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MONOGRAPHIC

Navigating digital frontiers: new paradigms and ethical challenges in social research

BOOK IN DISCUSSION

MONOGRAFICO

Navigating digital frontiers: new paradigms and ethical challenges in social research

Edited by Gabriella Punziano (University of Naples “Federico II”) and Angela Delli Paoli (University of Salerno)

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NAVIGATING DIGITAL FRONTIERS: METHODOLOGICAL POTENTIALS AND ETHICAL CHALLENGES IN SOCIAL RESEARCH

Editorial

by Gabriella Punziano and Angela Delli Paoli[*]

Abstract

This special issue, "Navigating digital frontiers: methodological and ethical challenges in social research", will contributes to the debate about the implications of the complex interactions between digital technology, social research and social life.

The different papers collected in this issue look both at *epistemic concerns* related to the nature of digital data and *normative concerns* related to the consequences of digital social research. On the *epistemic side*, it critically analyses the changing nature of the data collection process, the place and role of technological objects, affordances and applications, the influence and entity of digital biases by at the same time looking at the methodological principles which are not easily dismissed by the new availability of data and the strengthened potentials of methods and techniques. On the *normative side,* social research in the digital context also raises several ethical dilemmas deriving both from institutional deregulation and innovative challenges.

Keywords

Digital social research, ethics, AI, bias

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1. INTRODUCTION

This special issue explores the evolving intersection of digital technologies and contemporary social research. It touches the intersection between methodology and ethics.
On the one hand, the works collected looks at the consequences of digitalization for social research, and, on the other hand, at the consequences of digital social research for people. These two souls of the special issues are highly interdependent.

Starting from the former, the digital transformation of social life opens new opportunities for social research, not without costs. The opportunities lie in the huge availability of new type of data, of new data collection techniques and research environments (e.g. Metaverse), potentiated methods and data analysis. The huge availability of data together with computing advancements make possible a previously unimaginable magnitude of data collection, storage and retention. Digital information is moving objects, constantly changing nature according to the evolutions in the use and affordances of digital devices and platforms (Veltri, 2019). They are generated as a result of online life from our daily use of the Internet and digital applications (e.g. posts, comments published on social media, communities, blogs, photos of our private life, profiles of our social accounts), from our online behavior (e.g. searching for certain keywords on search engines, clicking certain links, visiting certain websites, etc.), or from the use of the Internet of Things (sensors for health monitoring or self-tracking devices, the use of home automation such as the recording of domestic energy consumption or of assisted home automation such as the monitoring of movements in the case of driving aids, etc.) (Marres, 2012; Amaturo & Aragona, 2019). Although their internal differences, they share a common feature: they are not requested and not designed but spontaneously released by internet users (Lewis, 2015; Molteni & Airoldi, 2018) and "found" or scraped by the social researcher.

Digital data are the basis also of AI systems and their algorithms which may support in the whole social research process (citation assistance, communication assistance, data analysis assistance, and data extraction assistance). They may potentially allow very large samples. However, sample size is not a sufficient (or even necessary) condition for sampling representativeness. A sample is representative of the population if it reproduces on a smaller scale its characteristics with insignificant deviations attributable to chance (isomorphism, Marradi, 2022).

Randomness is a property of the extraction procedure; representativeness is a property of the outcome of that procedure independent from randomness and evaluated based on the similarity on certain characteristics between the sample and the population.

In digital research both the extraction procedure and the outcome of that procedure may be biased. The extraction is affected by selection and accessibility biases. Selection biases derive from the opacity of algorithmic mechanisms of information selection. This opacity can in fact produce direct and/or indirect digital discrimination in extraction in the form of inequalities based on income, education, gender, age, ethnicity, and religion. This risk increasing inequality both by reproducing or exacerbating the marginalization of historically disadvantaged groups and by creating new inequalities or reinforcing the power hierarchies that contribute to economic inequalities. Digital discrimination debunks the myth of data objectivity and algorithm neutrality, emphasizing the need for human oversight in automated processes (Criado & Such, 2019).

Moreover, the accessibility of information is challenged by Cambridge Analytica (Bruns, 2019; Perriam et al., 2019) and regulated by social platforms which sets limits on accessibility (Olteanu et. al., 2019).

Representativeness is affected by the digital divide which although lower in the last years, is still present and cuts out of digital research the segment of the population excluded from the Internet. Moreover, also generalization of results to the Internet population is critical due to the wrong equivalence between access and participation and the different level of participation of users: some studies have demonstrated that the minority of internet users actively participate in discussion on digital fields whereas the majority participate only occasionally and many of users act as lurkers, passively following and reading comments and posts by others without participating in the discussion (Lombi, 2015; Olteanu et al., 2019; Addeo, Punziano & Padricelli, 2021).

Thus, digital representativeness only refers to the internet population leaving digital traces useful for social research and this may exclude some relevant social groups with relevant social consequences. However, this representativeness is not based on traditional sampling criteria built along known demographic axes, not always available or reliable on the internet. This makes digital research typically a post-demographic approach.

On the data analysis side, the developments in computational science have caused the spread of explanatory models (topic modelling, machine learning, etc.) driving social research toward a *data-driven approach* with a revival of the myth of data objectivity (Kitchin 2014).

