthusiasm for self-regulating automatons causes us to forget that these are precisely the machines that most need humans; while the other machines only need humans as servants or organizers, self-regulating machines need humans as technicians, i.e., as associates; their relation with humans is at the level of the said regulation and not at the level of elements or sets. However, through this self-regulation, automatic machines may be connected to the technical set in which they operate (author translation).

When commenting about Simondon, Mills poses that, nowadays, computational machines present an openness in their indetermination possibility, with it being that "[...] the openness of the technological operation means the inventive powers of the technician, as a new kind of worker engaged in the technical activity, is requiredy to forge and regulate these new unities of meaningful operation" (Mills, 2016, p. 135).

The Simondonian idea of humans associated with machines goes against the current imagination of superintelligent and independent machines that exclude them. Computational machines appear as automatons that self-regulate and make their own decisions as if the construction of the patterns and ethical decisions made by machines did not go through human behavioral pattern and ethical choices. Differently, "Simondon argues that the human has an important place *among* the machines, working with this openness" (Mills, 2016, p. 136, *author's emphasis*), with their indetermination and interdependence. Such an association with machines that Simondon points out becomes more and more pertinent, complex, and interdisciplinary, involving technicians, engineers, philosophers, psychologists, designers, artists, sociologists, etc. in projects such as that of self-driving cars, in which the technological decisions made imply social behaviors and ethical conduct moderated by artificial intelligence.

For that reason, there is a biological and technological evolution for Gilbert Simondon (1989) that does not separate nature and technique, or culture and technique, given that it is not about technology as a tool/instrument but as an act inserted in the culture (Simondon, 2015). We have always been submerged in a certain technical culture; we subjectivize ourselves to technologies, produce them, and are produced by them. We speak in terms of technologies, which are not only digital, as "Don Ihde insisted that human bodies and technologies cohabit with each other in relation to particular projects or lifewords. In so far as I use a technology, I am also used by a technology" (Haraway in Jones, 2010, p. 123). Technologies are forms of subjectivity and determine ways

of thinking, acting, and feeling, just as individuals themselves create technologies according to their needs and desires, i.e., there is no way to separate individuals from machines, given that a subjectivation process is produced in which individuals and machines are simultaneously constituted from a psychosocial agency. Our own human historical timeline is separated by technological divisions: Stone Age, Fire Age, Metal Age... The First, Second, Third Industrial Revolutions, and now the Fourth Industrial Revolution 4.0, with significant automation, with the Internet of Things, Big Data, Machine Learning... a Fifth Industrial Revolution is already hypothesized with the modes of implementation of such technologies in relationships among humans, non-humans, and cyborgs.

We seek to put the nature of machines in the technical culture, given that what is defined as human nature is already part of a technological system. In The Mode of Existence of Technical Objects (1989), Simondon seeks insistently to integrate technology and culture, pointing out that "it is necessary for the technical object to be known in itself so that the relation of humans with machines is stable and valid: hence the need for a technical culture" (Simondon, 1989, p. 82, author translation). He criticizes approaches that understand the technique in only a utility mode, devoid of senses and meanings. Hence, we point out the pertinence of a philosophical approach to technology as a way to understand the individuation processes implied in the techno-aesthetic artifacts and their associated environments (Oliveira, 2020). A false opposition is found between culture and technique, as Arlindo Machado puts it: "[...] no reading of the recent or old cultural objects can be complete if the intrinsic 'logic' of the material and technical procedures that give shape to it are not considered relevant in terms of results" (Machado, 1996, p. 11, author translation, *author's emphasis*).

From this perspective that knowledge of human culture necessarily goes through knowledge of technologies, Simondon (2015) intentionally relates the word culture to the word cultivar, the plant and animal cultivation techniques of humans acting to modify the environment through technical gestures. Mills states that to "Simondon is explicit that culture is the use of technique for cultivating the human species" (Mills, 2016, p. 132). In principle, there is no conflict between culture and technique; they oppose when one of the parties is in a static position, in which self-regulation dynamics do not occur, in which both are changed: positively as a transformation, negatively as a hazard. To Simondon, "[...] 'Culture' is the set of techniques of direct human manipulation that each human group uses to perpetuate itself in stability" (Simondon, 2015, p. 23, author translation), and culture may be in sync with technique or against it or vice-versa, which we see in most cases. Culture positively regulates the social when it appears as a regulator of social values upon appropriating technological knowledge and negatively upon denying and alienating such knowledge.

