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ARTICLES

Productive Organizations: The Human-Computer Interaction in *Black Mirror* / *Organizações produtivas: a interação homem-máquina em* Black Mirror

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ABSTRACT
The series *Black Mirror*, broadcast between 2011 and 2023 on Netflix, has become a media phenomenon and its episodes have shown ways of human-computer interaction. The series' name refers to the fact that when a screen is turned off, it becomes a black mirror that reflects the user's image. This paper[1] aims to analyze the side effects of human-computer interaction in *Black Mirror*'s production organizations. This research used discourse analysis, mainly from *Mikhail Bakhtin's* contributions. The method consisted of three stages that relied on the collaboration of Industrial Engineering students. The research included undergraduate and postgraduate students working collectively, since this procedure integrates teaching and research and helps beginners develop a critical sense. The results indicate that in *Black Mirror* organizations there is a transition from the concept of human factors to cyborg factors, as well as the use of human-computer interaction to promote social control.
KEYWORDS**:** Human-computer interaction; Human factors; Organizations; *Black Mirror*; Discourse analysis

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RESUMO
A série Black Mirror*, transmitida entre 2011 e 2023 pela Netflix, tornou-se um fenômeno de mídia e seus episódios mostraram formas de interação homem-máquina (terminologia também referida como humano-computador). O nome da série se refere ao fato de que, quando uma tela é desligada, ela se torna um espelho negro que reflete a imagem do usuário. Este artigo tem como objetivo analisar os efeitos da interação homem-máquina nas organizações produtivas apresentadas em* Black Mirror*. Esta pesquisa utilizou a análise do discurso, principalmente a partir das contribuições de Mikhail Bakhtin. O método consistiu em três etapas que contaram com a colaboração de estudantes de graduação e pós-graduação em Engenharia de Produção, integrando ensino e pesquisa e desenvolvendo o senso crítico dos pesquisadores-iniciantes. Os resultados indicam que, nas organizações apresentadas na série* Black Mirror*, há uma transição do conceito de fatores humanos para fatores ciborgues, bem como o uso da interação homem-máquina para promover o controle social.*
PALAVRAS-CHAVE: Interação homem-máquina; Fatores humanos; Organizações; Black Mirror*; Análise de discurso*

Introduction

The question of human-computer interaction in the human sciences has been investigated at different levels, ranging from "research into interaction hardware and software" or "design research" to "research into organizational impact" (Booth, 2014). Over the years, developments in this field of research on computer-based artifacts are extensive, as the notion of human-machine interaction has moved from the dynamics of pushing knobs and pulling cranks (Suchman, 1990) to the analysis of how specific operations may have a psychological influence on the user or system operator.

Some of these most recent studies even incorporate the theme of science fiction in its elements of reference. Indeed, observed from the fictional prism of technology and human factors, human-computer interaction has been the subject of several articles, which even consider such meta-narratives as elements that provide interesting alternative perspectives, being particularly valid as potential sources of insights within productive organizations (Phillips; Zyglidopoulos, 1999). This occurs since the strategies of corporate groups vis-a-vis science and technological innovations are critically reflected in science fiction narratives, and their study, therefore, allows us to characterize and highlight current and prospective scenarios of the consequent impacts of these interactions on a world which is in constant development.

Despite the difficulty of establishing a conceptual definition to the term *science fiction* (Piassi, 2012; Hrotic, 2013), mainly due to the intersections of this genre with the notions of fantastic literature and fantasy (which change with time), the central idea revolves around a virtual narrative situated in a hypothetically plausible, utopian, or dystopian future, allowing possible scientific developments or involutions.

Although the narratives explain such a chronological and temporal configuration, it is not only a question of considering such supposed future scenarios. Written texts from this perspective — or produced films — also have dialogic relations with the cultural environment of their production, since they arise from the preoccupations of the times in which they are conceived (Cardoso, 2006). Apart from mere entertainment, such a discursive approach alludes to the dialogism between real life and people's concerns about the future, sometimes imagining a coming techno-future, sometimes criticizing the effects of technology in the present. Science fiction is undoubtedly a discourse about the future, but mainly about the present, an aspect that brings to light its fundamental ambiguity and, unequivocally, its dialogic and problematizing vocation.

Therefore, it is worth remembering that a science fiction narrative is considered the discursive genre of such future scenarios and different environments — always containing implicit (and sometimes explicit) statements about contemporary society. This means that, from a discursive point of view, science fiction authors use their ostensibly strange environments as prospective scenarios to examine the implications — material and psychological — that new technologies may have on social life. This perspective makes clear that science is not only fictionalized but also the relations among people and the relations between these people and technological artifacts.