Turning to the latter issue–the consequences of digital social research for people–there are growing discontinuities between digital research practices and established principles and tools of research ethics regulations. Principles and tools cannot be cleanly exported from biomedical research to digital social research. Ethics is complicated in digital research practices due to the data subjectivity of digital information, the difficulties in data management which may lead to deliberate or accidental releases of private information, in data slippage deriving from moving data from one context to another, in technology design for search engine biases, by the risk inherent in the affordances of machine learning and so on.

Four factors may wrongly bring to gloss over the ethical issues: the formal public nature of some private information, the textual nature of data produced by people (which makes difficult to determine the relationship between data produced by people and people themselves), the fragmentation and abstraction of people into a constellation of data points and the idea that big flows of data tell much about humanity and can speak by themselves.

Although it is not easy to distinguish private for public in digital context, to understand to what extent some data involve or not people, it is necessary to acknowledge that at some extent digital data are people and they can cause harm if disclosed.

The role of researcher appears crucial in collecting, analysing and interpreting ethically results, contextualizing them and making sense of the correlations identified within a dataset, without considering them automatically meaningful or reflecting causal relationships (correlation is not causation) only because they derive from big flow of data.

The scholars involved in this special issue ask whether digital social research should be forced to conform to existing norms or whether particular regulatory concepts like "privacy", "informed consent", "anonymity", should be re-focused and new protocols and commitments are needed (Markham, Tiindenberg, Herman, 2018).

Contributions critically examine how transformations in digital infrastructures—such as API restrictions, generative artificial intelligence, and immersive virtual environments like the Metaverse—are redefining methodologies, ethical standards, and theoretical frameworks in social sciences. Addressing critical themes like algorithmic transparency, digital discrimination, and public engagement, these studies leverage interdisciplinary approaches, notably Actor-Network Theory (Latour, 2005) and sociotechnical imaginaries (Jasanoff & Kim, 2009), highlighting the need for ethical responsibility and methodological innovation. Collectively, these articles call for heightened awareness and proactive adaptation in addressing emerging challenges posed by digital transformations (Zuboff, 2019).

2. WALKING THE RED THREAD BETWEEN PARADIGMS, ETHICAL ISSUES, AND DIGITAL FRONTIERS

In curating this issue, there were selected papers that trace the underlying red thread sustaining the methodological debate, drawing upon paradigm shifts, critical reflections on ethics, and the evolving digital frontiers of social research. Each contribution engages with key epistemological and methodological tensions, offering insights into the challenges and opportunities posed by computational methodologies, algorithmic mediation, and the dynamic nature of digital environments. Through this collection, we aim to foster a deeper understanding of the interplay between methodological innovation, ethical imperatives, and the transformative impact of digital and AI-driven research in the social sciences.

On the *Digital Data Double Standards in Social Research*, the paper by Dario Pizzul and Alessandro Caliandro critically analyzes the concept of a digital data double standard, highlighting disparities between economic exploitation of digital data by private platforms and the ethical and technical restrictions imposed on social science research. It explores the dynamics of surveillance capitalism, framing digital data as both a commodity and a source of social and economic power asymmetry, emphasizing the contrast between corporate freedom and academic constraints. The authors adopt an autoethnographic approach, reflecting on their direct experiences in navigating Research Ethics Committees (RECs) approvals. The paper discusses the limitations imposed by RECs, often guided by biomedical ethics rather than the specific needs of qualitative and digital social research. It also addresses methodological alternatives, such as scraping, tracking, and data donation, proposed as viable research strategies in the post-API era, illustrating their respective advantages and technical or ethical challenges. The paper highlights significant concerns related to privacy, consent, data transparency, and autonomy. It critiques the double standards of data ethics applied differently to academia versus private platforms, arguing for a more participatory and user-controlled approach exemplified by data donation, where users voluntarily contribute their digital data. The research underscores the adverse impacts of API closures and platform control over data access, proposing digital data donation as an innovative, ethical method of data collection. Tools facilitating data donation, such as Port and OSD2F, are presented as promising solutions enabling greater transparency and ethical responsibility in digital research. The authors advocate for the reformation of REC practices, urging the establishment of discipline-specific ethical frameworks that align better with the practical realities and methodological requirements of digital social research. This would effectively address the identified double standards, promoting a more equitable and ethically robust approach to digital data use.

The paper by Suania Acampa, on the side of *API Restrictions and the Future of Digital Social Research*, critically explores the significant challenges posed by recent restrictions on social media APIs to digital social research, particularly highlighting their impacts on theory, methodology, and ethics within digital contexts. Historically, APIs facilitated extensive studies on social phenomena such as disinformation, hate speech, and political polarization. However, increased restrictions by platforms such as Meta (Facebook and Instagram) and X (formerly Twitter), especially following incidents like Cambridge Analytica, have severely constrained academia's capability for replicable, large-scale analyses. The paper argues that API restrictions push research toward "data-driven determinism," where available data dictate research questions, potentially reducing the critical independence of scholars. These limitations force researchers toward smaller datasets and alternative collection methods, like scraping, which raise significant ethical and legal concerns. The closures have thus led to a shift toward less restricted platforms or data-collection techniques violating platforms' Terms of Service, fueling ethical dilemmas around privacy and consent. European regulations, notably GDPR and the Digital Services Act (DSA), have complicated access by imposing stringent rules balancing transparency with privacy protection. While GDPR enforces user consent and anonymization, the DSA explicitly mandates regulated data access for qualified researchers, though practical implementation remains challenging. Consequently, this regulatory environment, coupled with platform-imposed barriers, necessitates rethinking research methods, including adopting approaches like interface methods, digital traces analysis, semantic web integration, digital experiments, and crowdsourcing. The paper calls for robust cooperation between academia, technology platforms, and regulatory bodies to ensure ethical, transparent, and effective research practices, emphasizing the urgent need for accessible, high-quality data to maintain research independence and societal accountability.

