

<https://doi.org/10.15446/mag.v40n1.124493>

AN ANTHROPOLOGICAL UNDERSTANDING OF  
ARTIFICIAL INTELLIGENCE TRANSFORMATIONS  
IN CIVIC AND DOMESTIC LIFE, LABOR,  
AND HIGHER EDUCATION THROUGH THE  
CYBERNETIC ORGANISM (CYBORG) CONCEPT

---

JOSHUA J. WELLS\*

Indiana University South Bend

JAMES M. VANDERVEEN\*\*

University Center for Excellence in Teaching, Indiana University South Bend



\* [jowells@iu.edu](mailto:jowells@iu.edu) ORCID: [0009-0002-3023-2198](https://orcid.org/0009-0002-3023-2198)

\*\* [jmvander@iu.edu](mailto:jmvander@iu.edu) ORCID: [0000-0002-5993-9608](https://orcid.org/0000-0002-5993-9608)

Artículo de investigación recibido: 26 de octubre de 2023.

Aprobado: 21 de octubre de 2024.

**Cómo citar este artículo:**

Wells, Joshua y James Vanderveen. 2026. "An anthropological understanding of artificial intelligence transformations in civic and domestic life, labor, and higher education through the cybernetic organism (cyborg) concept".

*Maguaré* 40, 1: 00-00. DOI: <https://doi.org/10.15446/mag.v40n1.124600>

### ABSTRACT

This essay uses cyborg anthropology to model interactions between humans and artificial intelligence (AI) and highlights potential strengths and weaknesses of AI regarding learning and innovation. Informed by Haraway's emphases on inequalities, we recognize AI is neither a separate nor superior form of intelligence, but a tool that augments human agency. Current examples of AI implementation in the civic, domestic, labor, and educational domains expose the potential of AI for biases and oppression as a human construct that reflects and affects the sociocultural and ethical values of its creators and users. These examples inform practical and ethical considerations for the development and use of AI in the future, including structured human-AI collaboration, promotion of human-AI literacy, respect for human dignity and rights, and addressing inherent biases and inequalities.

*Keywords:* artificial intelligence, civic life, cyborg, domestic life, higher education, inequalities, work life.

## RESUMEN

Este ensayo utiliza la antropología *cyborg* para modelar las interacciones entre los humanos y la inteligencia artificial (IA), y destaca las fortalezas y limitaciones de la IA en relación con el aprendizaje y la innovación. Basados en el énfasis de Haraway en las desigualdades, reconocemos que la IA no constituye una forma separada ni superior de inteligencia, sino una herramienta que amplifica la capacidad de acción humana. Los ejemplos contemporáneos de implementación de IA en ámbitos cívicos, domésticos, laborales y educativos evidencian su potencial para reproducir sesgos y formas de opresión, en tanto se trata de una construcción humana que refleja —y a la vez influye en— los valores socioculturales y éticos de sus creadores y usuarios. Estos casos ofrecen insumos para plantear consideraciones prácticas y éticas sobre el desarrollo y uso futuros de la IA, entre ellas la necesidad de fomentar colaboraciones estructuradas entre humanos y sistemas algorítmicos, promover la alfabetización humano-IA, garantizar el respeto por la dignidad y los derechos humanos, y abordar los sesgos y desigualdades inherentes.

*Palabras clave:* *cyborg*, desigualdades, educación superior, inteligencia artificial, vida cívica, vida doméstica, vida laboral.

## 1. THE RELEVANCE OF CYBORG ANTHROPOLOGY TO AI

The cybernetic organism, or (generally hereafter) cyborg, as originally coined by Clynes and Kline (1960) and made important in anthropological, sociological, and feminist theory by Haraway (1985, 1988, 1989, 1991, 1994) and others (e.g. Benjamin 2018; Case 2014; Davis-Floyd and Dumit 1998; Gray 2002; Hakken 1999, 2003; Vertesi 2015) is a vital explanatory concept which details the relationships between humans and the technologies they imagine, create, employ for survival, and use in furtherance of a tremendous portion of sociocultural interactions (for good or ill) past, present and future. With the cyborg concept in mind, we approach the rise of AI, developed by powerful interests and often serving existing hegemonic patterns, but also holding potential for human curiosity and liberation beyond the control of its creators. Haraway's (1985) introduction of the cyborg concept to the social sciences focused keenly on the myriad and manifest inequalities of sex and gender developed by historic forces, then perpetuated and more deeply entrenched by technological forces of oppression around us. She took aim (1989, 1991) at how colonial-descended patriarchies develop numerous categories of otherness which can be thrown together in pastiches of negative or subordinate identities on female bodies (recognizably expanded to any non-cisgender-male, non-white bodies in general). These identities are enforced in new ways by high-tech developments in monitoring and augmenting bodily functions through instrumentalist medical intervention and by channeling flows of human relationships through information and communication technologies (ICTs).

In this essay, we engage in a deep bibliographic review to illuminate the deep and myriad, direct and indirect influences Haraway's work has upon current conceptions of our world of technology and knowledge. Also, ways in which the concept of the cyborg has itself become contested in a kind of ubiquity which is especially important to disentangle in the age of AI. It is vital to recall that Haraway developed these ideas, not in small part, to describe inherent inequalities of labor, availability of information, and access to technological development, especially inequalities driven by sexism, racism, and classicism (Haraway 1988; Bernius 2012). In a similar vein, a recent overview of female biology from a human evolutionary perspective (Bohannon 2023) goes to extraordinary lengths to model the value to the survival of our species

of culturally transmitted gynecological knowledge structures, the value of mother-child interactions in human language development, and the value of post-menopausal elders as living repositories of communal memories. Bohannon recounts the more relatively recent developments of hierarchical expressions of sexism exacerbated by nation-state politics and industrial capital economies which have too often severed women from their deep-seated agencies and autonomies (cf. Haraway 1988), which we can directly connect to how information has similarly been severed from bodies in cybernetics (Hayles 1998) and then turned back on them through surveillance (Bauman and Lyon 2013).

As ethnographers and other social scientists grappled with Haraway's concepts for the next almost four decades, important trends began to develop in recognition that patterns of interventionist and oppressive technologies are recognizable in furtherance of what could be considered novel new forms of rather classical hegemonic ends (e.g. Davis-Floyd and Dumit 1998; Gray 2002; Powell 2018). From there grew the recognition that in the decades comprising the end of the 20th Century and early 21st Century, human dependence on ICTs in many ways exemplified in its totality not just political realities but a new baseline for human interactions and cultural behavior in general for a species whose lives are so often dominated by physical and cognitive mediation of their worldly experiences through technology (e.g. Case 2014; Escobar 1994; Hakken 1999; Kadlekova and Krbec 2020). More current publications on human-technology interaction which expand on the cyborg concept popularized by Haraway recognize that high-tech instrumentation and ICTs in general comprise (bluntly) the way we live now, as likely to be employed to subjugate people in 2024 using centuries-old nonscientific colonial European folk classifications of race (Benjamin 2018), as to exploit and marginalize the working class across the vast networks of the Internet (Hakken 1999, 2003). Additionally, these technologies provide a foundation for embodied virtual identities among scientists using robots to explore the surface of Mars (Vertesi 2015).