The discursive thread marked by the imagination of a future — from a present that gives an account of this discursive production of meanings — is not limited to the present-future bipolarity, since it also implies dialogues with the past. This dialogism also does not establish itself in a linear dynamic, as a reproduction of an old account, but through the attempt to clarify given social trajectories and paths. Considering it may perhaps even explain why cinematographic producers, notably in television series, started to seek advice from researchers and scientists in elaborating their scripts (Machado, 2013).

Academic studies on science fiction show that this genre implies a poignant critique of the existing science. Such fictional narratives can occupy a critical place in the

face of problems launched by contemporary scientific research, disseminating and suggesting, as in the case of the hole in the ozone layer, measures that need to be taken (Milner *et al*., 2015); can make reflections about collective anxieties regarding organ transplantation possible (Chozinski, 2016), or the lack of ethics and irresponsibility of some scientific practices, in general (Van der Laan, 2010). However, science fiction can also play a significant role in the acceptance and implementation of novelties such as nanotechnologies (Bowman *et al*., 2007); with the caveat that there are scientists who use this fictional genre, especially in the movies, as promotional devices for their fields of research (Kirby, 2003). Eventually, the general horizon of research in the area is varied and multifaceted.

There are also studies in the field of organizational management that value fictional analyses from literature or cultural industry. This is especially true in methods based on a critical approach (Warwick, 2016), in which it is indicated that a productive system — to generate its efficiency continuously — can resort to processes of social domination and control of production. In such contexts, therefore, the validity of fictional narratives, which work in an analogous way to a case study, emerges, where the central question is not merely in *information* or *data*, but in the possibility of generating a relationship of empathy that translates into an impulse for action (Czarniawska; Monthoux, 2004). In a fiction that is understood as *scientific*, this factor should not be underestimated, especially since this type of fiction — in film and literature — in a certain way reflects critical perspective (Drago, 1992), to discuss the situation of the individual against the oppression of technocratic society (see examples of the works of George Orwell, especially *Nineteen Eighty-Four*).

For the approach developed in this article, it is fundamental to emphasize that, although it began as a literary genre, science fiction does not remain today in a predominantly literary domain, because it includes a media network of cinematographic, television, and hypertextual discourses, and in constant interaction with the production of comics and computer games. In addition, due to their great penetration in the social environment, such stories often have their plots and personages associated with products, such as action figures, buttons, t-shirts, fanfics, and many other objects commercially exploited by the Cultural Industry (Cardoso, 2006), very recurrent aspect in a social model that is interpreted as a consumer society.

From the point of view of the Cultural Industry, some of these discursive narratives — such as film productions — have received a lot of attention in recent years. Especially those in which a series of technologies assume roles of protagonists in the structuring of imagined fictional societies. These films, which focused centrally on issues related to technology, were distributed in a variety of forms, either short or feature-length; initially through cinemas, satellite, cable, or digital broadcasting, on open or closed TV, trade in the form of sale or rental of VHS and DVD; and later playback via streaming, torrent, or downloading content.

Although the development of new technologies has strongly impacted the contemporary mass media for some time, cyberspace dynamics make the new teleseries something different from the classic films of traditional science fiction of the cinema and the television. It fundamentally occurs because, in a scenario favored by easy diffusion via system and streaming service and varied transmissive implications (streaming online content on Xbox 360, blue-ray devices, TV converters, Ps3, iPad, iPhone, Nintendo Wii, and other internet-connected devices), some television series have developed narrative innovations worthy of analysis and research (Sola; Lucena, 2014).

There is particularly a series of outstanding highlights — *Black Mirror* — in which the episodes call into question elements of Information Technology supposedly typical of highly developed societies from the technological point of view, to show the impacts and implications of this interaction in social life. The narratives are set in a future time but maintain dialogical relations with situations and aspects very characteristic of the present societies. From the point of view of the discursive genre, *Black Mirror* has recurrent themes of the literary and cinematographic genre of science fiction, whose discursive effect is to lead the viewer to accept, or at least admit, as verisimilar interactions and elements that are considered factually as real, a discursive dynamic that operates a tension between what is understood as reality and what mixes technology, science, fantasy, and fiction.

On December 1, 2011, Charlie Booker wrote an article in *The Guardian* newspaper about the *Black Mirror* series, under his direction, which would be released three days later on Channel 4. In the presentation of the three episodes, of what would later be known as the first season, he spoke of the dialogical relations that the episodes maintained with contemporary situations. According to Brooker, writer, and producer of

the series, his inspiration came from Rod Serling who, to deal with frequent censorship of his television screenplays, created in the late 1950s *The Twilight Zone*, a series of fiction focused on contemporary social criticism. That's because a teleplay about racism in the southern United States would certainly face editorials aimed at pleasing corporate sponsors. Describing racism in a fictional world, however, would not entail major oppositions (Brooker, 2011).

