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Social Sciences in the Face of Artificial Intelligence Development – Selected Challenges and Analytical Opportunities

Nauki społeczne w obliczu rozwoju sztucznej inteligencji – wybrane wyzwania oraz możliwości analizy

Abstract

The aim of this article is to provide a theoretical reflection on the challenges that the development of artificial intelligence (AI) poses for the social sciences. The research method applied in this paper is a review and analysis of the literature, through which the author – starting with the issues related to defining artificial intelligence itself and differentiating among the various tools on the market equipped with "intelligent algorithms" – identifies analytical areas of particular relevance from the perspective of the social sciences, such as communication and media studies as well as sociology. The sociocultural changes resulting from technological advancements encompass, among others: 1. the domain of communication; 2. social roles and relationships; 3. power dynamics; and 4. ethical considerations. By addressing selected issues, the paper explores analytical possibilities for examining emerging research problems related to AI. Special attention is given to Human-Machine Communication (HMC), which is an interdisciplinary approach to studying human-machine interactions. The concluding reflections emphasize the importance of integrating insights from various branches of the social sciences to capture better the transformations brought about by modern technologies and their implications.

Keywords

social sciences, artificial intelligence, human-machine communication, social robots, conversational agents

Abstrakt

Cel niniejszego artykułu stanowi teoretyczna refleksja nad wyzwaniami, jakie rozwój sztucznej inteligencji (ang. Artificial Intelligence – AI) stawia przed naukami społecznymi. Zastosowaną w tekście metodą badawczą jest przegląd i analiza literatury, przy pomocy której autorka – wychodząc kolejno od problematyki związanej z definiowaniem samej AI, jak i różnicowaniem dostępnych na rynku narzędzi wyposażonych w „inteligentne algorytmy" – wskazuje na pola analityczne godne uwagi z perspektywy nauk społecznych takich, jak komunikacja społeczna i media oraz socjologia. Zachodzące w wyniku rozwoju technologicznego zmiany o charakterze społeczno-kulturowym obejmują m.in.: 1. obszar komunikowania; 2. role i relacje społeczne; 3. dynamikę władzy; 4. kwestie etyczne. Nawiązując do wybranych kwestii w tekście zostały ukazane możliwości w zakresie analizy pojawiających się za sprawą AI problemów badawczych. Szczególna uwaga skierowana jest w stronę Human-Machine Communication – interdyscyplinarnego podejścia do badań interakcji zachodzących pomiędzy ludźmi a maszynami. Zawarte w podsumowaniu refleksje podkreślają znaczenie przedsięwzięć łączących dorobek różnych nauk społecznych, mających tym samym na celu uchwycenie zmian dokonujących się za sprawą nowoczesnych technologii oraz ich implikacje.

Słowa kluczowe

nauki społeczne, sztuczna inteligencja, komunikowanie człowiek – maszyna, roboty społeczne, agenci konwersacyjni

Introduction

Dynamic technological development particularly advances in the fields of Artificial Intelligence and robotics, poses significant challenges to the social sciences while also imposing an urgent need to observe and analyze the phenomena they are causing in the surrounding social reality. Identifying the implications of social, political, cultural, and economic transformations is crucial in this context. It is a fact that the results of the work of engineers and specialists in engineering, science, and natural sciences go far beyond laboratories and research institutes. As Anthony Elliot (2021) points out, AI is a ubiquitous yet invisible technology.

This article aims to address the following question: What challenges does artificial intelligence pose to the social sciences, and how can the interdisciplinary research field of Human-Machine Communication help in understanding and analyzing them? Recognizing that it is impossible to describe all the challenges exhaustively, the text presents some relevant aspects from a social science perspective. Among some of the key phenomena currently taking place with AI, the author includes: 1. the crossing and blurring of the boundaries of social communication caused by the presence of technological tools such as social robots and conversational assistants using natural language; 2. the emergence of advanced technologies in everyday life (not only in professional but also in private spheres) and the formation of new power dynamics as a result, as well as approaches to social relations; 3. the emergence of hitherto unprecedented ethical dilemmas related strictly to the presence of artificial intelligence and robots in the human world. As mentioned in the abstract, to achieve the stated aim, this study employed a research method based on the analysis and review of the literature.