In dealing with cultural and political matters, Yuk Hui alerts us that "in the colonization and modernization processes, the techno-

logical differences also preserve and reinforce power differences" (Hui, 2020, p. 83, author translation). For example, currently with technologies serving domination, such as facial recognition algorithms for the incarceration of convicted individuals: the vast majority of Brazilian prisoners are black, given that the social patterns of structural racism are reproduced due to the input of neural networks and the creation of datasets, to machine learning models and the outputs that result in future recognitions. In other words, the central issue does not consist of the opposition between culture and technology, as previously stated, that considers technology as guilty, neutral, or redemptive. However, we need to focus on how the relationships between culture and technology occur, while raising questions about notions of culture and technology presently prevalent, which may involve moments of friendship, tension, or overlap between them.

Posthumanism and technodiversity

To expand our view about technology and deviate from alienating and technocratic stances, we propose more comprehensive and non-anthropocentric approaches to it: approaches that point to alternatives that go beyond dichotomous and polarized stances between the human and the machine, or which emphasize a model of domination, sometimes by the human, sometimes by the machine, as well as a purist model that dissociates human and machine, in favor of universalist ideas about what we accept as human and as a machine.

As such, we note the need to review what we mean by human. Both Simondon and Hui point to the importance of problematizing and updating the concept of human and, consequently, of humanism. As Simondon puts it, "each time must discover its humanism, directing it toward the primary hazard of alienation" (Simondon, 1989, p. 121, author translation), while Hui states that "the concept of human is a contingent historical concept" and that "rejecting the concept of humanity is to shatter the illusion created by a unifying discourse of the human, connected to a modernization process as a form of synchronization" (Hui, 2020, p. 85, author translation). In recognizing that there is no human essence to be revealed or conquered, we think of humans as a multiple and diversified historical conceptual fabrication that needs to be revised in each place and time.

Posthumanist critic Rosi Braidotti (2017) also problematizes what we call human in the sense of the other non-humans, against the idea of a dominant individual (male, white, European) and an anthropocentric view. The author places posthumanism as a convergence of anti-humanism and anti-anthropocentrism, yet going further toward a more complex and current direction. She points to the need for a posthumanist approach that does not separate what is given (nature) from what is constructed (culture). On the contrary, she points to the contingent historical aspects of the nature and culture relation, considering the vital, self-organization, and non-naturalist structures (Braidotti, 2013). This

marks the importance of rethinking subjectivity as a collective agency that covers human and non-human actors in the sense of multiple compositions and collective practices of a posthumanist development (Braidotti, 2017).

Yuk Hui (2010) discusses posthumanism so as to avoid a homogeneous technological development based on a Eurocentric, deterministic, apocalyptic, and totalitarian view. By positing that, in posthumanism, humans are a technical existence, Hui indicates the importance of critical studies and problematizations of the human-machine relation: "the concept of the milieu is extended beyond human organs to analog and digital organs, constituting a new milieu characterized by an *inorganic organicity*" (Hui, 2019, p. 214, author's emphasis), in which the inorganic becomes organic. Hui points out two great lines of thought of the 20th century: organicism and organology. To Hui, from the beginning of cybernetics, it no longer makes sense to separate the mechanic and the organic, but rather to think of organo-mechanic.

> The cybernetic machines, especially the Turing machine, have a new status, since it is no longer a mere mechanism in the Cartesian sense, nor is it a living being. Instead, it is an *organo-mechanical* being: a mechanical being implemented in an organic form. (Hui, 2019, p. 151).