From an analytical point of view, it should be pointed out that the Brooker series, following in the footsteps of Serling and others, presents each episode with a different scenario and also a cast differentiated from actors, that is, there are neither permanent characters nor sequence between the narratives. There is, however, a common denominator that pervades all episodes and seasons, for there are continual criticisms, not of the future society, but of how we interact with technology in the present moment. The rhetorical question that Brooker (2011) raised was: "If technology is a drug — and it does feel like a drug — then what, precisely, are the side-effects"?

Therefore, the distinctive aspect of this series — the side-effects of technology — compared to other productions of similar content, raised the purpose of this article: analyse which are, in *Black Mirror*, the side effects of human-computer interaction, within the productive organizations.

1 Method

The method of this research, of qualitative character, used the analysis of the discourse, mainly from the contributions of Mikhail Bakhtin (Volóchinov) (2004).[2] It is worth recalling that Mikhail Bakhtin (1895-1975) is often referred to as the Bakhtin Circle, which, among others, was also composed of Pavel Nikolaievitch Medvedev (1895-1975) and Valentin Nikolaievitch Vološinov (1895-1936).[3] Therefore, to keep the

[2] For reference, see VOLOŠINOV, V.N. *Marxism and the Philosophy of Language*. Translated by Ladislav Matejka and I. R. Titunik. New York: Seminar Press, 1986.

[3] In 1973, the famous Russian philologist Vyacheslav Ivanov, later joined by other authoritative sources, publicly announced that Bakhtin was the true author of *Marxism and the Philosophy of Language*, originally published by Vološinov. To refer to the historical issues of authorship inherent in Bakhtinian work – Vološinov's widow attested to Bakhtin's authorship (Clark; Holquist, 1998) – would take too much time, would imply the contextualization of Stalinist censorship, and would add little, since methodological

focus on Black Mirror, some more specific historical circumstances need to be highlighted.

Charlie Brooker had previously produced the miniseries *Dead Set* in 2008, and a five-episode documentary called *How TV Ruined Your Life* in 2011. *Black Mirror*, however, has superior quality, as it is a science fiction that uses the resource of metafiction very well, a metalinguistic narrative as a pretext for self-criticism (Sola; Lucena, 2014).

Human-computer interaction involves, in this metafiction, paradoxes, and dystopias. The term *Black Mirror* refers to the mirror, or a screen, ubiquitous of a TV, a monitor, a tablet, or smartphone, that can be found on every wall, in the palm of anyone's hand (Brooker, 2011). Thus, the name given to the series is a reference to the fact that when these screens are turned off, they become a *black mirror* that reflects the projected image of the user. In a techno-drama, Black Mirror uses cinematic effects to show the conditions of a possible future in which human subjectivity would be affected by digital dynamics (Conley; Burroughs, 2020).

In February 2013, three more episodes formed the second season, also releasing a new special episode in December 2014. These first episodes were produced by Zeppotron (content production company for television, internet, radio, and mobile devices), but an interesting point of change occurred when Netflix launched the third season in October 2016, since from there it is possible to see changes of format (some more recent episodes are distinguished from the previous ones) and greater range of distribution, which made Black Mirror a worldwide phenomenon.

Therefore, there are episodes originally made for Channel 4 and others produced for a streaming platform, which entailed asymmetries between the sizes of the episodes. Some are much bigger than others because in certain cases there was a lasting standard (by the contingencies of having or not intervals of television broadcasts). The relation of the episodes — all of them are currently distributed by Netflix, including the fourth and fifth seasons, released respectively in December 2017 and June 2019 — can be seen in Table 1 (which also includes the December 2018 movie).

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issues of the same nature as this discussion have already been developed in other articles (Castro, 2015; Castro; Leão, 2020).