At the same time, the author is aware that the article does not exhaust all issues related to the challenges posed by the development of AI in the social sciences. Given this, it is proposed to refer synthetically to Human-Machine Communication, an area within the discipline of social communication sciences and media. HMC, which is currently being developed mainly by American research centers such as the University of Central Florida, Northern Illinois University, and the University of Oregon, focuses on studying the phenomenon of human-machine communication with its sociocultural implications. At the same time, this research program is an interdisciplinary platform bringing together researchers from various social sciences and humanities disciplines while drawing on theoretical and methodological approaches present in sociology, philosophy, and pedagogy, among others. An open attitude towards the achievements of other sciences is critical when studying dynamic phenomena of an interdisciplinary nature.

What is artificial intelligence?

The term "artificial intelligence" was first used in 1956 at a scientific conference held at Dartmouth College in the US state of New Hampshire. John McCarthy (2007), one of the field's founding fathers, defined it as the science and engineering involved in creating intelligent computer programs. It is worth noting that the name itself, and its – too narrow for the present day – framing, carry an anthropomorphic charge, fostering sometimes far-reaching comparisons between the capabilities of machines and the biological intelligence with which humans are equipped. Although the explanation cited above may be considered outdated or too concise nowadays, this does not change the fact that, as Lucy Suchman (2023) points out, to this day, science is still struggling with the lack of clear and concrete definitions of artificial intelligence, making it sometimes appear as a completely autonomous entity.

Andreas Kaplan and Michael Haenlein, authors of one of the current, more precise, and less anthropomorphized definition of artificial intelligence, state that it represents the 'ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation' (Kaplan & Haenlein, 2019, p. 17). In the presented conceptualization, key features of AI include: 1 the ability to process massive data sets and recognize patterns in them; 2. the ability to self-learn; 3. daptability manifested by adjusting to conditions in an uncertain and unfamiliar environment; 4. automatic planning capabilities and autonomous decision-making. The definition of artificial intelligence is being explored by researchers from various fields, including science, engineering, technology, social sciences, and the humanities. Public and private actors are also taking up this challenge. The absence of a commonly accepted conceptualization of the term is due to: 1. the lack of general agreement on what biological intelligence is; 2. doubts about the validity of comparing machine skills with human intelligence; and 3. different approaches to the design of AI systems (Kaplan, 2019; Walsh, 2018). Indeed, AI is not a unified mechanism based on universal instructions and rules of operation. Different technologies, often disparate from each other, are responsible for the whole thing and various applications. A key area for AI today is machine learning, which can be divided into several types: supervised, unsupervised, and reinforcement. Equally important is deep learning based on artificial neural networks and natural language processing (NLP), which enables machines to interpret and use human speech.

The literature distinguishes three types of AI – factual and two theoretical – which should also be considered, albeit to a limited extent, when considering social science. The first is narrow AI, which is present in people's everyday lives through, for example, content recommendation systems, image recognition software, conversational assistants, and social robots (Elliott, 2021). It is designed to perform specific tasks or solve problems of one type. It can handle some situations better than

a human, but its skill level generally does not exceed that of biological intelligence. Subsequently, it is assumed that the general AI that would emerge in the future – although this is a matter of constant debate – will have human-level knowledge and cognitive abilities. Because of this, it could perceive the surrounding world precisely as humans do. There is also the concept of a superintelligence, or Technological Singularity, beyond all human capabilities. As Ray Kurzweil (2013) assumes, it could protect homo sapiens from disease, death, thus making the species immortal. In the social sciences, it is worth looking at the social imaginaries, including narratives about the future of AI, prevalent among transhumanists such as Ray Kurzweil, Nick Bostrom, and Max More, and the opinions of researchers distancing themselves from the concept of the Technological Singularity (Toby Walsh, or Jerry Kaplan, among others). The issue of societal perceptions of technological development, which may be influenced by certain narratives from the business world (e.g., Elon Musk and the Neuralink company) and popular culture, also remains important (Knapik, 2018).