With cybernetics, Nobert Wiener "discovered a technical operation able to assimilate human behavior" (Hui, 2020, p. 165, author translation), with recursive implications between the organic and machines. With its notion of feedback, the interdisciplinary field of cybernetics accommodates recursive operations; it "allows the algorithm the effective absorption of the contingency for improving the computational efficiency. The intelligence emerges when it is no longer mechanical, i.e., when it becomes able to handle unpredicted accidents in its rules" (Hui, 2020, p. 167, author translation). Hui notes that when recursiveness gradually opens up to the system contingencies, it starts giving space to intelligence that operates recursively between cognition and the world (machine learning). We may relate the contingencies mentioned by Hui to the machinic indetermination's alluded to by Simondon, given that both open output alternatives of restricted programming towards the creation of unforeseen possibilities. "Simondon sees in the informational nature of cybernetic technology an indeterminism that is its saving grace" (Mills, 2016, p. 136), considering that such indeterminism is linked to interdependent relations between humans and machines.

According to Hui (2019), upon inserting the accidental and the contingent, organology deviates from anthropocentric and substantialist approaches to humans and culture. Organology is a line of thought from the 20th century and "Organology could be considered a materialist science, but it is not a materialism that opposes spirit and matter. Rather it seeks, at every opportunity, to allow spirit to exercise its freedom without producing the alienation of the soul" (Hui, 2019, p. 56). Organology is more focused on posthuman conceptions than transhuman ones. According to Hui's position, transhumanism (right-wing

radicalism) takes refuge in technology as the savior of the human, "in the desire for inorganic immortality" (Hui, 2019, p. 243). By improving its functioning based on the automatism imposed by current artificial intelligence, transhumanism aims to overcome an obsolete human. For Hui, transhumanists

> [...] on the other hand, take an opposite position and exploit technology to an extreme. They embrace functionalism (seeing the human as composed of functions that can be improved individually) and an interdisciplinary program for human enhancement, including information technology, computer science, cognitive science and neuroscience, neural- computer interface research, materials science, artificial intelligence, regenerative medicine and life extension, genetic engineering, and nanotechnology (Hui, 2019, p. 243).

There is a deterministic emphasis on automation systems, as Yuk Hui (2019, p. 17) alerts us:

> We will reflect on the increasing determination of technical systems realized in the new wave of industrialization, fueled by artificial intelligence, machine learning, and all sorts of surveillance technologies endowed with a transhumanist ideology that wants to overcome the limit of the human and politics.

Understanding that the current automation policy is a capitalist and colonialist policy of automatism that sees competitiveness as a solution, Hui (2019) criticizes the idea of right-wing accelerationism (as a continuity of Enlightenment thinking), such as that by Nick Land, who stated that the technological singularity in favor of the intensification of capitalism from the perspective of its self-overcoming: "[...] neo-reactionaries and transhumanists celebrate artificial intelligence in the name of a posthumanist triumphalism because superintelligence and technological singularity demonstrate the 'possibility of a sublime humanity'" (Hui, 2020, p. 86, author translation). Supported by strong artificial intelligence with unsupervised learning, the technological singularity foresees that we will arrive at a level of superintelligence that is omnipresent, omnipotent, superior to all others, and that converges on itself. Due to being so specific and separate from humans, it becomes singular and transcends it.

> Modern technology syncs non-western stories on the global time axis of Western modernity. Simultaneously an opportunity and a problem, the synchronization process allows the world to enjoy science and technology, but it also launches it on a time axis that, animated by humanism, is moving toward an apocalyptic end, whether in the form of technological singularity (the explosion of intelligence) or of the emergence of a 'superintelligence' (Hui, 2020, p. 85, author translation).

According to this accelerationist vision, only this hegemonic superintelligence would be able to manage humanity's conflicts eco-

nomically, politically and socially on a global time axis, since all information would be synchronized and conflicts could be predicted and programmed. This technocratic stance implies a "naïve" vision in which humans with geopolitical power interests do not exist.

According to Hui (2020), there is a convergence of time and synchronization with modern technologies at the global level, causing a unification and, later, an explosion of intelligence that reaches all uniformly. However, he also poses that there is a possibility of multiple differentiated bifurcations after the convergence into a synchronized global time axis, bifurcations stemming from localities and their cosmotechnics, from technodiversity practices, such as various technological practices that have been adopted by minority communities such as indigenous, *quilombola*, and aboriginal communities.