With respect to *Algorithmic Transparency through Actor-Network Theory*, the paper by Ciro Clemente De Falco and Caterina D'Ambrosio provides a systematic review examining how social sciences approach the study of algorithms, with a particular focus on theoretical frameworks, methodologies, and ethical considerations. The Actor-Network Theory (ANT) perspective, influenced by Bruno Latour, emerges as a significant theoretical lens, viewing algorithms as socio-technical constructs involving complex interactions between human and non-human actors. ANT challenges the notion of algorithmic neutrality, emphasizing the embedded biases and socio-technical networks shaping algorithmic outcomes. The paper employs a comprehensive bibliometric analysis using data from Scopus and Web of Science, complemented by an in-depth analysis of empirical studies published in 2024. Findings highlight that research themes predominantly address the ethical implications of algorithms, algorithmic biases, and interactions on digital platforms, especially in contexts like journalism and social media. The review underscores a methodological diversity that includes traditional qualitative tools such as interviews and ethnography, as well as innovative methods like automated tracking and walkthrough techniques. Significant attention is devoted to algorithmic transparency, accountability, and the societal impacts of algorithmic discrimination. Studies explore harms related to representation and allocation, emphasizing the need for greater awareness and responsible governance. The paper advocates deeper interdisciplinary engagement with ANT and encourages methodological innovation to better capture the dynamics of human-algorithm interactions, thus fostering ethical responsibility and transparency in algorithmic practices.

Following this line of reasoning, *Algorithmic Feedback Loops and Cultural Consumption* are at the basis of the paper by Gabriella Punziano, Giuseppe Michele Padricelli Padricelli and Antonio Vettori that analyzes the evolution of algorithmic feedback loops within soft science disciplines through a comprehensive systematic literature review spanning from 2000 to 2023. The study situates feedback loops within recursive systems, emphasizing their role in shaping user behaviors and consumption patterns on digital platforms like Netflix, Spotify, and YouTube. It highlights how these loops involve complex interactions between users and algorithms, influencing cultural consumption practices and potentially limiting cultural diversity. The paper employs the PRISMA model to conduct a systematic review, using Web of Science as a primary database. The study includes a temporal analysis of publications categorized into hard and soft sciences, employing content analysis and topic modeling techniques such as Latent Dirichlet Allocation (LDA), Lexical Correspondence Analysis (LCA), and Cluster Analysis to map conceptual shifts and thematic trends. The paper discusses the implications of algorithms on cultural diversity, user agency, and societal dynamics, highlighting concerns over filter bubbles, personalization biases, and the societal influence of algorithms. It also stresses the ethical challenges posed by algorithmic governance, emphasizing transparency, accountability, and user autonomy. The research addresses how digital platforms and AI technologies mediate cultural and social interactions. It illustrates algorithms as social actors embedded in socio-technical systems, influencing socialization, economic structures, and information dissemination. The study advocates an interdisciplinary approach integrating Actor-Network Theory (ANT) to better understand the socio-technical dynamics of algorithms. It calls for methodological innovation and continued ethical scrutiny to ensure algorithmic technologies promote diverse and equitable social outcomes.

Integrating AI in Social Research methodologically and etically is the dimension in discussion in the paper by Alfredo Matrella, Michela Cavagnuolo and Viviana Capozza that explores the integration of Artificial Intelligence into social research, offering a structured classification of AI-powered tools based on their functions and relevance across various research phases. AI is framed as a transformative element within social and behavioral sciences, enhancing research methodologies and outcomes through innovative applications. The paper employs a multichannel strategy for identifying approximately 350 AI tools, systematically categorizing them into six functional domains—content creation, analysis, development, assistance, commerce and marketing, and leisure—further refined into four macro-categories specific to social research: citation assistance, communication assistance, data analysis assistance, and data extraction assistance. These classifications were established through rigorous content analysis, considering tool functionality and potential contributions to research stages, including literature review, data collection, analysis, and dissemination. The paper addresses critical issues, highlighting concerns related to privacy, fairness, transparency, data control, and AI-generated inaccuracies ("hallucinations"). It advocates for responsible usage of AI tools by researchers, emphasizing human oversight, careful prompt formulation, and validation of AI-generated outputs to mitigate biases and ensure research integrity. The paper emphasizes the significant potential of AI to enhance efficiency, robustness, and innovation in social research, providing detailed examples such as automated content synthesis, multilingual communication support, and advanced data processing capabilities. Despite the advantages, it recognizes barriers such as cost, technical expertise, and accessibility, particularly among early career researchers. The paper encourages the responsible adoption of AI in social research, advocating for an informed, balanced approach that integrates ethical vigilance with technological advancement to optimize research practices and outcomes.