These latter-day understandings of cyborg life help us to consider the world in which we meet AI as a growing part of our ICT environment. To further illuminate this emergent-AI moment we must also consider the place of the cybernetic in the cybernetic organism beginning with its origins in the early space program of the United States, which

although obscure today is often intermingled with Haraway's concept of the cyborg in both academic and popular discourse. In 1960 Clynes and Kline published their article "Cyborgs and Space" in the journal *Astronautics* intending to define how early American space scientists (in the sexist language of the time) should consider an astronaut as a cyborg:

...it is becoming apparent that we will in the not-too-distant future have sufficient knowledge to design instrumental control systems which will make it possible for our bodies to do things which are no less difficult. The environment with which man is now concerned is that of space ...

... This self-regulation must function without the benefit of consciousness in order to cooperate with the body's own autonomous homeostatic controls. For the exogenously extended organizational complex functioning as an integrated homeostatic system unconsciously, we propose the term "Cyborg". The Cyborg deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments.

Clynes and Kline went on to describe a series of increasingly invasive physiological and psychological cyborg enhancements, across all of which the concept of cybernetics was firmly established as being put in service to the survival of the organism. Technology, and the knowledgeable (cybernetic) control of inputs and outputs to manage the technology, were necessary for human survival. This harkens to the original definition of cybernetics by Wiener (1948) as a self-regulating process where feedback provides corrective input to change the process as needed to reach a destination or meet a goal (the term cybernetics itself derived from the ancient Greek 'kybernetes' referring to one who steers a ship). Such reliance on technology is also a fundamental evolutionary adaptation of genus *Homo* in general. The interplay of technologies that are now necessary for survival such as stone tools (e.g., Lewis and Harmand 2016) and their modern correlates of myriad physical implements, fire (e.g., Wrangham 2009) and its modern correlates of controlled energy, and artistic representation (e.g., Bar-Yosef 2002). We can see that the cyborg is not just a human in space, but in fact all humanity who as genus *Homo* have become increasingly and now completely reliant

on technology for survival in all earthly environments (e.g., Donath 2014; Hanson 2009; Haraway 1994; Turkle 2008; Wells 2014).

For cyborg humans in 2024, already evolutionarily entirely reliant on technology, ICTs, and general-purpose computation have come to dominate toolkits of individuals and societies alike. With all the positive and negative potentials mentioned above, this is the moment of AI and how we can understand its place in a world of networked inequalities (Foucault Welles and Sarmiento 2022), algorithmic oppression in myriad forms (Noble 2018), and where capital interests constrain and commodify development of personal development and expression (Doctorow 2023). Coincidentally, the term “cyberspace” itself was coined by the science fiction author William Gibson in his 1982 short story “Burning Chrome” and soon after popularized in his 1984 novel *Neuromancer* (Prucher 2007), which forty years ago predicted the rise of AI. In Gibson’s universe, there are variously conflicting and overlapping technological hegemonies, from the corporate to the nation-state to the criminal, which all vie for control over the powerful posthuman AI characters Wintermute and Neuromancer. Although the cognitively complex, ultra-powerful, and self-determining AIs depicted by Gibson remain the realm of science fiction, and in these authors’ opinion are unlikely to ever manifest, it is worth considering that many of the failings and miseries of the world of *Neuromancer* are also those of our world today.

The concepts that underpin AI are increasingly accessible and apparent to workers and the public despite the claims of AI developers and marketers to obscure intellectual heights of power. The definition of AI generally consists of a form of automated training data processing, recognition of patterns in those training data, and using those patterns to create an extrapolation when presented with new information. The American Medical Association (AMA) in a turn towards the cyborg already prefers the term ‘augmented intelligence’ instead of using the word artificial, in recognition of how software and databases enhance physicians’ scope of available information for decision-making (American Medical Association 2023; Vearrier et al. 2022). There is nothing artificially intelligent in the mix of data and algorithms compiled by humans (aided or unaided by other machines), and all the intelligence brought to bear is within the humans who are being augmented (Bender 2023; Bender et al. 2021). One area of action where AI tends to be frequently

anthropomorphized is in the domain of error, because what is more human than to err, and what might be more erroneous than to explain incorrect extrapolations from a big data set using the word ‘hallucination’ with all the trappings of mind that it carries? A large language model does not have sensory experiences or beliefs as humans do. Suggesting otherwise only perpetuates misconceptions that artificial intelligence functions like the human brain. Instead, it generates plausible responses based on its training data, without truly understanding the content. When it lacks data, it makes educated guesses. This isn’t a perception error; it’s an attempt to fill gaps in its training data, which can’t cover every possible scenario (Bergstrom and Ogbunu 2023). AI does not ‘hallucinate’.

A better term for this behavior comes from a concept that has nothing to do with medicine, engineering, or technology. When AI chatbots flood the world with false facts, confidently asserted, they’re not breaking down, glitching out, or hallucinating. No, they’re bullshitting. (Bergstrom and Ogbunu 2023)

As the public begins to interact in recognizable ways with AI tools and outputs, the veneer of intelligence is stripped away, and the lived experience of AI as an information processing tool with inputs and outputs, strengths, and weaknesses, is already becoming more common than not. Anthropologist Richard McElreath’s (2023) quip on the Mastodon social network that, “I told a colleague that logistic regression is AI and they got mad at me, so I made a chart. Find yourself. I am ‘Tinder is AI,’” listed varieties of real and fictitious predictive tools that are already part of our cultural milieu (e.g., Alpha Go, C-3PO, Magic 8 Ball, Tinder, xGBoost). The bigger dangers of AI to very human concerns such as political rights, workplace safety, community life, and a general sense of well-being, however, have much more to do with the inaccessible construction and opaque implementation of AI tools as finished consumer objects or in enforcement programs by hegemonic interests.

Whether or not people are afforded the privilege to understand or influence how AI works under the hood, the encroachment of AI into daily life was recognized by participants in a Pew Research Center study who correctly identified the presence of AI in everyday implementations like a customer service chatbot (65%), a playlist recommendation (57%), email spam filters (51%), analytics from wearable fitness trackers



(68%), product recommendations based on purchase histories (64%), and facial recognition security cameras (62%) (Nadeem 2023). These indicate a moderately strong general base of AI awareness already present within the public, which may yet grow considering that publicly available AI experiences have mostly only appeared in the last decade. In comparison to an assessment of the general scientific literacy of residents in the United States (the Pew study involved only US-based respondents), knowledge of AI in general may already be more developed than US residents' knowledge of electrons, lasers, sexual reproduction, antibiotics, and evolution (National Science Foundation 2020, 23-26).