For Hui (2020), there is a convergence of time imposed, a synchronization with modern technologies on a global level, causing a technological unification and, subsequently, an explosion of intelligence that affects everyone uniformly. However, he also points out that there is the possibility of multiple differentiated bifurcations after convergence on a synchronized global time axis, bifurcations stemming from the diversity of localities and their cosmotechnics, technodiverse practices, such as the various technological practices adopted by minority communities, such as indigenous, *quilombola*, aboriginal, etc.

For example, we mention the project "*DNA afetivo: Kame e Kanhru*" (Affective DNA: Kame and Kanhru) as a technodiverse practice. This project has been operational since 2016 at Gormecindo Jete Tenh Ribeiro and Augusto Ope Da Silva *kaingáng* indigenous schools, which involved the children of the *kaingáng* communities of Terra do Indígena do Guarita km10, located in the northeast of the state of Rio Grande do Sul, and the Santa Maria community. In this project, creation laboratories were developed in which the children used digital technologies to produce photographs, videos, and graphic designs and contributed to elaborating a bilingual digital game that works with the hallmarks of *kaingáng* social structure Kame and Kanhru. author translation) - author's emphasis

> The digital game Kame Kanhru aggregated visual and audio images, gamification strategies, and playful interaction dynamics as another possibility of telling the same myths, traditions, and costumes. The culture of passing the Kaingáng wisdom down from the older to the younger is present in the creation process and in the objective of the digital game Kame Kanhru, which is intended primarily for children and the young school-age audience (Lorenci Mallmann et al., 2021, p. 193, author translation).

The project problematizes "how emerging technologies, when available and parts of the social realities of these peoples, may also be assimilated and related to the preservation and perpetuation of their cultural heritage" (Lorenci Mallmann et al., 2021, p. 193, author transla-

tion). From its demands, the *kaingáng* community uses emerging technologies, although appropriating other values, costumes, and knowledge, bringing their cosmologies to other technological practices. As Viveiro de Castro (2018, p. 21) puts it: "what every experience of another culture offers us is the occasion to make an experience about our own culture; much more than an imaginative variation" (author translation) or an exotic or speculative one.

In this sense, the construction of the digital game Kame Kanhru is not directed only to the *kaingáng* community but also to communities with distinct cultures in propitiating a diversified technological practice from their own cosmology. The digital game Kame Kanhru agrees with what Hui poses: "all non-European cultures should systematize their own cosmotechnics and the stories of these cosmotechnics" (Hui, 2020, p. 42, author translation). Hence, such a project somewhat shows how different cosmologies may make other uses of the synchronized technologies mentioned by Hui (2020) and how technological practices arising from different cosmologies may cause a revision of our own practices.

Yuk Hui stresses that "for us to be able to move away from this synchronization, by all indications, we will have to demand a fragmentation that will free us from a historical-linear time defined in terms of pre-modern, modern, post-modern, and apocalyptic" (Hui, 2020, p. 17), author translation. The power of fragmentation of a synchronized time that exists in the diversity of their way of life, their cosmopolitics, and their technological practices.

> We need to escape its global time axis, escape a (trans)humanism that subjects other beings to the terms of our fate and propose a new agenda and a new technological imagination that allow new forms of social, political, and aesthetic life and new relations with non-humans, the Earth, and the cosmos (Hui, 2020, p. 95, author translation).

In asking us about a global time axis, Hui confronts us with the current technological alienation in which we find ourselves:

> Why not consider another form of acceleration that does not take the speed to its extremes but rather changes the direction of the movement, that gives technology a new reference and a new orientation regarding the respect for time and technological development? (Hui, 2020, p. 88, author translation).

His answer goes towards a systematic reflection of thinking about new epistemes from multiple cosmotechnics and technodiversity, of opening up the technological recursiveness to the contingencies in the sense of an epistemology of recursiveness, i.e., "new ideas, the functioning of which takes place from nonlinear forms of reasoning, among which are cybernetics, systems theory, complexity theory, and ecology" (Hui, 2020, p. 163, author translation). Such discussions lead us to point to two primordial aspects in the thinking of technology: diversity

of relations between humans and non-humans, which include distinct information, sensations, thoughts, aesthetics, and ways of living, and de-substantialization of totalitarian worlds and unitary points of view that lead to time synchronizations.