Artificial intelligence, as opposed to deterministic algorithms, adapts its actions to its environment based on data provided to it, for example, through the sensors of various types of devices connected as part of the Internet of Things. This enables it to better cope with new situations. Deterministic algorithms operate in a strictly limited way because they are based on top-down instructions implemented by the programmer. They always generate the same result for the same input data (Kapelczak, n.d.). Therefore, their operation can be described as predictable and repeatable. As Nowina-Konopka (2023) points out, a significant proportion of Poles equate artificial intelligence with deterministic algorithms or with another engineering discipline, robotics, which deals with the design and production of robots, i.e., machines that exist in the physical environment of humans. Initially, robots found their application in dangerous, difficult, tedious, and repetitive jobs for humans (Sztuczna inteligencja, n.d.). In the 1990s, new generations of machines emerged, equipped with artificial intelligence that enabled them to be used in advanced activities such as space and deep-sea exploration.

On the differentiation of machines

AI is both a field of knowledge and a technology through which unprecedented social, cultural, economic, and political phenomena occur (Elliott, 2021). As a science, it deals with the creation of computer programs while also making a significant contribution to the construction of physical machines, as mentioned earlier. Significant problems can be posed to social sciences – especially to novice researchers – because technological tools are diverse in their forms and use. Indeed, people can carry out voice and text conversations in digital environments with virtual conversational assistants – voicebots and chatbots. These tools are widely used in business, marketing, healthcare, finance, education, customer service, media, and many other

areas. They are subject to what the author calls 'top-down' anthropomorphization, whereby they are given human names equipped with a suitably modulated, synthetic 'female' or 'male' voice, as well as specific personality traits. Another technological tool category is social robots, typically found in airports, hospitals, hotels, theme parks, restaurants, or shops. Social robots serve humans' social, emotional, and communication needs, so it is assumed that they should look 'familiar' to users. Such machines are usually divided into: 1. humanoid robots – which replicate the appearance of a human being due to attributes such as make-up, clothing, hair, and manner of movement, among others. This group includes fembots – female-like robots (e.g., Sophia, Bina 48) or child-like robots (e.g., Kaspar); 2. zoomorphic robots – animal-like robots (e.g., Paro the seal, Spot the dog). The phenomenon of machine anthropomorphization itself is fascinating from the point of view of the social sciences. The author distinguishes between two types of it – the aforementioned 'top-down' anthropomorphization, which involves designers attributing human-like characteristics to technological tools, and 'bottom-up' anthropomorphization, which is expressed through users' social reactions to technologies (Skrzypiec, 2023). The issue of attitudes manifested towards social robots and conversational virtual assistants, taking into account the factors influencing them, i.e., individual characteristics of the individual, including anthropomorphization tendencies and belief in the uniqueness of human nature, as well as the cultural context, should be relevant in the social sciences. Equally important are issues of ethical and safe use of the machines, including the degree of trust shown towards them. Furthermore, the diversity of machines forces social science researchers to design their research carefully – methods suitable for analyzing the communication styles present when interacting with chatbots may not necessarily work for the same type of research conducted on social robots. It is worth noting that, with the intensive development of machines and the interest shown in them by the social sciences, experimentation based on the design and simulation of human-machine interactions, controlling for factors that may be relevant to the interaction, will play an increasingly important role in ongoing research (Innes & Morrison, 2021).

Machines as new actors in social communication

Human-Machine Communication describes chatbots, voicebots and social robots, among others, as tools of communicative AI. Because of them, the boundaries in social communication are shifting. Given current technological conditions, generative AI (GAI), which uses large-scale language models and natural language processing methods to create new content in the form of text, images, music, videos, and programming codes, among others, plays a significant role in this process (Fui-Hoon Nah, Zheng, Cai, Siau & Chen, 2023). GAI generates utterances in natural human language, so equipped tools can carry on conversations with humans, formulating

realistic messages that are difficult to distinguish from human utterances. Consequently, technological artifacts cease to mediate communication between people merely – they become senders and receivers of content. As Byron Reeves and Clifford Nass (2000) proved, people exhibit social reactions towards them – they anthropomorphize, apply gender stereotypes, and adhere to norms of politeness and reciprocity. This means that when interacting with a machine or virtual software, users apply rules that guide interpersonal communication. This, in turn, can generate changes in the social structure, including the social roles and relationships described later, new power dynamics, and ethical dilemmas.