On *Generative AI, Ethical Complexities and Methodological Potentials* the paper by Elisabetta Risi and Riccardo Pronzato examines the relationship between social research and generative artificial intelligence (GenAI), exploring theoretical, methodological, ethical, and digital dimensions. It positions GenAI both as an object of study and as a methodological tool, comparing it with prior developments in Internet research and digital platform studies. It critically addresses two distinct yet interconnected research frameworks: "research on GenAI" and "research through GenAI." The paper discusses the implications of using GenAI in qualitative and quantitative social research. It illustrates how GenAI tools, such as ChatGPT, are primarily framed as research "assistants" rather than autonomous methodologies. This framing highlights the practical utility of GenAI in streamlining data collection, analysis, and interpretation while simultaneously cautioning researchers against methodological pitfalls such as data biases, algorithmic hallucinations, and the opacity of AI systems. Significant attention is dedicated to the socio-technical complexities and moral responsibilities involved in employing GenAI. Concerns around representational bias, data privacy, transparency, and authorship are underscored, urging critical reflection on the hidden labor, power structures, and ethical tensions underpinning AI production and implementation. The paper emphasizes the transformative potential of GenAI, focusing particularly on Large Language Models (LLMs). It explores how interactive conversational interfaces and automated content generation redefine user-system relationships and raise novel methodological and epistemological questions. The authors advocate for an integrated approach, emphasizing that research through GenAI is fundamentally entangled with research on GenAI itself. They call for sustained interdisciplinary engagement and ethical vigilance to ensure that GenAI's integration into social research remains critically reflective and methodologically robust.

Representativeness and Bias in AI-Driven Research are the core of the paper by Beba Molinari critically investigates the integration of Artificial Intelligence into social research, emphasizing theoretical considerations, methodological challenges, ethical implications, and digital contexts. The study positions AI as both an evolution of and a departure from traditional and web-based (e-methods) social research tools, questioning whether AI-generated data represent continuity or entirely new forms of information. The paper scrutinizes the concept of representativeness, exploring how traditional statistical paradigms and notions of error and bias apply within AI contexts. It suggests that AI and machine learning techniques significantly diverge from classical methods by reshaping the processes of data collection, analysis, and interpretation, challenging the conventional boundaries of research reliability and validity. The study addresses concerns around algorithmic biases, data privacy, transparency, and the accountability of AI-generated outcomes. It stresses the critical need for researchers to maintain human oversight, especially when constructing datasets and machine learning models, to prevent ethical and methodological errors. The paper explores how rapidly changing technological environments impact data quality and analytical methods. It argues for enhanced interdisciplinary collaboration, integrating robust mathematical, statistical, and computing skills within social science research to effectively leverage AI technologies. The paper advocates for redefining methodological boundaries and ethical frameworks within social research to responsibly embrace AI's potential, underscoring the need for a human-centric approach to algorithmic development and utilization.

From the side of *Ethical Challenges in Netnographic Research*, the paper by Angela Delli Paoli discusses the ethical complexities inherent in netnographic research, focusing specifically on digital social research's theoretical, methodological, ethical, and digital dimensions. Netnography is framed as an adaptation of ethnography to digital contexts, emphasizing cultural interpretation through long-term, engaged observation of digital interactions. The paper explores dilemmas such as distinguishing between text-based and people-based research, managing covert versus overt access, and negotiating physical versus digital representations of reality. Netnography leverages user-generated, non-intrusive digital traces such as social media interactions, yet raises questions around the authenticity and social desirability biases within digital identity presentations. The paper identifies critical dilemmas including public versus private data handling, informed consent, anonymity, and confidentiality. It emphasizes the inadequacy of traditional static consent in dynamic digital contexts, advocating for continuous consent processes. Ethical principles are context-dependent and sensitive to participants' perceptions and potential vulnerabilities. The paper underscores the blurred boundaries between public and private spheres online, stressing the need for researchers to adopt innovative practices that protect participant identities and privacy. This involves employing composite narratives, fictionalization techniques, and dynamic consent methods. The paper calls for heightened reflexivity, urging researchers to continually adapt their ethical frameworks to address emergent challenges in digital research contexts, emphasizing self-regulation and context-sensitive ethical considerations.

The paper by Danilo Boriati, focused on *Digital Exclusion of Older Adults in Social Research*, addresses digital discrimination against older adults, particularly focusing on their exclusion from online social research due to perceived deficiencies in digital literacy. It highlights how digital technologies have become integral to societal inclusion, but the existing digital divide significantly marginalizes older populations, reflecting broader societal ageist biases. The paper reviews existing literature and identifies common biases, including selection and sampling issues, technological barriers, and question design biases. It stresses the importance of inclusive and age-appropriate online research protocols, emphasizing clear communication, user-friendly interfaces, and proactive technical support tailored specifically to older adults. The paper emphasizes the importance of combating ageism by promoting digital literacy and inclusive research methodologies. It argues for ethical responsibility among researchers to ensure equitable representation and accessibility in research studies. Strategies recommended include comprehensive training programs to enhance older adults' digital competencies, developing accessible technologies and research tools, and integrating mixed-method approaches to bridge online and offline methodologies. The paper advocates for proactive strategies to enhance digital literacy among older adults to foster inclusive participation, reduce research biases, and improve the representativeness and validity of online social research outcomes.