Periodicity	Episode	Screenwriter
1st Season	The National Anthem	Charlie Brooker
	Fifteen Million Merits	Charlie Brooker & Kanak Huq
	The Entire History of You	Jesse Armstrong
	Be Right Back	Charlie Brooker
2nd Season	White Bear	Charlie Brooker
	The Waldo Moment	Charlie Brooker
Special Christmas	White Christmas	Charlie Brooker
3rd Season	Nosedive	Charlie Brooker, Rashida Jones & Mike Schur
	Playtest	Charlie Brooker
	Shut Up and Dance	Charlie Brooker & William Bridges
	San Junipero	Charlie Brooker
	Men Against Fire	Charlie Brooker
	Hated in the Nation	Charlie Brooker
	USS Callister	Charlie Brooker & William Bridges
4th Season	Arkangel	Charlie Brooker
	Crocodile	Charlie Brooker
	Hang the DJ	Charlie Brooker
	Metalhead	Charlie Brooker
	Black Museum	Charlie Brooker
Film	Bandersnatch	Charlie Brooker
5th Season	Striking Vipers	Charlie Brooker
	Smithereens	Charlie Brooker
	Rachel, Jack e Ashley Too	Charlie Brooker

Table 1. Seasons, Episodes, and Screenwriters of *Black Mirror*. *Source*: The authors

The method of analysis consisted of stages that had the collaboration of students and fellows of scientific initiation. At first, all the episodes of the series were analysed, with the identification and enumeration of scenes that showed the side effects of human-computer interaction, within productive organizations. Next, the identified scenes were transcribed with the consequent classification of these same scenes, according to analytical categories from the studies and articles used as theoretical references. After the critical discussion of the results obtained, including the students and volunteers who participated in the research, occurred the systematization of the discussion.

A lot of research done in our Lab includes as members undergraduate students, masters, and doctoral students, who act collectively. This procedure integrates teaching and research and helps beginners to develop the critical sense, going beyond common sense. One of the things found in undergraduate student's articles about the same series, for example, is that some considerations have been limited to verifying how the episodes

describe human-computer interaction in terms of clusters, juxtapositions, or hybridizations between human beings and technological artifacts, including emphasis that mobile devices sometimes disconnect users from each other (Boren, 2015). However, if we are to consider the contributions of discourse analysis proposed by Bakhtin (Volóchinov) (2004),[4] the important thing is to investigate how the *Black Mirror* series acts in the production and circulation of meanings that organize and regulate the life of the people, having, in this sense, direct link with the industrial production of digital devices.

In discourse analysis's approaches, discourse is a system of thought, knowledge, or communication that constructs an experience of the world. But a problem for some studies approaches to mass communication lies in defining relations between discourses and social, political, and cultural practices, because they tend to consider monological perspectives. In Bakhtin Circle's theories of language, it is possible to find some critical and emancipatory solutions. For Bakhtin (Volóchinov) (2004),[5] an utterance necessarily maintains links with other utterances, which he calls *dialogism*. These networks of links in which a discourse incorporates, reflects, and refracts other discourses. Thus, a promising procedure for analysis is to select a topic and inquire, *what is this here dialoguing with?*

Bakhtin Circle's focus applied to mass communication offer new directions for studying relations between discourses and the side effects of human-computer interaction, within productive organizations. One powerful result of this Bakhtin Circle's model has been mentioned in studies about television (Newcomb, 1984): communication is constantly refracted by the contexts of reception. So, an episode of television develops the system of world-views inherent in its visual representation, and every episode of a television series is part of a larger dialogue involving every other episode. These relationships are fictional but dialogue with the viewers' real world. Thus, an analytical emphasis will be to relate the various companies mentioned and to see the dialogism implied in the technological productions.

[4] For reference, see footnote 2.
[5] For reference, see footnote 2.

It is quite possible to argue that *Black Mirror* is merely a commercial production, and the task of the television producer is to generate novelty, to use that novelty to attract an audience that generates commercial profit. But in *Black Mirror* there is a very distinct critical aspect, and Bakhtin Circle's dialogical analysis allows us to indicate how corporate group strategies have the potential, shortly, to use human-computer interaction to promote social control.

Therefore, in this investigative approach, the analysis of how *Black Mirror* relationships man-machine organize, control, regulate and prescribe social practices has acquired such importance. Thus, from the point of view of the Bakhtinian proposition (Castro *et al*., 2013), it was considered that language and social signs produce meanings, and the scenes where companies use *human-computer interaction* to promote social control represent discursively power relations. The results obtained in the material analysis — collected and systematized dialogically (Bakhtin (Volóchinov), 2004)[6] — allowed the configuration of two main axes, since it was verified that the productive organizations portrayed indicated (1) a transition from the concept of *human factors at work* to the hybrid idea of cyborgs; (2) interest in the use of human-computer interaction to promote social control.

1.1 A Transition from the Concept of Human Factors at Work to Cyborgs Factors

The research established that throughout the *Black Mirror* episodes several scenes showed the effects of human-computer interactions in the scope of productive organizations. Moreover, the interactions in those cases occur with such intensity that, numerous times, the characters portrayed cease of the mere human condition to be depicted as effective cyborgs. On the other hand, the digital Nano-prosthesis inclusion does not optimize the social life but compromises it regarding fraternity, hopes, happiness, and liberal values. Therefore, the condition of human existence comes to be seen in an unprivileged way, as a side-effect of hardware and software's integration in the human body.