Social roles and relationships

As indicated earlier, technological artifacts are designed to resemble human actors. They are also assigned specific social roles such as assistant, teacher, counselor, therapist, and carer, among others. This is to help establish – and, in the long term, the formation – of a better relationship between humans and machines. Thanks to the fact that they recognize familiar features in technological tools, humans know how they should behave (Guzman & Lewis, 2020). This is due to the possessed – and evolutionarily conditioned – experience of interacting with other humans (Guzman & Lewis, 2020). Furthermore, designing machines this way means that users do not have to learn how to use them. Intuitive behavior helps to achieve desired goals without putting unnecessary effort and time into the learning process. However, this situation generates not inconsiderable risks for individuals, such as: 1. the creation of pseudo-relationships, affecting the quality of interpersonal relationships; 2. the alienation crisis and questioning of what is authentic in the real world; 3. exaggerated expectations of AI (Etzrodt et. al. 2024); 4. the risk of manipulation; 5. problems related to the loss of privacy (Krzysztofek, 2011).

New power dynamics

I is present in almost every area of social reality. It is encroaching not only on workplaces but also on the private spaces of everyday life through, among other things, applications designed for meditation, mental health, fitness, personal financial advice, and the various kinds of devices present in homes, integrated into smart homes or the Internet of Things. Humans are not only beginning to make their existence dependent on their functioning. Still, they are also becoming a valuable data resource provided for free to powerful corporations like Facebook, Google, Amazon, and Apple. Mühlhoff (2020) points out that new forms of power and work (often unpaid) are taking shape in the age of artificial intelligence through:

1. Gamification – engaging users in interactive, enjoyable entertainment that looks seemingly harmless. Players, consciously or not, perform specific tasks, sometimes unrelated to the game, to unlock its successive stages. From

a machine learning perspective, the results of these tasks can be a valuable data resource for teaching AI algorithms the mechanisms that govern human behavior;

2. Tapping and tracking – using special scripts that guide human interactions with the machine interface, containing the steps needed to achieve a specific goal. This is how search engines (e.g., Google) work, collecting user data required to train artificial intelligence algorithms when searching for information on the web;
3. Social media platforms – seemingly simple social media activities such as tagging friends in photos are captured and turned into network resources needed for machine learning. Most platforms like Facebook track users' communication habits to improve machine cognitive abilities in a free way;
4. Incentives and economic pressure – extracting data from website and app users through discounts offered to them in return;
5. Crowdsourcing – creating unique platforms by corporate giants (e.g., Amazon's MTurk) dedicated to people willing to perform simple tasks that are difficult to automate. Most often, they are low-paid and targeted at economically disadvantaged people in the Global South, among others. The results of the work carried out are used to train algorithms.

Selected ethical dilemmas

Fui-Hoon Nah and co-authors (2023) highlight several categories of challenges associated with the development of artificial intelligence. They analyze them from the perspective of developers, users, and public institutions. Key dilemmas include: 1. the problem of disseminating harmful content, whether of a vulgar, offensive, discriminatory, sexual, or pornographic nature; 2. AI bias contributing to the favoritism of specific social groups and the simultaneous dehumanization of others on the basis of race, religious belief, sexual orientation – its cause is often unrepresentative or "infected" data; 3. over-reliance on technological tools, including the use of content generated by it, devoid of critical thinking, and lack of willingness to solve problems on their own; 4. privacy and security – the risk of sensitive, or confidential data getting through (business and state importance, among others) into the public domain; 5. abuse – this is a capacious category, drawing attention to, among other things, copyright issues and fraud in the attribution of human authorship to AI-generated content; 6. the digital divide – artificial intelligence is expected to lead to a deepening of digital exclusion and the emergence of new types of social inequality.