## 2. IMPORTANCE OF DOMESTIC AND PERSONAL ECONOMIES TO THE CYBORG EXPERIENCE OF AI

Cyborg theory indicates to us that patterns of familiarity with AI among people, in general, are being achieved through daily interactions that are part of domestic life and political economies. In fact, our evolutionary history is dominated over the last three or more million years by a mixture of constant cybernetically-organized tool production and use for basic survival, as well as hominins' intrinsic sociocultural patterns of signifying, sharing, and teaching within our trend of ever-growing dependence on technology (Bohannon 2023; Case 2010; 2014; Hanson 2009; Wells 2014). Today, as individuals, families, households, and other corporate groups engage in a constant process of imagination, creation, reimagination, and recreation of selves and relationships, they do so in an environment with a growing presence of AI, and the mosaics of their experiences will form habits and patterns, ultimately making AI interaction a part of lived experience like fire, electricity, infrastructurally supplied water, and ICTs in general. It is then vital to consider how myriad vectors of inequalities (race, sex, class, etc.) do of course impact the lives and economies of both haves and have-nots who may variously struggle for control of resources or develop networks of mutual aid (cf. Foucault Welles et al. 2022).

An example of this domestic pattern is visible in the development of general-purpose and AI-driven ICTs for home kitchens in the consumerist markets of the Global North. Deprecation of household labor and women's work, in general, has been a frequent and consistent feature of state societies in their various emergences and continuities over

the past five or more millennia (Graeber and Wengrow 2021: Chapter 6), a trend which continues to this day in kitchen technology. In the late 1960s, Honeywell corporation marketed a home minicomputer for women as a \$10,000 recipe book, ignoring other potential domestic uses for a computer in balancing finances, tabulating inventories of home supplies, or family scheduling (Doctorow 2023, 160-161); Honeywell's sexual discrimination was not limited to cisgender women, as a senior executive for the company publicly expressed their policy in 1970, "We would not employ a known homosexual" (Raeburn 2004:8). To be clear, patterns of sexual discrimination in ICT development, implementation, and beneficence remain a current and critical concern (cf. Evans 2018; Noble 2018; Perez 2019). The well-to-do cyborg woman who could afford (or whose husband could afford, from the perspective of the manufacturers) a \$10,000 computer in 1969 has today been replaced by a diverse socioeconomic spectrum of household food producers (not always but still modally women) who work in cyborg concert with search engines, specialized apps, digital assistants, and kitchen robots, all of which function to some degree with AI. These cyborg cooks must negotiate available ingredients and cooking equipment with the outputs of suggested recipes and instructions, cybernetically modifying search terms and combining query results as necessary to illuminate possible substitutions and alternate parameters of time and temperature. They also tweak the settings on sensor-driven "smart" devices to better accommodate desired outcomes as opposed to those which are standard (Graf 2023).

The cyber-economic needs of cooking go beyond the context of a kitchen if one considers the roles of digital tools in provisioning, finding groceries, sourcing cooking tools, navigating between physical and online shopping experiences, manipulating digital payment methods, and a host of other daily chores to keep oneself and household fed and organized. In accomplishing all of these needs and more the cybernetic qualities of information flows can be conceived as a new form of *umwelt*, a subjective experiential world of phenomena, sensory flows, and interpretation, for cyborgs who probe targets and conceptualize environments using ICTs and AI with the same readiness as do eels with generative electrical fields, or as do cetaceans with echolocation (Kadlekova and Krbec 2020). Recognizing emergent cyborg capacities

to understand one's own umwelt and networked information flows, similar to our biological senses, necessitates that ICT developers, social scientists, and policymakers maintain "a larger frame through which to explore the plurality and diversity of contemporary practices of making futures [with technologies which enable] coherent sets of practices that enact distinctive practical and goal-oriented rationalities" (Lemke and Welz 2023, 5). The realization of cyber-economic needs, or the understanding of one's own cyborg life with AI-enabled ICTs raises questions related to AI development and function which may be posed in a manner similar to five questions developed by Onuoha and Nucera (2018, 27):

What issue are designers expressly attempting to address? (Is this a problem of people with or without power?)

How can AI help solve that issue? (Who has access to the solutions?)

What role do humans have in that process? (Who makes choices with the results? Who is governed by the results? Does the issue originate in inequalities?)

What data are needed to create an AI to address the issue? (Whose needs or statuses are represented within the system?)

How will those data be gathered in a responsible way that respects the privacy and consent of individuals? (Does the design of the system target particular individuals or categories of people for benefits or abuse?)

Comparable questions could be posed in any circumstance of power relations, regarding any resource fundamental for survival. Although people with infrastructure that provides running water may take it for granted, in moments where water service is uncertain or of dubious quality the lines of power demarcation can be stark. This invisibility of infrastructure is often by design, and such opacity can be exacerbated by infrastructural coupling with AI if human oversight of outcomes is obviated (Mervic 2020). So too does AI as cyberinfrastructure provide ready evidence of cyborg users' places in power structures, and hint at unequal data mining strategies, when it fails or glitches in ways that are technically opaque but more apparent in a lived moment, or when it attempts to sell related products or features, or when it requires fees to unlock certain features (Doctorow 2021). This potentially precarious infrastructural relationship also helps to define the affordances and constraints through which humans augmented with life-changing medical technologies such as pacemakers, insulin pumps, glucose monitors, co-

chlear implants and other differentially enabling medical devices interact with their built and informational surroundings, acquiring firmware updates and sending alerts through passive WiFi, engaging with their human hosts through data-driven outputs and inputs dependent on the built environment (Forlano 2017; Gray 1995; Gray et al. 2021; Helmreich 2016; Oudshoorn 2020; Quigley and Ayihongbe 2018). With a nod to a possible future involving more functional and available brain-machine interfaces than presently available, such will also necessarily involve the inextricable yet highly contingent cognitive connections of human organisms directly with potentially inequitable infrastructures.