Audience Engagement in Science Museums through Digital Platforms is the main topic of the paper by Noemi Crescentini and Andrea Rubin that investigates how science museums are perceived in Italy by analyzing user-generated content from TripAdvisor, emphasizing audience engagement through a mixed-methods approach combining quantitative Topic Modeling and qualitative content analysis. The paper situates science museums as central actors in the Public Engagement with Science and Technology (PEST) paradigm, transitioning from passive knowledge dissemination (the deficit model) towards active public participation and dialogue. The study applies Topic Modeling techniques (Latent Dirichlet Allocation, LDA) to systematically extract thematic clusters from over 31,000 visitor reviews, followed by qualitative analysis using Nvivo software to deepen the understanding of visitor narratives. This mixed-method approach effectively captures both general patterns and nuanced perceptions. The study emphasizes the importance of accessibility, inclusivity, and responsiveness of museums to diverse visitor needs, including multilingual content, physical accessibility, and interactive experiences that accommodate different age groups and abilities. The research highlights how platforms like TripAdvisor transform audience engagement, providing real-time, user-generated feedback that shapes visitor expectations and perceptions. These platforms act as critical digital forums for public dialogue, enabling museums to assess and enhance their communication strategies effectively. The findings identify accessibility, interactive and educational content, organizational clarity, staff competency, and collection quality as primary determinants of visitor satisfaction. The paper concludes by recommending museums leverage digital tools and user feedback to enhance public engagement, inclusivity, and educational effectiveness.

On *Digital Fashion and Identity in Virtual Environments* the paper by Michele Varini examines the intersection between fashion and digital technologies, particularly within virtual environments of popular multiplayer video games such as League of Legends, Apex Legends, Overwatch 2, and Valorant. It situates fashion as a critical cultural industry historically responsible for shaping identities, social classes, and gender norms, exploring how digitalization challenges or reinforces these paradigms. The study employs netnography and visual ethnography to analyze a dataset of 2,142 official images from selected video game platforms. The coding process is systematically structured into three levels: initial objective categorization (species, gender, ethnicity), conformity to mainstream fashion aesthetics (muscularity, thinness, sexualization), and interpretative semiotic analysis identifying prevalent thematic clusters (e.g., fantasy, cyberpunk, anime). The research critiques the persistence of traditional beauty standards and gender stereotypes within digital spaces, highlighting concerns around representation, inclusivity, and the reinforcement of unrealistic body ideals, particularly concerning female avatars. It questions the extent to which digital platforms genuinely democratize fashion representation or simply replicate existing exclusionary and performative paradigms. The paper underscores the hybrid nature of fashion in digital contexts, emphasizing the fluid boundaries between virtual and physical identities. It discusses the impact of digital capitalism on the commodification of digital avatars, linking these practices to broader socio-economic and cultural dynamics. The paper argues that despite digital fashion's potential for democratization and innovation, prevailing norms and inequalities within traditional fashion systems persist. It advocates further critical exploration and ethical vigilance to address and potentially transform these entrenched dynamics.

With regard to *Constructing Space Exploration Narratives*, the paper by Ilenia Picardi and Marco Serino investigates sociotechnical imaginaries embedded in online discourses surrounding NASA's Artemis program, which aims for a renewed human presence on the Moon. It leverages Science and Technology Studies (STS), specifically the sociology of associations (Actor-Network Theory, ANT), and the concept of sociotechnical imaginaries, to explore how space institutions construct and legitimize their narratives through digital communication platforms. The research employs a mixed-methods approach combining narrative analysis to uncover discursive structures and Social Network Analysis (SNA) to examine actor relational dynamics within NASA's online narratives. Digital ethnography, content analysis, and network analytics (degree and betweenness centrality measures, community detection) are used to systematically identify claims about space exploration and actors enrolled to support these claims. The paper discusses implicit tensions between inclusive, universalist rhetoric employed by NASA and the pragmatic involvement of private corporations, highlighting concerns about equity, diversity, and the implications of privatized space exploration. The study questions the underlying motivations and beneficiaries of space colonization narratives, pointing to potential conflicts around global commons and ethical considerations in multi-planetary endeavors. The analysis demonstrates how NASA utilizes online spaces and digital platforms strategically to enroll diverse actors—both human and non-human—in promoting and legitimizing its ambitious projects. It emphasizes the role of digital infrastructures and autonomous technologies in shaping public perception and engagement with space exploration initiatives. The paper argues that online narratives about space missions are complex assemblages interweaving scientific, political, economic, and cultural elements. It advocates for critical awareness of the socio-political and ethical dimensions embedded within the construction of sociotechnical imaginaries of human life beyond Earth.

In the end, *Ethical and Methodological Considerations for Social Research in the Metaverse* is the core topic of the paper by Salvatore Monaco that examines the integration of the Metaverse into social research, emphasizing theoretical, methodological, ethical, and digital dimensions. The Metaverse is explored as both a new subject and a novel environment for sociological investigation, raising critical questions about digital identity, community dynamics, social interactions, and economic implications, particularly around labor and consumption. The paper highlights how the Metaverse enables innovative research practices, offering virtual laboratories that facilitate real-time variable manipulation and immersive qualitative research methods, including netnography and autoethnography. It underscores the Metaverse's potential to overcome traditional logistical constraints by providing cost-effective, expansive, and interactive research environments, yet cautions about issues of external validity, representativeness, and the influence of digital self-representation. Significant attention is directed toward privacy, informed consent, data protection, and the implications of algorithmic governance in these digital spaces. The paper stresses the necessity of developing robust ethical frameworks tailored specifically for virtual environments to mitigate risks associated with data misuse, digital disinhibition, and the potential exploitation of digital labor. The Metaverse is positioned within broader transformations of digital infrastructure, emphasizing its role as a central component of Web 3.0, alongside blockchain, virtual reality, and augmented reality technologies. It argues for the necessity of interdisciplinary skills, encompassing algorithmic literacy, digital analytics, and cybersecurity. The paper calls for comprehensive methodological innovation and ethical vigilance to responsibly harness the Metaverse's capabilities for rigorous and equitable social research, advocating for interdisciplinary collaboration and continuous critical assessment of digital developments.