[6] For reference, see footnote 2.

The term *cyborg* — a *cybernetic organism* contraction — was originally proposed in September 1960 by Manfred Clynes and Nathan Kline, published in a scientific journal called *Astronautics*, to indicate the benefits of man-machine systems in outer space. The historical context was the space race (a series of competitive technology demonstrations between the Soviet Union and the United States of America, to show superiority in spaceflight), and these authors advocated the thesis that it seemed more appropriate to alter bodily functions to meet the requirements of space travel than build similar environment to the Earth in the space. Thus, in the classical definition, "the cyborgs deliberately incorporate exogenous components extending the self-regulatory control function of the organism to adapt it to new environments" (Clynes; Kline, 1960, p. 27).

Such pertaining notions regarding the concept of *cyborg* started to popularize in the following year, with the release of the book *Cyborg: Evolution of Superman* (Halacy, 1965), that even had a foreword from Manfred Clynes, who hypothesized other cyborg concepts as well as space travel. Therefore, the book's main idea became a driving force and a huge influence in common sense and cultural industry in the following decades, given the symbolic strength in a concept which a human being can be able to increase the incorporation of technological devices.

Nevertheless, in the academic context, the concept of *cyborg* refers mainly to a fundamental essay from Donna Haraway — A Cyborg Manifesto — originally published in 1985, on the Socialist Review magazine (Haraway, 1985). Her work has been crucial to *Science and Technology Studies* (STS) explorations of technoscientific imaginaries (Mcneil *et al*., 2017), and it provided some inputs that would be incorporated into the analysis of the scenes of *Black Mirror*. That mainly occurs because on the current academic landscape, the reference to the idea of cyborg consists in a blend of imaginary conceptions and genuine practices (Picon, 1998), and it has been recently amplified to describe large communication and control networks, for instance, the day-to-day life in an urban population, the software networks, the companies, and the whole range of the social tissue (Gray, 1995).

The narratives in *Black Mirror* mention some companies and products which induce the cyborg condition, and they occasionally appear in more than one episode. In this sense, this analysis based on Bakhtinian dialogism is not restricted to mere relations between isolated statements but allows us to deduce a corporate discourse that emerges

dialogically on several occasions. In other words, the narratives of the series incorporate in the script, in the speeches of the characters, and especially in the discursive practices, the language in force in the environment of human factors at work. SaitoGemu, for instance, is a corporation that produces games, and it is associated with TCKR Systems, a natural research and technology company. Testing new virtual reality software, SaitoGemu, in the episode *Playtest*, hires some volunteers to technologically innovate the games industry with a horror game that would search the user's unconscious for all his fears. In this partnership project development, TCKR is the company that provides the devices which were inserted in the brain, which allows the player to experience augmented reality (AR system).

Developed by TCKR, this technology is particularly considered representative of the human transition into the cyborg once a person deliberately incorporates exogenous digital components. In the episode, such technology is being improved by SaitoGemu and although it is still in its developmental stages, the same neural electrodes are equally portrayed in other *Black Mirror* episodes, as in the sanction of the characters Victoria Skillane and Joe Potter, respectively in *White Bear* and *White Christmas*. The overall concept remains featured in the fifth season episode *Striking Vipers*, in which the same technology — although even more improved and developed by TCKR — leads to the problematization of the gender relations and the cyborg condition, which, indeed reminds to the seminal discussion from *A Cyborg Manifesto* (Haraway, 1985).

A productive system equally associated with the human/cyborg transitions is the Smartelligence company, regarded as a *technology and home services company*, which developed a technology known as *cookies*. Those devices that show up in *White Christmas* are sort of small chips that are inserted in the cerebral cortex of people interested in a special kind of domestic service. In the narrative, when it is surgically removed from the brain of the character *Greta*, the cookie is plugged into a portable electronic device. Therefore, it transforms into a *Greta cookie*, a complete neuro-digital copy of Greta's consciousness, which, transformed into a cookie, will control Greta's smart house and agenda, ensuring that everything happens as if she was in command since it comes from a completely identical representation, an artificial intelligence cyborg. Greta cookie's enclosure, however, is experienced in the consciousness as real suffering, and that contingency, in the *Black Mirror* narrative landscape, entailed the European

Convention of Human Rights (ECHR) to decide that those cookies have human rights, as such is shown on a news footnote in the following season episode: *Hated in the Nation*.