### 3. CYBORGS IN THE AI-AUGMENTED WORKPLACE

These lessons of inherent potentials and realities of inequality are then the lessons that cyborg humans bring to AI in their workplaces. These are the experiences which help to frame cyborg attitudes and concerns about AI as components of ICTs in sociocultural contexts, not in a high-level abstract way like an understanding of evolutionary theory and antibiotic resistance (cf. NSF 2018), but in the very direct ways in which services one depends upon to live through the day either function or not and the patterns of experience which develop (cf. Nadeem 2023; Onuoha and Nucera 2018). Recall the stance of the American Medical Association, which calls AI “augmented intelligence” to highlight that AI tools augment human medical workers. This terminology would likely make sense to any cyborg connected to the inputs and outputs of an AI system as they must monitor, govern, and potentially take the blame for failures, similar to how agricultural or factory workers are responsible for monitoring mechanical equipment. A recent working paper published by the Harvard Business School (Dell’Acqua et al. 2023) developed a detailed bivariate model of how workers partnered with AI, again with a very deliberate emphasis on a relationship of augmentation between the AI and the worker, may succeed or not at their given tasks. Dell’Acqua and colleagues (2023) do not discuss anthropology, Donna Haraway, or cyborg theory in their paper, yet it is particularly illustrative of the mindset of the managerial class regarding these situations; problematically for readers of this essay, those authors name their models the “Centaur” and the “Cyborg” which for purposes of clarity will here be referred to as “Type 1” and “Type 2” respectively.

To Dell’Acqua et al. (2023), both types of workers function within a “jagged frontier” of AI development, by which they mean the current implementation of the AI is such that a closed-source model may function unpredictably well or poorly depending on the state of available training data for the AI which exists in a black box with respect to the cyborg worker (especially OpenAI’s multimodal large language model, Generative Pre-trained Transformer 4, or GPT-4). Type 1 workers switch between AI-forward and human-forward modes of work, focusing on AI solutions when they recognize that the knowledge domain is well within the AI’s frontier. They use the AI model to both map a knowledge domain and refine human-generated content. Regarding this essay’s definition of the cyborg, it is apparent that Type 1 workers utilize the cybernetic qualities of the AI which are proven to the cyborg worker’s satisfaction to supplement or augment information seeking activities. Type 2 workers are more AI-centric, reliant upon workers’ linguistic skills in query formation, that is to ask/state a more precise question/instruction to elicit useful output. Type 2 worker actions as often as not do not deeply engage esoteric facts within the training data but instead instruct the AI to use worker supplied information such as essays, scripts, and data to request editorial changes or other critical analyses, development of derivative or summary material, or otherwise searching for internal patterns in the limited set supplied by the worker. Regarding this essay’s definition of the cyborg, it is apparent that Type 2 workers utilize the cybernetic qualities of the AI to speed and regularize organizational, clerical, or pattern recognition activities.

Real-world examples of AI-enabled activities may involve cyborg workers oscillating between the two types of AI-worker models described above. For instance, city workers as described by Richardson (2019) may engage in automated decision-making reliant on the knowledge domain of an AI (Type 1), or to supply data to an AI system with queries designed to elicit responses for predictive policing or traffic management (Type 2), the latter examples emphasizing AI’s considerable strength-of-function to serve as surveillance technology on an unwitting public (Coldewey 2023). Recent media reports indicate that United States government immigration employees may be overly reliant on AI translation software in a Type 1 fashion that does not account for errors in the software, creating dangerous issues and delays in the asylum

approval process (Bhuiyan 2023). Political choices on whether or not to include expert critiques of AI methodologies in civic implementations will have tangible impacts on the public good (Martin 2023). Such critique is imperative, considering the origins of so many AI tools in the industrial relationships of modernity and ongoing colonial relationships of surveillance and control masquerading as governance. In such scenarios, unchecked AI deployment not only follows the oppressive inheritance of centralized extractive systems which are used to subjugate marginalized peoples in the periphery and ultimately core alike, but AI development left unchecked also ultimately follows the original abusive patterns of colonial systems by utilizing diverse peripheral populations as cheaply exploited labor for such repetitive tasks as checking language modeling and screening traumatic imagery and text from training data (Muldoon et al. 2023; Muldoon and Wu 2023).

Within the geospatial analysis community including users of geographic information systems (GIS), as described by Locate Press (2022) cyborg workers may engage no-code tools to perform complex tasks defined by prose language queries, reliant on the training data of the AI to produce code to accomplish the desired tasks (Type 1), or may use the AI to provide semantically structured analyses of datasets to suggest alternative interpretations of their distributions (Type 2). Furthermore, Type 2 automation to recognize buildings in aerial imagery, followed by human validation, has proven to have significant value in open data disaster relief and development support work conducted by Humanitarian OpenStreetMap with long term plans to support open-source AI-assisted mapping which mitigates model bias and facilitates stakeholder feedback (HOTOSM 2023, 20).

Within heritage research, curation professionals described by Kansa (2023) may coordinate and engage pattern recognition algorithms on artifact imagery to facilitate computer-aided typological identification of new finds (Type 1). However, the complex colonial histories of many collections as well as varied contextually ethical concerns regarding stakeholders in heritage big data and visual data will need to be continually addressed as such models are constructed (Knazook 2023).

#### 4. CYBORGS IN AI-AUGMENTED EDUCATION

These extant (and growing) examples of normalized AI-augmentation in the workplace and everyday life raise immediate concerns for educators who have a very real need to comprehend the boundaries of AI behaviors in various arenas of practice to develop and implement successful curricula. Such educational programs must, of course, involve technical training in the management and organization of inputs, AI tools, and outputs in a strict mediational sense. As noted by Dell'Acqua et al. (2023), AI users of all types were immensely constrained by the qualities of their domain-specific training which enabled critical comprehension of AI results. Even more importantly, educational programs must grapple with the ethics of AI training and implementation at all levels to help students understand the benefits and harms that may accrue from decisions they make for themselves and their communities without inadvertently normalizing worldviews encoded in always limited and necessarily biased data sets (Miceli and Posada 2022).

For instance, recent advances in natural language processing (NLP) have led to the development of large neural language models (LMS), such as Google's Bard or OpenAI's ChatGPT, that can generate fluent and coherent texts on assorted topics and tasks. However, how well do these models understand the meaning of natural language, which is how a cyborg user will most often encounter and critique them? And what are the implications of using them for teaching students in higher education? Bender and Koller (2020) argue that LMS cannot learn the meaning of natural language from form alone. They define meaning as the relation between a linguistic form and communicative intent, and they present several thought experiments to show that meaning is not in the training signal of language modeling. They also discuss the role of human language acquisition and distributional semantics in grounding language in the world. They conclude that the field of NLP should be more careful about the claims and terminology used when evaluating LMS on tasks that involve natural language understanding (NLU). They suggest that a clear distinction between form and meaning will help guide the field towards better science and progress on NLU. The issue is further compounded by the fact that "large language models, machine translation systems, multilingual dictionaries, and corpora -- is currently limited to 2 to 3 percent of the world's most widely spoken



and/or financially and politically best-supported languages” (Helm et al. 2023).