Considerations on possible technological indeterminations

Lastly, by proposing to think about technologies and how they work based on the philosophers of technology Gilbert Simondon and Yuk Hui, we aim to problematize the possibilities of re-establishing cultural values based on technological knowledge, of reflecting on the mutual relations between humans, machines and nature, in order to counter technological alienation. As Simondon (1989) affirms, the machine can only take the place of the human when they take upon themselves the function of "bearers of tools", a simple executor of tasks. Technology can only be incorporated into culture if the human-machine relation does not establish patterns of inferiority or superiority, but instead establishes relationships of respect and reciprocity, embedded in a technical culture.

Guided by these ideas, in this article we aim to deconstruct negationist or salvationist positions in relation to technologies, bringing ideas on the importance of a technological education that is directed towards the ways in which technical objects function, inserted in culture and intertwined with nature (Simondon, 1989); on the relevance of a technical culture that links cultural values to technological ones; on the need to review the understanding of the human itself, based on notions such as the post-human, in order to think of other alternatives against technological alienation in education.

In this sense, Yuk Hui updates Gilbert Simondon by problematizing emerging technologies from the perspective of overcoming oppositions between human and machine, between objectivity and subjectivity. Based on ontological pluralism and the concepts of reticulation and technicity, Hui (2016) proposes a cosmotechnical way of thinking that aims to integrate technology and culture. Preventing homogeneous technological development based on a Eurocentric vision, Hui unites the contemporary and the traditional, and Western and Eastern cosmological visions, through the analysis of multiple technological systems and their particularities.

By weaving relationships between the traditional and the modern, between the local and the global, Hui opens up space for other differentiated thoughts, such as Chinese cosmologies, pointing out that there are multiple natures, cosmologies, mythologies (systems of thought), and technologies. He seeks to deconstruct hierarchies of narratives, since each cosmological narrative creates its own world within other worlds. Starting with Chinese cosmologies, Hui creates a space for discussion so that other minority cultures can investigate their multiple cosmologies and technologies, asking us: "What does an Amazonian, Inca or Mayan cosmotechnics mean? And, beyond indigenous art and

craft forms to be preserved, how might these cosmotechnics inspire us to recontextualize modern technology?" (Hui, 2020, p. 10, author translation). Thus, the concept of cosmotechnics is implied in a vision of technodiversity, since we must understand in which technological system cosmologies are inserted. The concept of cosmotechnics encourages us to investigate how each culture and era develops particular technologies in their localities, alongside universalized and synchronized technologies. These other uses of such technologies become fundamental as they incorporate their cultural values and contribute to the diversity of other contemporary knowledge and practices.

In this direction, Hui revises the notion of locality, which is no longer a spatially or temporally isolated locality, but must be a locality that appropriates itself of the global instead of simply being produced and reproduced by the global (Hui, 2019), not being in opposition to the global. He says that the universal character and locality need to be seen together; technique is universal in the sense of hominization, but it is also "motivated and limited by geographical and cosmological specificities" (Hui, 2020, p. 89, author translation), which are transformed thanks to their heterogeneous character. Locality turns to practices that respond to the contingencies of life with its diversities, to technodiversities that do not dissociate the local and the global.

Bruno Latour (2012) also goes against any substantialist approach aimed at the purity and isolation of any social group, by stating that both the individual and society are produced in relations between human and non-human mediators, establishing bonds between the global and the local based on the specificity of each association. "We only have to establish continuous connections between a local interaction and other places, times, or agencies through which a *location* is led to do things" (Latour, 2012, p. 251, author's emphasis). He seeks the modus operandi of the mediators in a given place so as to reveal the controversies that reside there, even if they are temporarily closed in black boxes.