3. CONCLUSION

The special issue provides a cursory sketch of key issues, shifts, opportunities and costs of contemporary social research, so highlighting the complexities of digital social research.

Although aware of the potential of digital research for expanding the possibilities of social research in engaging with contemporary social life, the contributions resist the temptation of not considering its epistemological and ethical consequences.

By looking critically at digital social research, it poses many dilemmas at different levels of the research process: from research design to data analysis and research consequences. It stresses the importance of avoiding overstating claims to innovations, highlighting also their costs. Writing of innovation in digital research is dangerous due to its rapid ongoing transformations in both digital social life, online environment, digital data and digital methods. Innovating does not neither mean erasing the "old". It is in the tension between continuity and change that we can really understand at the epistemological and ethical levels the potentials and costs of digital social research.

The huge availability of data is complicated by their non-traditional nature, the invisibility of their research design (which causes a lack of knowledge of their scope, provenance and quality), the technological and sometimes economic nature of their acquisition and the ethical consequences of their use for research. In other words it calls into questions the process of data construction as traditionally understood. Extraction and representativity problems put in question the statistical significance of a sample. The accessibility of digital data does not necessarily imply that they can be collected and analyzed without any concern. Possible ethical pitfalls include breaching user's privacy (Goroff, 2015) or enabling racial, socioeconomic or gender-based profiling (Barocas and Selbst, 2016). The assumption that publicly data cannot harm because they do not directly impact people's lives is wrong since they can be combined with other data sets posing serious risks to individuals and communities. While innocuous in themselves, such anonymous public datasets when merged with other may make individuals highly identifiable (Metcalf and Crawford, 2016). There are several cases of re-identification of de-identified data. This highlights the challenges of dealing with ethical issue in institutionalized mainstream ethical processes such as research ethics committees.

Digital social research subverts existing ethical regulations, their assumptions about responsibility, types of risks and researcher-subject relationship and strategies. Moreover, digital traces pose challenges to the practice of informed consent. New ethics framework balancing between privacy and accuracy should be provided against possible harmful outcomes such as stalking, discrimination, black-mailing or identity theft.

Data analysis is strengthened by computational techniques but for the effect of algorithms the evidence they produce may be inconclusive, inscrutable and misguided. Biased evidence may lead to biased decision-making leading to discrimination. Data-driven discrimination may be more severe than those fueled by anecdotal evidence.

In its complexities, the special issue aims to avoid collecting data, adopting methods simply because they are available or easy to use. It provides grounds to substantiate methodological choices. Social research methodology cannot be delegated to technology. The special issue provides a way to avoid techno solutionism (Heilinger, 2022), the tendency to prioritize technological over non-technological solutions which may lead to choosing unsuitable methods.

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THE DIGITAL DATA DOUBLE STANDARD: ECONOMIC VALUE EXTRACTION VERSUS SCIENTIFIC KNOWLEDGE LIMITATION AND THE OPPORTUNITIES OF DATA DONATION

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Abstract

Social science research with digital data faces ethical and technical challenges, often intensified by Research Ethics Committees (RECs). While RECs provide oversight, their criteria—rooted in medical fields—may not align with social research, especially in qualitative studies. This paper introduces the concept of a "digital data double standard," highlighting how private platforms exploit vast user data while researchers face strict access limitations. In the post-API era, alternative methods like scraping and tracking are explored, with "data donation" emerging as a promising solution. This approach allows users to voluntarily share their digital traces, balancing ethical compliance and research needs. By embracing data donation, RECs could better support digital social research, addressing the growing gap between corporate data use and academic inquiry.

Keywords

Data donation, digital methods, research ethics committees

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1. INTRODUCTION

Research ethics is an issue often heavily dependent on the work of boards or committees, such as institutional review boards (IRB) in the US or research ethics committees (RECs) in Europe. These bodies, and particularly their criteria and approaches, have frequently been criticized, especially by scholars in the social sciences, and more specifically by those who employ qualitative methodologies (Schrag, 2011; Roth and von Unger, 2018; Van Den Hoonaard, 2019). The role of ethics committees in social science research is a well-documented issue, with numerous criticisms and complaints highlighting their weaknesses (Bosk, 2007; Brown, 2023). A central argument against RECs' work is that their criteria are largely derived from medical and biological disciplines, particularly randomized controlled trials. When these paradigms are applied to social science projects, unreasonable critiques and caveats often arise, as inappropriate principles are used due to a lack of field-specific expertise (Schrag, 2011). This leads to the necessary flexibility required in qualitative research being perceived as non-rigorous or pseudo-scientific by RECs (Bosk, 2007). As a result, social scientists often view RECs as obstacles to their research endeavors (Brown et al., 2020). Some argue that the impact of RECs, and what has been termed the "seduction of ethics", affects social research on a more fundamental, systematic level. RECs guidelines, lacking specific knowledge of social science methodologies, tend to push all projects toward a uniform standard, thereby stifling creativity and pioneering work in favor of adherence to ethical codes. This has led some to suggest that the richness of social science is gradually being diminished, moving toward more conventional approaches (Van Den Hoonaard, 2019).