Applying this argument to teaching students in higher education, it is important not to rely solely on LMS or other NLP tools to assess students’ language skills or comprehension. LMS can only capture the form of language, but not the meaning or the intent behind it. Therefore, they might miss the nuances, ambiguities, and errors that human teachers can detect and correct. Moreover, LMS are not grounded in the real world, so they cannot provide feedback or guidance on how to use language effectively in different contexts and situations. Teaching students in higher education requires more than just evaluating their linguistic performance, but also their critical thinking, creativity, and problem-solving abilities. One might argue that LMS can be useful for teaching students in higher education by providing them with examples, suggestions, or corrections for their writing or speaking tasks. However, this argument overlooks the potential risks and limitations of using LMS for such purposes. First, LMS are not reliable sources of information or knowledge, as they can generate texts that are factually incorrect, inconsistent, or biased. Second, LMS are not transparent or explainable, as they do not reveal how or why they produce certain outputs or decisions. Third, LMS are not ethical or responsible, as they can generate texts that are harmful, offensive, or misleading. Therefore, using LMS for teaching students in higher education might lead to plagiarism, misinformation, or manipulation. Comprehension of ethical contexts involves cybernetic skills that LMS cannot teach or measure, and that require human interaction and collaboration to generate information, glean knowledge, and interpret resulting feedback for continued action.

AI also poses other ethical challenges and risks, such as discrimination, bias, and exclusion. According to Ramírez (2023), the root of these problems lies in the anthropological view behind the algorithms of AI, which often reflects a partial and limited understanding of reality and the human person. She suggests that a more holistic and integral view of the person is needed to overcome the discrimination generated by AI. This implies that AI should not only be designed and evaluated based on technical criteria, but also on ethical and humanistic criteria, such as respect for human dignity, diversity, and rights.



One example of how AI can discriminate against or exclude people in higher education is the use of predictive analytics to identify students who are at risk of dropping out or failing. While this can help provide timely interventions and support, it can also create a self-fulfilling prophecy or a label that affects the students' self-esteem and motivation. Moreover, the algorithms that generate these predictions may be based on data that is biased or incomplete, such as standardized test scores, demographic variables, or previous academic performance. These data may not capture the full potential or circumstances of each student and may ignore other factors that influence their learning, such as personal interests, goals, or passions. Therefore, AI should not be used to judge or categorize students based on narrow or superficial criteria, but rather to empower and inspire them to achieve their full potential.

Another example of how AI can enhance or diminish the role of human agency and creativity in higher education is the use of automated grading or feedback systems to assess students' work. While this can be useful to save time and provide consistent and objective feedback, it can also reduce the quality and depth of the learning process. For instance, automated systems may not be able to recognize the originality or complexity of students' ideas, arguments, or expressions. They may also not be able to provide personalized or constructive feedback that addresses the specific needs or strengths of each student. Furthermore, automated systems may discourage students from exploring different perspectives or approaches and encourage them to conform to a predefined standard or model. Therefore, AI should not be used to replace or undermine the role of human teachers or peers in providing meaningful and relevant feedback, but rather to complement and enrich it through reflective modes of cybernetic interactions.

The caveat is that AI in higher education should be guided by a vision that values the whole person, and not as a mere object or data point (cf. Powell 2018). This requires a more holistic and integral view of the person that respects their dignity, diversity, and rights. It also requires a balance between human and machine intelligence that enhances rather than diminishes the role of human agency and creativity in learning. By doing so, AI can create new opportunities for collaboration, communication, and innovation in higher education. In other words, teachers should use LMS as a supplementary tool but not as a replacement for human

instruction and evaluation, creating a contextual cybernetic balance for students between the AI tool, other educational materials, other ICT tools, and the learning community.

One way that professors can use LMs as a supplementary tool is to generate prompts, questions, or exercises for their students based on the topics or texts that they are teaching. For example, a professor can use an LM to create a summary, a paraphrase, or a critique of an article that they want their students to read and analyze. Then, they can ask their students to compare and contrast their own summaries, paraphrases, or critiques with the ones generated by the LM. This can help the students improve their reading comprehension, writing skills, and critical thinking abilities. Moreover, it can also help the students learn how to identify and avoid the mistakes or biases that LMs might make when generating texts, and if implemented with proper positive feedback provides for students a functional rationale to appreciate close reading skills and a willingness to cognitively engage with large texts as important educational materials and not just as legacy media.

Another way that professors can use LMs as a supplementary tool is to provide feedback, suggestions, or corrections for their students' writing or speaking assignments. For example, a professor can use an LM to check the grammar, spelling, or style of their students' essays or presentations. Then, they can provide their students with the errors or improvements that the LM detected or suggested. However, they should also explain the reasons behind the feedback, and verify that the feedback is accurate and appropriate. This can help the students improve their language proficiency, communication skills, and academic standards. Furthermore, it can also help the students learn how to evaluate and use the feedback from LMs wisely and responsibly.

Critical thinking abilities are the skills that enable one to analyze, evaluate, and synthesize information from various sources and perspectives. LMs and humans differ significantly in their critical thinking abilities, as LMs are limited by the data and algorithms that they are trained on, while humans are capable of learning from experience and reasoning beyond the given data. LMs can generate texts that are fluent and coherent, but they cannot verify the validity, consistency, or relevance of the information that they use or produce. Humans as cyborgs can generate texts that are not only fluent and coherent, but also accurate, logical,

and meaningful. LMs can perform tasks that involve natural language understanding (NLU), such as answering questions or summarizing texts, but they cannot explain how or why they produce certain outputs or decisions. Humans as cyborgs can perform tasks that involve not only NLU, but also natural language generation (NLG), such as creating questions or critiques, and they can justify their outputs or decisions with evidence and arguments. Therefore, LMs are not now nor in any foreseeable future comparable to humans as cybernetic organisms in terms of critical thinking abilities, as LMs are restricted by the form of language (Bender 2023; Bender et al. 2021), while humans can grasp the meaning and intent behind language.

That said, Artificial Intelligence has a new and exciting place in higher education through the collaboration between humans and machines that it engenders. In a way that is exceedingly compatible with the understanding of cyborg anthropology, the idea of “social machines” put forth by Tim Berners-Lee, the inventor of the World Wide Web, describes environments that combine humans and technology to produce outputs or actions that would not be possible without both parties present (Hendler and Berners-Lee 2009). Applying the ideas of Berners-Lee to higher education, one imagines social machines that could enhance the learning experience of students and teachers. For example, a social machine allows students to collaborate on projects, assignments, or exams, by providing them with tools to communicate, share resources, and give feedback. A social machine also allows teachers to design more engaging and personalized courses, by using data from students’ interactions, preferences, and performance to tailor the content and delivery. A social machine facilitates peer review and assessment, by enabling students and teachers to evaluate each other’s work and provide constructive criticism. A social machine creates new opportunities for learning beyond the classroom, by connecting students and teachers with experts, mentors, or peers from different disciplines, cultures, or locations, and its growing reverberations in education can be most fruitfully understood in the words of Amber Case (2010), “We are all cyborgs now”.