In this sense, e stress the urgency for technological education that, on the one hand, goes beyond the bourgeois concept of culture and, on the other hand, of economic privileges linked to technological knowledge. According to Simon Mills, " Simondon therefore proposes a pedagogical shift such that technicity is taught simultaneously with cultural education, thus enabling the student to achieve a unified comprehension of the world" (Mills, 2016, p. 142). Technological education is not reduced to an instrumentalist or technicist education, since Simondon doesn't see technology as a mere tool or instrument; on the contrary, he sees technological education as a possibility to go against the alienation of our human condition and its power relations. Mills, in reference to Simondon, states that:

> Another important suggestion for helping to regulate the relation between technology and culture is via education. Given the importance of technology in the contemporary world it is clear that not all social problems can be addressed in purely cultural terms. What is required for the

> solution of many problems facing humanity is an understanding of the relation between man and the environment, which is predominantly mediated through technology (Mills, 2016, p. 141).

Thus, based on technology as a mediator of of the human-milieu relation, we need to think about the social and economic relationships implicit in each technological innovation, with its simultaneous possibilities for expanding and alienating realities, for social and economic inclusion and exclusion, and for integrating and polarizing ideas. Yuk Hui has currently positioned himself as a thinker who problematizes emerging technologies, especially those focused on automation. He points out that "restating the issue of technology is to refuse this homogeneous technological future presented to us as the only option" (Hui, 2020, p. 46, author translation), when referring to the imposition of a technological singularity that would be above the diversity of localities.

Thus, from technology as a mediator of the human-milieu relation, we may think of social and economic relations implicit in each technological innovation, with their simultaneous possibilities of expansions and alienations of realities, of social and economic inclusions and exclusions. Nowadays, Yuk Hui has put himself as a thinker that problematizes emerging technologies, especially those directed at automation. He points out that "restating the issue of technology is to refuse this homogeneous technological future presented to us as the only option" (Hui, 2020, p. 46, author translation) when referring to the imposition of a technological singularity that would be above the diversity of localities. Regarding future technological possibilities and indeterminations, Hui asks: "what futures may still be imagined and realized?" (Hui, 2020, p. 94, author translation); and Braidotti points to the need for a nomad subjectivity, for "an active transposition, a deep-level transformation, a culture change similar to genetic mutations but also recorded at the ethical level" (Braidotti, 2006, p. 207). Thus, when we speak of the interconnections between posthumanism and artificial intelligence, we point to the relevance of interdisciplinary research in AI, including art, philosophy, science and technology, since we are constantly being "shaped" and modulated by discourses, and by behavioral and aesthetic patterns resulting from AI practices. We are in the midst of emerging technologies such as machine learning in artificial intelligence, or organoid intelligence with brain cell biocomputers, or so many other future intelligences driven by technological accelerationism. Given that such technologies imply constant interactions between humans and machines, interactions permeated by information networks.

When referring to the intelligence of AI, Hui suggests that we need to consider the diversity of approaches to what we understand as intelligence, and demand a historicity of the term intelligence and of artificial intelligence itself. For Hui (2019), machine intelligence is more susceptible to mutation than human intelligence, as it occurs within the indeterminacy of human-machine agency, within recursive digital operations. "However, to expose the limit of artificial intelligence is not

to make machines weak again, but rather to free machine intelligence from the bias of certain notions of intelligence and therefore to conceive of new political ecologies and political economies of machine intelligence" (Hui, 2021b, p. 341).

Intelligence is different from instinct because it manufactures objects that manufacture objects: "thanks to the invention of tools, intelligence allows the complexification of the organism through exteriorized organs" (Hui, 2020, p. 160, author translation). Intelligence

> [...] is capable of transferring itself from one material to another - a modern form of transubstantiation. This process gives artificial intelligence the ability to produce faster and broader mutations than those linked to human intelligence - a fact also recognized by Bergson (Hui, 2020, p. 160, author translation).