Other kinds of psychological side-effects can be identified, as a consequential use of the product Z-Eye, also featured in *White Christmas*, which works as a sort of augmented reality device with visual effects, technology analogous to the product *Willow Grain*, addressed in detail in *The Entire History of You*, an episode which, notably, all the social life directly guided on the mandatory use of these grains.

The Grain is also a small chip that, when implanted behind one's ear, records all the memories of the user's whole life, which includes speeches of people engaged in diverse situations. In the narrative, the most exploited aspect is that the grain allows access to all the memories, even the bad ones, through a process called *redo*. The loss of the human condition becomes evident, since this *redo* feature allows the reproduction of those memories, on the user's eyes or in a screen, with zoom effects and multiple speeds and such features can be previously chosen in a menu, controlled by a small portable console. The psyche relinquishes the ability to forget, therefore, a fundamental element in a human being's mental health.

The Grain, just as other neural implants introduced over the series, sustains relations of dialogism with plenty of older technologies, such as K7 and VHS tapes, which since the 1970s were able to ease up the general and domestic recording of sounds and images; and other subsequent technologies, such as CDs, DVDs, Blu-Rays, and also MP3 Players, iPods or even Napster, Spotify, and other streaming services software. The *redo* features are, indeed, discursively similar to the attribute of watching a movie scene again or repeating an audio track.

In *Crocodile*, the technological sophistication is even greater: the legal obligation to share personal memories, in case of accident investigation for insurance payment, there is the use of the *recaller*. It is a system that incorporates a more specific *Grain*, which only scans accident-related records, viewable in a small monitor. The transition is notable because if initially the technology only allowed a private review of the memories, subsequently a legal requirement demanded the appropriation of which, upon the public interest. In all these cases, however, the main issue of this analysis is that, in *Black Mirror*, the devices are hybridized in the human body, evoking the transition from human to cyborg.

Is worth mentioning that *Black Mirror* explores different interaction possibilities. In some cases, a virtual reality inductor device is inserted inside the human mind, as the image representation prevalent in *San Junipero*. However, in other episodes, the human mind is integrated inside virtual reality, such as the first episode from the fourth season.

With the title *USS Callister*, this episode depicts consciousness backups to a simulated reality designed as a Massively Multiplayer Online Game, similar to the vintage television show Star Trek. The point is the algorithmic version of the consciousness is not a priori susceptible to the same typical conditions of the already limited human life, to the programming variants developed to the virtual environment.

That would not be the case, however, to take a broad description, in this article, of every gadget, device, and the nominated cyborg technology; either turn the human being into a machine (see the MASS neural implant from *Men Against Fire*) or turn the machine into human (such as the intelligent synthetic flesh in *Be Right Back*). Digital and virtual systems like these cross over in all episodes from every season and indicate a constant that restarts the cycle as far as the narrative goes.

The main point to be objectively highlighted is that there is a social dysfunction in the cyborg portrayals displayed in *Black Mirror*. An aspect that reminds the social criticism developed by the author, whose development of this technological process brings, inevitably, undesirable psychological side-effects. Therefore, it's possible to seek a dialogical relation between the television series and the current environment of large corporations. Therefore, this fits in a greater reflection regarding the technological innovation strategies currently in development on several productive organizations, considering all the future impacts that might be caused by the new human-computer interaction forms that are currently being built.

1.2 The Use of Human-Computer Interaction to Promote Social Control

Another relevant fact from the research states that *Black Mirror*'s technological innovations imply essentially ways of social control. Therefore, it is not only about accessing the technological dimension of the cyborg's lives as individuals, but also perceiving the power relations on which such social groups practices are historically built by man-machine interactions.

The episode *Nosedive* describes personal relations mediated by a digital reception application. The matter of the control, in this case, is explicit and evident due to the consequences of one's lack of mainstream adaptation and how this would cause the exclusion of one's social life. Via an ocular implant, users share mutual condition approvals or disapprovals, which grants them a real-time rating system, from 0 to 5. The constant approval is viewed as a major issue because each assessment is calculated as weighted averages with previous evaluations, then producing a score that would define if one can have access to day-to-day privileges such as discounts and better mortgages rates for purchases, have access to preferential services, rent a house on noble areas or even be allowed to participate in reserved social events. Thus, it means that there is a social status level ranking system.

Such technology approximates dialogically to products and contemporary services — be it Facebook or other social media – that equally attribute scores or quantifications to rank several users. *Nosedive*, however, is focused on the issue of showing how Lacie Pound, the main character of this story, realizes that the spontaneity of her acceptance involves a certain portion of social exclusion.