It almost goes without saying that the many criticisms to RECs do not undermine the importance of ethics in social science research (De Wet, 2010; Van Den Hoonaard, 2019). The central issue is the bureaucratic interpretation of ethics by committee members—a topic that has long been subject to reflection and calls for reform, alongside suggestions for possible solutions to the widely recognized problems (Bosk, 2007).

This work engages with this ongoing challenge, focusing on a relatively underexplored but important issue: research ethics in social science when dealing with digital data, particularly concerning the role of RECs. Data ethics has been identified as a new branch of ethics specifically focusing on data and algorithms (Floridi and Taddeo, 2016). While the ethics of digital data has been widely discussed in relation to biomedical projects (Dobrik et al., 2018; Ferretti et al., 2021; 2022), social science -

especially through its engagement with digital methods - has also taken the topic seriously (Caliandro and Gandini, 2017; Caliandro et al., 2024). Experts in internet research have been working to develop guidelines for ethically engaging with digital data (Markham and Buchanan, 2012). However, it is well understood that universal prescriptions concerning ethics in social science research with digital data cannot be established (Floridi and Taddeo, 2016; Caliandro, 2021). Among these valuable contributions, the topic of the role of RECs requires further exploration as it has not been extensively considered.

We first add an additional "complaint" to the "chorus" of ones that have been rising through the years against how RECs have been evaluating ethics in qualitative social research (Bosk, 2007). By briefly recalling a personal research experience, we introduce the concept of a "digital data double standard", which on the one hand sees almost unlimited access to personal data by private platforms, and on the other, strongly limits the activity of researchers. We structure our argument around two core issues in social science research involving digital data: the ethical limitations imposed by rigid RECs principles and the technical limitations of data collection. Regarding the latter, we discuss how recent policies implemented by private platforms - primarily the closure of social media APIs[1] - have further hindered research efforts. We examine two potential workarounds, scraping and tracking, considering their advantages within the current digital methods landscape, while also acknowledging their limitations, particularly in terms of ethical data collection. To address these challenges and confront the data double standard, we explore the concept of "data donation" (Boeschoten et al., 2022; Ohme et al., 2024), a practice primarily studied from a methodological perspective but one that could offer significant ethical advantages. This approach has the potential to align with RECs guidelines while providing researchers with richer and more valuable data for their studies.

2. DIGITAL DATA DOUBLE STANDARD

[1] Since in computer science the concept of API (i.e., Application Programming Interface) has a broad scope, it is worth stressing that, in this article, when we talk about APIs we are referring to social media APIs - insofar social media have been the principal (if not the only, in some cases) field of research for digital sociologists in the last two decades. Social media APIs are interfaces (that is - to put it very simply - a set of routines, protocols, and lines of code) provided by social media platforms themselves, that «let users interact with or respond to data or service requests from another programme, [or] applications» (Murugesan, 2007: 36). In this way users can retrieve data directly from the targeted social media platform (Caliandro and Gandini, 2017)

To reflect on the role of RECs we rely here on a sort of 'auto-ethnography' (Risi et al., 2020), that is, we discuss (and critically reflect) on the (tortuous) journey we undertook to see our research project (Digital Literacy and Learning[2]) accepted by the ethical board of the University of X[3]. In the spring of 2024, we conducted a study on citizens' digital literacy. While providing too many details about the study could compromise the anonymity we have sought to preserve through the use of fictitious names, offering further context regarding the study's rationale may be helpful. Italy has one of the lowest shares of individuals with basic or above-basic digital skills within the European Union (Eurostat, 2023). Given the growing importance of digital competencies in an increasingly digitized society—where such skills are essential for accessing public services and other aspects of everyday life - the promotion of digital literacy should be considered a shared priority (Gatti et al., 2017). In our study, we designed and implemented a digital literacy course that employed a specific peer-education technique not widely covered in the existing literature (Ahmad et al., 2022). Beyond delivering the course, we aimed to evaluate its impact on participants' digital skills as well as other aspects related to their quality of life. The study involved a 10-session digital literacy course attended by 40 participants of different ages. Among the objectives, we sought to assess changes in participants' smartphone usage habits. To achieve this, we asked participants to install the Stay Free – Screen Time app on their smartphones, which monitored which apps they used and for how long. In our case, the different levels of digital literacy of our participants did not play a particular role in the process of data collection, since all of them agreed to have their data monitored - all of them being volunteer and aware members of an ad hoc pilot research group. It is important to emphasize that Stay Free does not, by default or by design, collect data regarding the specific content accessed within apps or the users' social connections. The data gathered would be associated with pseudonyms and shared in aggregated categories. For example, in possible future publications, we planned to discuss social media app usage in general, rather than focusing specifically on Facebook or Instagram use, following a similar approach carried out in other studies (Caliandro et al., 2021).

However, once we submitted our study to one REC of the institutions involved in the research, along with the required materials that, as in the experience of many others, do not align well with qualitative approaches

[2] This is a fictitious name crafted for privacy purposes.