These questions bring us directly to the technological indeterminacies and determinations that are still possible, such as the social platforms that use generative artificial intelligence (Gen-AI) systems such as ChatGPT, with natural language processing capabilities, and DALL-E, which generates images from text descriptions, recently launched by the OpenAI company. Together with other companies, we can see machines creating code (Metabob, Codis, Mutable AI), texts (ChatGPT, Jenni, Hipertype), audio (AD Auris, Resemble AI, Lovo), images (DALL-E, Hexo AI, Hypar), audiovisuals (Vidyo AI, Vochi, Steve AI), etc. And, surpassing this, we can catch sight of connections between multimodal technologies, such as the intelligence of the Alexa virtual assistant associated with ChatGPT, conversing in spoken word or text, offering us answers on topics ranging from everyday matters to philosophical, scientific, and artistic propositions. Just as in previous times we searched in encyclopedias, currently in online browsers and wikipedia, in the future we will have other ways of accessing information.

Although we are still at the beginning of the use of virtual and augmented reality platforms and AI systems, the subject is already becoming overly complex and we can see significant and decisive technological and cognitive leaps, in the order of the invention of electricity or the emergence of the www. We need to rethink what kind of human-machine interaction we are experiencing in order to understand the very human transformation we are facing. We need to be attentive to the cognitive and affective changes, on an individual and social level, that these technologies are causing. We need to come to terms with the potential of heightened human agency through algorithmic technologies, in the sense of dealing with machinic indeterminacy and human unpredictability; or, on the contrary, suffering restrictions imposed by such agency, limiting our ethical and aesthetic choices and determining our behavior in a predictable and calculated way for the sake of economic and political interests.

Since the 1950s there have been studies on artificial intelligence (AI), but after the development of machine learning and the acceleration of computer innovations, we have seen not only the recognition of

new patterns, but also the possibility of creating new content with AI. We stress that it is "with" AI, that is, we are involved in these creations, for AI does nothing on its own. The data generated is the result of human and machine interaction, from the creation of the datasets, the preparation of the data to be trained, the training of the algorithm, the testing of the models, the use of the trained algorithm, to the generation of data from the algorithm, in other words, between the inputs and outputs of the machines, the data and patterns are mediated in some way by humans.

Although AI is still capable of providing a very basic level of intelligence focused on manipulating information and recognizing patterns, on a social and political level, we need to understand the growing agency and functionality of human-machine assemblages in a new light. Working "with" AI is generating a cognitive shift, with the attribution of meaning and significance occurring in interaction with algorithmic technology, not being isolated and produced by the machine alone. As previously mentioned, there is human-machine production, and it is impossible to remove human ethical responsibility. When we mention that there is structural racism in AI, these patterns are not only created by machines, but come from previously instituted social patterns. Thus, there are risks not in AI itself, but in having polarized and exclusionary positions in relation to technologies, with consequences of alienation on a technological, cultural, ecological, political and social level.

Therefore, in order to think about what worlds we have built with emerging technologies, theorists such as Gilbert Simondon and Yuk Hui have provoked us to question what kind of society we want to live in, and in which direction are we taking these technologies in our everyday lives. How can these emerging technologies, instead of just limiting and determining choice, challenge us to broaden our awareness of the psychosocial patterns we make and share, and open ourselves up to our indeterminacies and becomings. In this sense, we point to the need to position ourselves in favor of a technology education that goes against those technological exclusions and alienations that separate technology, culture, and nature[2].

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Notes

1 Simondon refers to the term technics and technology at different moments; in this paper, we prioritize the term technology, given that Simondon uses it as the study of technics.

2 Support: CNPq and FAPERGS.

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Andréia Machado Oliveira is a researcher at the National Council for Scientific and Technological Development (CNPq). Associate Researcher at the University of the Witwatersrand/Johannesburg/South Africa. Postdoctoral fellow at the City University of Hong Kong. She works as a professor in the Department of Visual Arts, as well as being part of the teaching staff of the Postgraduate Course in Visual Arts at the Federal University of Santa Maria (UFSM). He coordinates LabInter (Interactive Interdisciplinary Laboratory - https://www.ufsm.br/laboratorios/labinter) and is leader of the Research and Creation Group in Interactivity, Art and Technology (gpc.interArtec/CNPq).
ORCID: https://orcid.org/0000-0002-8582-4441
Email: andreiaoliveira.br@gmail.com

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