## CONCLUSION (A CONVERSATION WITH GUEST WRITER MICROSOFT COPILOT)

To sum up, it seemed pertinent to us as cyborgs in the Haraway model to engage “Type 2” behaviors and enlist an AI tool in conversation about this essay which we can critique as a final example. As employees of Indiana University, we are privileged to have access to enterprise-license usage of Microsoft’s Copilot AI (IU UITS 2023a) which the university administration is attempting to comprehend (IU UITS 2023b). A function of this tool is to conduct textual analysis of documents open within the Microsoft Edge web browser. We provided Copilot with the following prompt: “Write a 300-word conclusion to the essay in this PDF which emphasizes critical feminist theory as described in the essay, concerns about inequality as described in the essay, human evolutionary concepts as described in the essay, and the work of Donna Haraway cited in the essay”. The following text in italics is Copilot’s response:

*In conclusion, the integration of critical feminist theory into the discourse on artificial intelligence (ai) and cyborg anthropology underscores the persistent inequalities that technology can both perpetuate and potentially mitigate. Donna Haraway’s seminal work, which critiques the patriarchal and colonial structures embedded in technological advancements, remains profoundly relevant. Haraway’s cyborg metaphor challenges us to rethink the boundaries between human and machine, emphasizing that ai should not be seen as a separate or superior form of intelligence but as a tool that augments human agency.*

*The essay highlights the concerns about inequality inherent in ai development and deployment. ai systems, often created and controlled by powerful capital interests, can reinforce existing hegemonic patterns and biases. These systems reflect the sociocultural and ethical values of their creators, which can lead to the marginalization of already oppressed groups. Addressing these inequalities requires a concerted effort to promote human-ai literacy, respect for human dignity and rights, and the development of ethical ai frameworks that prioritize inclusivity and fairness.*

*Furthermore, the essay situates these discussions within the broader context of human evolutionary concepts. The reliance on technology for survival is not a new phenomenon but a fundamental aspect*

*of human evolution. From the use of stone tools to modern icts, humans have always been cyborgs, integrating technology into their daily lives. This evolutionary perspective reinforces the idea that technology, including ai, should be harnessed to enhance human capabilities and promote equitable social structures.*

*Ultimately, Haraway's work and the insights from cyborg anthropology provide a critical lens through which we can examine the transformative potential of ai. By acknowledging and addressing the inequalities embedded in technological systems, we can strive towards a future where ai serves as a liberatory tool, fostering human creativity, agency, and social justice.*

Returning to our human voices, and quickly dispensing with Copilot's awkward choice of describing Haraway's work as seminal, we can recognize how Copilot is statistically deriving textual tokens from the corpus of the essay and returning them to us as highly generalized output as explained in the works of Emily Bender and colleagues cited repeatedly above, or more derisively critiqued by Bergstrom and Ogbunu (2023). Copilot regurgitates the frequently used words with few contexts because the essay is its universe, basically plagiarizing the human authors in the first paragraph, neglecting any specific consideration of oppression from the essay (low-wage workers forced to endure toxic data, and women struggling under sexist policies are invisible). In the second paragraph, Copilot generically notes concerns about inequalities, letting "sociocultural and ethical values" carry the weight of myriad peoples who have been socioeconomically marginalized through bigotry, tenuous infrastructural relations, and who become the fuel for surveillance capitalists. In the third paragraph, Copilot glosses human evolution to pure technological determinism, neglecting the cybernetic aspect of human existence and thus ignoring the damage done to humans who are repressively severed from their own agency regarding our instinctual needs to relate to one another through the interplay of information and material culture. In the fourth paragraph, Copilot finishes with a glibly modernist tone of naivete which suggests that simply acknowledging the inequalities in systems will inherently point humanity toward an equitable future, it shoehorns Haraway back into the narrative with no discussion of sexism or classicism, as if oppressors

were not already keenly aware of how their dominance exerts control and yields dividends upon which they continue to base their oppression.

Thus, we human authors as researchers and educators here recognize that our own employer, a multi-billion-dollar per year non-profit corporation (also known as a research university) has provided us with a tool of intriguing but dubious qualities developed by an even larger for-profit corporation. This tool has strongly opaque construction which makes it hard for us to source and trace obvious discriminatory and biased results even as we recognize their construction. Microsoft like other large corporate AI producers has placed hard-coded stops into its AI tools which, aside from any pre-existing limitations of training data, can hamper them in directly dealing with controversial subjects like bigotry, inequality, and oppression (Marres et al. 2024). We, like the reader, and like humanity in general, now live as cyborgs with all the emotional and ethical strengths originally described by Haraway and embellished by others for decades, in an age of AI tools that increasingly push their tendrils into every sector of our lives and environment. It is through continued engagement with history, deeply evolutionary, and strongly critical of recent developments that we can expose the designs and functions of these AI tools to better advocate for all human cyborgs and to devise ways to work with and around AI to teach increasingly distant lessons of earlier humanity to current and future generations who will come of age with no direct understanding of a time before AI existed.

#### REFERENCES CITED

- American Medical Association. 2023. "Augmented Intelligence in Medicine". American Medical Association. October 6, 2023. <https://www.ama-assn.org/practice-management/digital/augmented-intelligence-medicine>
- Bauman, Zygmunt y David Lyon. 2013. *Liquid Surveillance*. Cambridge, UK: Polity Press.
- Bender, Emily. 2023. "Thought Experiment in the National Library of Thailand". *Medium* (blog). 27 de mayo de 2023. <https://medium.com/@emilymenonbender/thought-experiment-in-the-national-library-of-thailand-f2bf761a8a83>
- Bender, Emily, Timnit Gebru, Angelina McMillan-Major y Shmargaret Shmitchell. 2021. "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?" *Proceedings of the 2021 ACM Conference on Fairness*,