How are the social sciences responding to the changes taking place?

Based on descriptive and programmatic approaches, sociologists participate in normative discussions on what should be done – and by which actors – for

the sustainable development of artificial intelligence. According to Liu (2021), studies of AI production, distribution, and consumption are being conducted in the field of sociology, particularly in areas such as the sociology of science and Science and Technology Studies (STS). Zajko (2022) draws attention to the role of criticism of technology, constructed concerning sociological knowledge, which can contribute to strengthening the policy of opposition to specific solutions and thus promoting positive ones. The author states that a nonnegligible role is played by democratic and interdisciplinary participation in the creation of management mechanisms and public policies applied to algorithms. The changes taking place require sociologists to take practical action, including formulating clear and audible normative positions and policy proposals while remaining aware of their limitations. Zajko writes:

> Just as sociological critique can be effective by locating technologies and individualized consequences in systemic terms or a larger context, applied sociology may help orient these sociotechnical systems to address larger, interrelated, and systemic problems, including various kinds of inequality and their consequences. (p. 11)

Mlynář, Alavi, Verma and Cantoni (2018) highlight directions for future research and indicate that it should be oriented towards, among other things: conducting surveys on perceptions of AI in different areas of life, research on the positive and negative effects of its development and impact on employment structure, analysis of communication and discursive processes, and historical analyses of the image of artificial intelligence in pop culture. Joyce and colleagues (2021), on the other hand, state that sociologists should focus on analyzing the inequalities created by AI – including those of a racial, gender, and economic nature – while considering the global history of slavery, patriarchy, capitalism, and white racial supremacy. It is also crucial to explore the social, organizational, and institutional contexts for designing and using AI systems while promoting equitable constructionist practices made possible through participation in various research teams set up by public and corporate entities. Research on how AI can support social movements advocating for equality, emancipatory design, and minimizing harms associated with its presence plays an essential role in this context.

Human-Machine Communication – how can HMC contribute to the social sciences?

The name Human-Machine Communication indicates both the phenomenon of human-machine communication and the social science approach to studying this process, including its socio-cultural consequences. HMC can thus be defined as the exchange of messages between humans and machines and the resulting social meanings, relations, and behavior, occurring at the levels of micro-, meso- and

macro-structures, i.e., individuals, institutions, and organizations, as well as social structures and systems (Etzrodt, Gentzel & Ensgesser, 2022). Writing about HMC in the second context cited, it is important to point out that it is a research program focused on analyzing the specific dynamics, new challenges, and consequences of AI tools assuming communication roles hitherto characteristic of human beings. Human-Machine Communication researchers emphasize the interdisciplinary nature of their work while pointing out that, in fact, the discipline of social communication and media itself has numerous links with other areas of science. Indeed, HMC is strongly influenced by disciplines such as sociology, psychology, law, pedagogy, political science, and philosophy, among others.

Given that machines are communicating with humans at an increasingly advanced level, thanks to artificial intelligence, the acts of interaction, in this case, are not schematic and repetitive, as is the case with deterministic algorithms – communication is no longer exclusively the domain of the human world. The role of technology in society is changing as the functions it performs change. There is a noticeable shift – from devices mediating communication between humans to programs and robots dialoguing with humans. Given this, the lack of adequate communication and media theories that strictly deal with human-machine interaction is highlighted in HMC. This gap is attempted to be filled by Andrea Guzman of Northern Illinois University and Seth Lewis of the University of Oregon, who propose three analytical frameworks for studying AI in the communicator role. These are (Guzman & Lewis, 2020):