The thought that everyone controls everybody, via a reputation application, alludes to controlling society, on a scale that can be perceived as a sort of panopticon. Indeed, in the scope of the human and social sciences, it is a standard practice to reference The Bentham's Panopticon – which etymologically "pan" means "all" and "opsis" means "view" – when it usually describes surveillance and control procedures (Sewell; Barker, 2001).

The expression *Panopticon*, originally used to define a kind of manufacture which the manufacturing master could exert direct control over the subordinated employees was enforced as an architectural plan to a prison model, planned by Jeremy Bentham, in writings produced in Russia in 1787, and subsequently delivered to a friend in England (Bentham, 1995). Due to Foucault's (1979) influence, concerning the control on the disciplinary society, the *Panopticon* started to designate projects from totalizing visibility, organized in a dominant and coercive way, instituted in social relations of surveillance and social power.

Therefore, in *Black Mirror* technologies that enable new means of surveillance are introduced, new processes that also can be characterized as panopticons. One of the main instances is the episode *Fifteen Million Merits*.

The narrative is completely panoptic since it replicates social relations in which there is an omnipresence of interactive screens. The bedrooms do not have any sort of wall, instead, there are only screens. The same happens to toilets, and where people pedal in bicycles to produce electricity. Daily life is mediated by images from these black mirrors. There are even controlled image depictions from the users, which appear on the screen through one's avatar.

A portion of the social control in *Fifteen Million Merits* occurs through the entertainment media, in a talent show called *Hot Shot*. In this analytical axis, the concept of dialogism can once again be used to show how the discursive practice of modern reality shows is dialogically incorporated into the series. The people's engagement with this sort of amusement is so great that they alienate themselves from the oppressive reality they live. The contestants compete with their talents against each other and are evaluated by judges, inside a discursive structure that possesses dialogical perspectives with several television shows (which is even more highlighted since *Fifteen Million Merits* was originally aired on the same night as the final stage from the musical reality show X-Factor). Therefore, the panoptic screens from this society monitor the characters as much as alienate them. That is a denser aspect than the one mentioned in *The Nation Anthem*, in which the mass population witnessed the broadcast from a situation on the TV and smartphone screens. A situation, incidentally, marked by manipulation and persuasive procedures through which an individual (kidnapper) manipulated public opinion to, in turn, manipulated the Prime Minister (Mendes, 20019).

A technological device is developed in *Hated in the Nation* called ADIs (Autonomous Drone Insects) considering the interest in the environmental balance through the preservation of bees in the ecosystem. However, the narrative displays that the ADIs can have some other features besides avoiding the collapse of the bee's colonies, and the conflict between surveillance and liberty becomes the centre of attention. The panoptic perspective, therefore, is also present because the drones have advanced facial recognition software made for public surveillance. Thus, the technology in question allows the continuous observation of the population and social groups, a typical social

control trait that arises as a side effect of human-computer interaction, within an environmental robotics company called Granular (also quoted in *Bandersnatch*).

The notion of panoptic control persists in *Shut up and Dance* due to the company's deed whose software – Shrive – has a harmless guise of a free-of-charge malware remover. However, after it is installed, the software not only removes all the malware on the users' computer but also gives access to the hard drive and to the webcam, which provides the company the allowance to have absolute control of one's life. Given this permission, the Shrive controllers start blackmailing several people that utilized the software, always under the threat of spreading compromising information from its users. That spawns a whole cycle of actions, many of them illicit, to seek how far a person is willing to go to protect one's information.

A distinct social control device is shown on *Hang the DJ*, which involves a new kind of application called *The System* which controls the affective life of two characters in the search of the *perfect match*. The discourse developed in the narrative establishes the possibility of the technology to determine the future, assigning to artificial intelligence the individual decision-making power, and conditioning the social relations from its users to the developers' control.

One of the main manipulative ways of control, nevertheless, appears in *The Waldo Moment*, an episode in which the digital animation of a blue bear starts to grow standing in the English parliament elections. The animated character is dubbed by the comedian Jamie Salter and its mediatic success implies such a social projection that allows the idea of letting Waldo run for the election. The point is that a pixelated animation can be, in a democracy, more representative than other human beings. At the end of the story, the broadcasting process obtains external political relevance since the person suggests using Waldo as a way of manipulating and influencing the elections *in South America*.

Conclusion

The elaboration of this article started from a very clear premise: Science fiction narratives often criticize how productive organizations develop processes of domination and social control. Thus, the discursive analysis of such narratives provides interesting

perspectives to highlight the scenarios — present and future — in the impact of human-computer interaction towards the world of work. In this regard, this research offers a contribution that differs from other similar ones in the field of studies by focusing on the *Black Mirror* series from a Bakhtinian perspective.