- Accountability, and Transparency*, 610–23. New York: Association for Computing Machinery. <https://doi.org/10.1145/3442188.3445922>
- Bender, Emily y Alexander Koller. 2020. “Climbing towards NLU: On Meaning, Form, and Understanding in the Age of Data”. En *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, 5185–98. Association for Computational Linguistics. <https://doi.org/10.18653/v1/2020.acl-main.463>
- Benjamin, Ruha. 2019. *Race after Technology: Abolitionist Tools for the New Jim Code*. Cambridge, UK: Polity Press.
- Bergstrom, Carl y Ogbunu Brandon. 2023. “ChatGPT Isn’t ‘Hallucinating,’ It’s Bullshitting”. *Undark Magazine*. 6 de abril de 2023. <https://undark.org/2023/04/06/chatgpt-isnt-hallucinating-its-bullshitting/>
- Bernius, Matthew. 2012. “Manufacturing and Encountering ‘Human’ in the Age of Digital Reproduction”. En *Human No More: Digital Subjectivities, Unhuman Subjects, and the End of Anthropology*, editado por Neil Whitehead y Michael Wesch, 49-70. Boulder: University Press of Colorado.
- Bhuiyan, Johana. 2023. “Lost in AI Translation: Growing Reliance on Language Apps Jeopardizes Some Asylum Applications”. *The Guardian*, 7 de septiembre de 2023, sec. US news. <https://www.theguardian.com/us-news/2023/sep/07/asylum-seekers-ai-translation-apps>
- Bohannon, Cat. 2023. *Eve: How the Female Body Drove 200 Million Years of Human Evolution*. New York: Alfred A. Knopf.
- Case, Amber. 2010. “We Are All Cyborgs Now”. *ted* (video). 2010. [https://www.ted.com/talks/amber\\_case\\_we\\_are\\_all\\_cyborgs\\_now](https://www.ted.com/talks/amber_case_we_are_all_cyborgs_now)
- Case, Amber. 2014. *An Illustrated Dictionary of Cyborg Anthropology*. Segunda edición. United States: Cyborg Anthropology.
- Clynes, Manfred y Nathan Kline. 1960. “Cyborgs and Space”. *Astronautics*, septiembre 1960. <https://web.mit.edu/digitalapollo/Documents/Chapter1/cyborgs.pdf>
- Coldewey, Devin. 2023. “Signal’s Meredith Whittaker: AI Is Fundamentally ‘a Surveillance Technology’”. *TechCrunch* (blog). 25 de septiembre de 2023. <https://techcrunch.com/2023/09/25/signals-meredith-whittaker-ai-is-fundamentally-a-surveillance-technology/>
- Davis-Floyd, Robbie y Joseph Dumit. 1998. *Cyborg Babies: From Techno-Sex to Techno-Tots*. New York: Routledge.



- Dell'Acqua, Fabrizio, Edward McFowland, Ethan Mollick, Hila Lifshitz-Assaf, Katherine Kellogg, Saran Rajendran, Lisa Kraye, François Candelon y Karim Lakhani. 2023. "Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality". SSRN Scholarly Paper. Rochester, NY. <https://doi.org/10.2139/ssrn.4573321>
- Doctorow, Cory. 2020. *How to Destroy Surveillance Capitalism*. New York: Stonesong Digital, LLC.
- Doctorow, Cory. 2023. *The Internet Con: How to Seize the Means of Computation*. London: Verso.
- Donath, Judith. 2014. *The Social Machine: Designs for Living Online*. Cambridge, Massachusetts: MIT Press.
- Escobar, Arturo, David Hess, Isabel Licha, Will Sibley, Marilyn Strathern y Judith Sutz. 1994. "Welcome to Cyberia: Notes on the Anthropology of Cyberculture [and Comments and Reply]". *Current Anthropology* 35, 3: 211–31.
- Evans, Claire Lisa. 2018. *Broad Band: The Untold Story of the Women Who Made the Internet*. New York, New York: Portfolio/Penguin.
- Forlano, Laura. 2017. "Data Rituals in Intimate Infrastructures: Crip Time and the Disabled Cyborg Body as an Epistemic Site of Feminist Science". *Catalyst: Feminism, Theory, Technoscience* 3, 2: 1-28.
- Foucault Welles, Brooke, Olga Sarmiento, Ana Maria Jaramillo y Mariana Macedo, eds. 2022. "Networked Inequality: Studies on Diversity and Marginalization". Special Collection of *Applied Network Science*. <https://appliednetsci.springeropen.com/networkedinequality>.
- Graeber, David y David Wengrow. 2021. *The Dawn of Everything: A New History of Humanity*. UK: Penguin.
- Graf, Katharina. 2023. "Cyborg Cooks: Mothers and the Anthropology of Smart Kitchens". *Digital Culture & Society* 9, 1: 49–70. <https://doi.org/10.14361/dcs-2023-090104>
- Gray, Chris Hables. 1995. *The Cyborg Handbook*. New York: Routledge.
- Gray, Chris Hables. 2002. *Cyborg Citizen: Politics in the Posthuman Age*. New York: Routledge.
- Gray, Chris Hables, Heidi Figueroa-Sarriera y Steven Mentor, eds. 2021. *Modified: Living as a Cyborg*. New York: Routledge.
- Hakken, David. 1999. *Cyborgs@Cyberspace?: An Ethnographer Looks to the Future*. New York: Routledge.



- Hakken, David. 2003. *The Knowledge Landscapes of Cyberspace*. New York: Routledge.
- Hanson, Allan. 2009. "Beyond the Skin Bag: On the Moral Responsibility of Extended Agencies". *Ethics and Information Technology* 11, 1: 91-99. <https://doi.org/10.1007/s10676-009-9184-z>
- Haraway, Donna. 1985. "Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s". *Socialist Review* 80: 65-108.
- Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective". *Feminist Studies* 14, 3: 575-99.
- Haraway, Donna. 1989. *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. New York: Routledge.
- Haraway, Donna. 1991. *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge.
- Haraway, Donna. 1994. "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s". En *The Postmodern Turn: New Perspectives on Social Theory*, editado por Steven Seidman, 82-115. Cambridge, UK: Cambridge University Press.
- Hayles, Katherine. 1998. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press.
- Helm, Paula, Gábor Bella, Gertraud Koch y Fausto Giunchiglia. 2023. "Diversity and Language Technology: How Techno-Linguistic Bias Can Cause Epistemic Injustice". arXiv. <https://doi.org/10.48550/arXiv.2307.13714>
- Helmreich, Stefan. 2013. *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond*. Princeton, New Jersey: Princeton University Press.
- Hendler, Jim y Tim Berners-Lee. 2010. "From the Semantic Web to Social Machines: A Research Challenge for AI on the World Wide Web". *Artificial Intelligence* 174, 2: 156-61. <https://doi.org/10.1016/j.artint.2009.11.010>
- HOTOSM. 2023. "Impact Report 2022-2023". Humanitarian OpenStreetMap. [https://www.hotosm.org/uploads/2022-2023-ImpactReporto8\\_30.pdf](https://www.hotosm.org/uploads/2022-2023-ImpactReporto8_30.pdf)
- IU UITS. 2023a. "About Bing Chat Enterprise at IU". Indiana University, University Information Technology Services Knowledge Base. 2023. <https://kb.iu.edu/d/bing>