- Functional framework – based on the construction of new theories and the study of: 1. how artificial intelligence is designed, including its tools designed to communicate with people; 2. how they are perceived and received by users; 3. the characteristics and associations attributed to them; 4. who people communicate with; 5. the changing perceptions of machines in the long term; 6. the impact of previous generations of tools on how they interact with their more advanced forms.
- Relational frame – relating to: 1. the relationships forming between humans and machines in different social contexts; 2. human interpretations about the self regarding AI and AI regarding the self; 3. the factors influencing their formation; 4. the social roles assumed by machines; 5. the transmission of machine makers' prejudices and worldviews, made visible in the products offered; 6. power dynamics; 7. the encroachment of high-tech tools into personal spheres of human life; 8. the meanings of anthropocentric definitions of communication for the study of the issues indicated.
- Metaphysical framework – aimed at describing in the context of communication: 1. the characteristics of humans and machines; 2. the differences between them; 3. the changing dividing line and boundaries in communication between humans and machines; 4. the implications of ontological interpretations on

the nature of humans and artificial intelligence; 5. the desired behaviors that machines should exhibit towards humans in communication.

In the research conducted on the aspects mentioned above, it is recommended to use methods such as surveys, observations, analyses of transcripts of conversations between humans and AI tools, experiments, in-depth interviews, focus groups, and diary analyses, among others.

As can be seen, the approach proposed in HMC by Guzman and Lewis addresses the challenges considered by the social sciences to be central to the development of artificial intelligence. The authors, although focusing mainly on the communicative AI tools mentioned earlier in the text, thus indicate that the dilemmas generated by the development of advanced technologies require the attention of various scientific disciplines such as social communication and media, sociology, psychology, law, or pedagogy. HMC takes up the challenge of developing a new communication theory that considers completely new acts of human-machine interaction. In doing so, it addresses issues of great importance from the perspective of this science – but not always strictly within the scope of communication and media studies. The issues at stake here include the phenomena of machine socialization, anthropomorphization, and personalization, changes in power relations and dynamics, and the responsibility of AI creators not only in the legal dimension but also in ethical and socio-cultural terms. The HMC enables the analysis and tracking of how other processes, such as people's perceptions of technological artifacts, emotional relationships with social machines, and expectations of artificial intelligence, are shaped through communication with machines. HMC is also not indifferent to themes related to the change in perceptions of human beings through interaction with communicative AI. Guzman and Lewis' approach draws attention to the critical issue of the differentiation of machines today. In the functional analysis area, the authors pose the question of what humans are communicating with. The relational frame, on the other hand, considers themes concerning the design of contemporary machines and refers to findings from critical sociology and feminist theory. The metaphysical framework draws on the conclusions of philosophy, focusing on the ethics of artificial intelligence design.

Summary

In answering the question posed in the introduction – *what challenges does artificial intelligence pose to the social sciences, and how can the interdisciplinary research field of Human-Machine Communication help to understand and analyze them?* – it should be pointed out that AI is not only a field of science but also a technology, as it is a phenomenon transforming social, political, cultural, and economic processes (Elliott, 2021). Its development generates numerous psychological, philosophical, ethical, communicative, and legal challenges. The social sciences can

play a not-inconsiderable role in analyzing the changes taking place and their further directions while contributing to the development of appropriate strategies to counteract the adverse effects of automation and robotization. Difficulties related to the presence of AI issues in the social sciences begin at the stage of conceptualizing artificial intelligence itself, as well as distinguishing between other technologies and the tools equipped with it. In the face of these elementary dilemmas and other complex challenges, the social sciences and social communication and media sciences are not indifferent. They are formulating concepts that respond to the transformations taking place. The vital role of critical, practical, descriptive, and interdisciplinary approaches is indicated here. Bearing in mind the specificity of current problems, Human-Machine Communication is developing a research program in which the voice will belong to representatives of different social sciences. A. Guzman and S. Lewis present the issues in the development of artificial intelligence technology, creating an analytical framework – functional, relational, and metaphysical, that includes both communication-related issues and those raised when considering them from a sociological perspective. HMC researchers, guided by the interdisciplinarity of social communication and media science, formulate an inclusive approach in the field of social sciences. It is open to developing new theoretical foundations, breaking established patterns, and listening to specialists from different areas. Human-Machine Communication has the potential to play an essential role in the social sciences because while it refers to human-machine communication, it also touches on other important issues related to the digital revolution taking place.

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