The research aimed to analyse the side effects of human-computer interaction within the *Black Mirror* problematized organizations. Therefore, in the series' episodes, the methodological guidance identified scenes with the negative impacts of human-computer interaction in the scope of the productive organizations portrayed: SaitoGemu, Smartelligence company, TCKR Systems, among others. The data collected, however, did not receive a merely descriptive treatment. On the contrary, because of Bakhtinian's studies, the emphasis was given to how the language of the narrative articulated dialogisms with companies and organizations that discursively made use of human-computer interaction in their power relations.

Thus, the scenes identified were transcribed — precisely because, throughout the episodes of this series, several scenes show the side effects of human-computer interaction within productive organizations — the critical analysis of the results obtained showed that, in *Black Mirror*, human-machine relationships prescribe important social practices to serve as potential sources of insights within productive organizations. Namely, organizational practices that induce the cyborg condition and social control.

As already mentioned in the bibliographic survey, technological innovations and strategies of large corporations tend to be critically reflected in science fiction narratives. Consequently, articles like this one critically outline scenarios of impacts (current and prospective) on productive systems. Above all, they evaluate the situation of the human factor in productive chains, by taking into consideration trends in which there is a transition from the concept of human factors in work to the hybrid idea of cyborgs factors; and possible organizational interests in the use of human-computer interaction to promote social control.

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Statement of Authors' Contribution

The authors of "Productive Organizations: the Human-Computer Interaction in Black Mirror" state their contributions in the preparation of this article, according to the aspects specified by the journal "Bakhtiniana - Journal of Discourse Studies" (1. Conception and design or analysis and interpretation of data; 2. Writing the article or relevant critical review of the intellectual content; 3. Final approval of the version to be published. 4. Responsibility for all aspects of the work in ensuring the accuracy and completeness of any part of the work). They supplement the information with details of the other activities carried out. *Georgia de Souza Assumpção:* Conception and design; Analysis and interpretation of data; Writing the article; Responsibility for all aspects of the work in ensuring the accuracy and integrity of any part of the work; Project administration; Development of the Methodology. *Carolina Maia dos Santos:* Analysis and interpretation of data; Writing the article - proofreading and editing; Responsibility for all aspects of the work in ensuring the accuracy and integrity of any part of the work; Teaching activities linked to the development of the article; Data Curation. *Raquel Figueira Lopes Cançado Andrade:* Writing the article; Responsibility for all aspects of the work in ensuring the accuracy and integrity of any part of the work; Teaching activities linked to

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Research Data and Other Materials Availability

The contents underlying the research text are included in the manuscript.

Reviews

Due to the commitment assumed by *Bakhtiniana. Revista de Estudos do Discurso* [*Bakhtiniana. Journal of Discourse Studies*] to Open Science, this journal only publishes reviews that have been authorized by all involved.

Review II

The text is well written, with excellent theoretical references and relevant explanations about the Black Mirror 5 series, up to 2019. The human-computer interaction is well portrayed in the text, justifying the subtitle. Text Approved.

I studied for my Master's in Cinema in the United States (Arizona State Univ) and had Mikhail Bakhtin as my first and most relevant reference. Therefore, if authors want to continue having Bakhtin as their main reference source, I suggest the adoption of the author's concept of polyphony. In case they decide to compare texts, to create a dialog between texts, I suggest Julia Kristeva's concept of intertextuality that I used in my PhD (Univ of California, USA). I wrote about Bandersnatch and USS Callister, but in case authors want to analyze Season 6, they have to be careful because some episodes do not reflect so well human-computer interactions. Beyond the Sea can be analyzed for its human-computer interaction, but the other episodes from season 6 follow other strategies that do not emphasize human-computer interation. APPROVED

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Review III

The article proposes to carry out a discursive analysis of episodes of the Black Mirror series, with the aim of investigating how television production presents and discusses the side effects of human-computer interaction in organizations. Bringing an important, original and creative contribution to the field of linguistic-discursive studies, the work promotes an interdisciplinary reading of the corpus, orchestrating the Bakhtinian

dialogical perspective and theories dealing with technology, organizations, mass communication, cyborgs and science fiction. The problem was clearly proposed, and the theoretical foundation was consistently exposed and discussed throughout the work. The methodology adopted satisfactorily met the purposes of the research. The authors' text is intelligent, cohesive, coherent and meets the grammatical and stylistic standards applicable to scientific articles. Moreover, the way in which the arguments were developed reveals the authors' theoretical and analytical maturity and security in dealing with the subject. The bibliographical references are current and relevant to the discussion held in the investigation. That said, I recommend publication. APPROVED

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