- IU UITS. 2023b. "Acceptable Uses of Generative AI Services at IU". Indiana University, University Information Technology Services Knowledge Base. 2023. <https://kb.iu.edu/d/biit>
- Kadlecová, Jana y Jaroslav Krbec. 2020. "Umwelt Extended: Toward New Approaches in the Study of the Technologically Modified Body". *Journal of Posthuman Studies* 4, 2: 178–94. <https://doi.org/10.5325/jpoststud.4.2.0178>
- Kansa, Eric. 2023. "Artificial Intelligence (AI) and Open Context". *The Alexandria Archive Institute* (blog). 8 de octubre de 2023. <https://alexandriaarchive.org/2023/10/08/artificial-intelligence-ai-and-open-context/>
- Knazook, Beth. 2023. "'Using Fair with Care' and Other Thoughts on Sharing Cultural Heritage Images as Data in South Africa". *Digital Repository Ireland* (blog). 26 de septiembre de 2023. <https://dri.ie/news/using-fair-with-care/>
- Lemke, Thomas, and Gisela Welz. 2023. "Fixing Futures: Technologies of Anticipation in Contemporary Societies". Goethe University Frankfurt am Main. <https://fixingfutures.eu/files/2022/12/Research-Programme.pdf>
- Locate Press. 2022. "How Artificial Intelligence Is Improving Open Source GIS". *Locate Press Blog* (blog). 2 de noviembre de 2022. <https://blog.locatepress.com/how-artificial-intelligence-is-improving-open-source-gis/>
- Marres, Noortje, Michael Castelle, Beatrice Gobbo, Chiara Poletti y James Tripp. 2024. "AI as Super-Controversy: Eliciting AI and Society Controversies with an Extended Expert Community in the UK". *Big Data & Society* 11, 2. <https://doi.org/10.1177/20539517241255103>
- Martin, Alexander. 2023. "British Government Quietly Sacks Entire Board of Independent AI Advisers". *The Record*. 21 de septiembre de 2023. <https://therecord.media/uk-disbands-ai-advisory-board-cdei-rishi-sunak>
- McElreath, Richard. 2023. "I Told a Colleague That Logistic Regression Is AI and They Got Mad at Me, so I Made a Chart. Find Yourself. I Am 'Tinder Is AI'". *NerdCulture.De* (blog). 23 de Agosto de 2023. <https://nerdculture.de/@rlmcelreath/110938545075497824>
- Mervich, Carlo. 2020. "The Human Infrastructure of Artificial Intelligence". Tesis de maestría, Universidad de Twente, Enschede, Países Bajos. <http://essay.utwente.nl/82808>

- Miceli, Milagros, and Julian Posada. 2022. "The Data-Production Dispositif". *Proceedings of the acm on Human-Computer Interaction* 6, 460: 1-37. <https://doi.org/10.1145/3555561>
- Muldoon, James, Callum Cant, Mark Graham y Funda Ustek Spilda. 2023. "The Poverty of Ethical AI: Impact Sourcing and AI Supply Chains". *ai & Society*. <https://doi.org/10.1007/s00146-023-01824-9>
- Muldoon, James y Boxi Wu. 2023. "Artificial Intelligence in the Colonial Matrix of Power". *Philosophy & Technology* 36, 80. <https://link.springer.com/article/10.1007/s13347-023-00687-8>
- Nadeem, Reem. 2023. "Public Awareness of Artificial Intelligence in Everyday Activities". *Pew Research Center Science & Society* (blog). 15 de febrero de 2023. <https://www.pewresearch.org/science/2023/02/15/public-awareness-of-artificial-intelligence-in-everyday-activities/>
- National Science Foundation. 2020. "Science and Technology: Public Attitudes, Knowledge, and Interest". National Science Board Science and Engineering Indicators 2020 (NSB-2020-7). <https://nces.nsf.gov/pubs/nsb20207/downloads>
- Noble, Safiya Umoja. 2018. *Algorithms of Oppression: How Search Engines Reinforce Racism*. New York: New York University Press.
- Onuoha, Mimi y Diana Nucera. 2018. "A People's Guide to Artificial Intelligence". Allied Media Projects. <https://alliedmedia.org/resources/peoples-guide-to-ai>
- Oudshoorn, Nelly. 2020. *Resilient Cyborgs: Living and Dying with Pacemakers and Defibrillators*. Singapore: Palgrave Macmillan.
- Perez, Caroline Criado. 2019. *Invisible Women: Data Bias in a World Designed for Men*. New York: Abrams Press.
- Powell, Alison. 2018. "The Data Walkshop and Radical Bottom-Up Data Knowledge". En *Ethnography for a Data Saturated World*, editado por Hannah Knox y Dawn Nafus, 212-232. Manchester, UK: Manchester University Press.
- Prucher, Jeff. 2007. *Brave New Words: The Oxford Dictionary of Science Fiction*. New York: Oxford University Press.
- Quigley, Muireann y Semande Ayihongbe. 2018. "Everyday Cyborgs: On Integrated Persons and Integrated Goods". *Medical Law Review* 26, 2: 276-308. <https://doi.org/10.1093/medlaw/fwyo03>

- Raeburn, Nicole Christine. 2004. *Changing Corporate America from Inside Out: Lesbian and Gay Workplace Rights*. Minneapolis: University of Minnesota Press.
- Richardson, Rashida. 2019. "Confronting Black Boxes: A Shadow Report of the New York City Automated Decision System Task Force". AI Now Institute. <https://ainowinstitute.org/publications/confronting-black-boxes-a-shadow-report-of-the-new-york-city-automated>
- Turkle, Sherry. 2008. "Always-On / Always-On-You". En *Handbook of Mobile Communication Studies*, editado por James Katz, 121-137. Cambridge, Massachusetts: MIT Press.
- Vearrier, Laura, Arthur Derse, Jesse Basford, Gregory Luke Larkin y John Moskop. 2022. "Artificial Intelligence in Emergency Medicine: Benefits, Risks, and Recommendations". *The Journal of Emergency Medicine* 62, 4: 492-99. <https://doi.org/10.1016/j.jemermed.2022.01.001>
- Vertesi, Janet. 2015. *Seeing Like a Rover: How Robots, Teams, and Images Craft Knowledge of Mars*. Chicago: University of Chicago Press.
- Wells, Joshua. 2014. "Keep Calm and Remain Human: How We Have Always Been Cyborgs and Theories on the Technological Present of Anthropology". *Reviews in Anthropology* 43, 1: 5-34. <https://doi.org/10.1080/00938157.2014.872460>
- Wiener, Norbert. 1948. *Cybernetics: Or Control and Communication in the Animal and the Machine*. Actualités Scientifiques et Industrielles. New York: J. Wiley.