[3] This is of course a fictitious name employed for privacy and ethical reasons.

in social science (Schrag, 2011; Roth and von Unger, 2018; Van Den Hoonaard, 2019), our study was deemed too invasive after a lengthy evaluation. They asked us to significantly reduce the amount of information gathered, focusing exclusively on app categories rather than specific apps from the early phase of measurement, not just in the communication of results. This request limited the granularity of the data and the precision of the general categories. In fact, we had to rely on the categorization provided automatically by the Stay Free App, which meant we had no visibility into how these categories were created, thereby exposing the data to potential inaccuracies. Arguably, globally used apps, such as the most popular social media platforms, are likely to be classified correctly. However, more country-specific apps - which could offer more interesting and valuable insights into usage patterns - are more likely to be misclassified, significantly limiting the informative value of the gathered data. Nevertheless, in order not to delay our fieldwork further, we modified our study as suggested by the REC. After collecting informed consent from the participants, we carried out the research.

Reflecting on this experience with REC approval, it made us think about the existence of a double standard regarding the same data users generate. Consider the example of our research: on the one hand, one of our research participants visits the Facebook app and engages in several activities that are precisely monitored by Facebook—the pages they visit, the likes they give, the friends, brands, and political candidates they interact with, just to name a few categories. On the other hand, a group of researchers, through a specific app, is planning to ask the same user for consent to measure how often they use Facebook and for how long, without having any visibility whatsoever into the activities they conduct within the app. The rich data gathered by the private firm in the first case are then used for targeted advertising and other practices of value extraction. Meanwhile, the limited data gathered for research purposes is considered too invasive. While the two situations are not exactly the same - since RECs only have visibility and authority over academic research - at a general level, the standard applied to digital data in the commercial sector differs significantly from that applied to research. This disparity becomes even more evident when considering that both social media users and research participants are presented with terms of service or rules of engagement, to which they are required to give acceptance or consent in order to gain access to the platform or participate in the research. However, it is well understood that the terms of service or policies of online platforms are rarely read in full by users and are often difficult to comprehend (Fiesler et al., 2020). In contrast, research participants—both in our study and more broadly - typically undergo a much more structured and personalized process designed to ensure they provide informed consent.

We wish to highlight - somewhat provocatively - what we see as an 'ethical paradox.' On the one hand, social researchers use digital data (typically public and limited in scope) to advance knowledge about digital society, doing so under strict and transparent ethical protocols. On the other hand, companies collect vast amounts of digital data that users 'willingly' provide, often leveraging them for purely commercial purposes - sometimes with questionable ethical consequences, such as facial recognition technologies or worker surveillance - through opaque and largely unregulated processes. Given this scenario, it appears paradoxical that, in a highly datafied society, social scientists are often regarded as the primary threat to users' privacy and are subject to oversight by ethics committees that strictly regulate their activities. In this paper, we introduce the concepts of the 'digital data double standard' and 'data donation' as, respectively, a conceptual and methodological framework to address - or at least navigate - this paradox.

In the upcoming section we describe how digital data is managed by several commercial actors that can largely benefit from the economic value they are able to extract from it under regulations that have been loose for years and in many parts of the world continue to be as such

2.1 Digital data and platforms: economic value and control

The standard applied to personal digital data by platforms strongly depends on the recent transformation of the dominant socio-economic model, which could be called surveillance capitalism. Surveillance capitalism, as described by Zuboff (2019a, 2019b), marks a shift in the nature of capitalism, where data becomes a central asset. In this system, digital platforms have blurred the lines between online and offline spheres, monitoring users' behavior through a pervasive multitude of digital devices (Mejias and Couldry, 2019; Wood and Monahan, 2019). These platforms collect and analyze data to predict, and often influence, user behavior for commercial gain (Zuboff, 2019a, 2019b; Darmody and Zwick, 2020). User data has thus become a key commodity, with some businesses even focusing primarily on trading data and data marketplaces (Spiekermann, 2019). Despite being the primary source of this valuable resource, consumers' influence has diminished (Andrejevic, 2011; Draper, 2012). Users' understandings of and opinions on these dynamics are rarely taken into consideration by platforms. Digital companies often use or sell data for scopes which users would unlikely agree with (if fully informed in advance). Consider for example the usage of users' data to train AI systems of facial recognition (by companies like Meta or Amazon), which are seldom employed to control (and sometimes oppress) minorities (Eubanks, 2018; O'Donnell 2020; Hill and Mac, 2021). Even the rise of Web 2.0, which allows users to create and share content, largely benefits companies that exploit this user-generated information for profit, limiting the role of users (Andrejevic, 2011).

In this data-driven economy, power is concentrated in the hands of those who control and manipulate information (Arvidsson, 2016; Hintz et al., 2017; Beer, 2018). The system is characterized by a stark imbalance between those who produce data and those who profit from it (Crain, 2018). Traditional economic principles such as customer autonomy and sovereignty are increasingly undermined by the pervasive use of personal data (Darmody and Zwick, 2020). As a result, transparency and user empowerment are no longer sufficient responses to the commodification of personal information (Crain, 2018). Companies are even designing products and services specifically to gather more and more intimate and private data on consumers - consider Amazon's smart devices like Alexa that registers consumers' activities within their own households (West, 2019).

Privacy concerns are a major topic in the discussion of surveillance capitalism, with scholars emphasizing the ways in which privacy has become a kind of currency in this datafied environment (Liu, 2011; Huey, 2012; Luther and Radovic, 2012; Hulsey and Reeves, 2014; Marwick and boyd, 2018; Helm and Seubert, 2020). In the commercial sphere, platforms offer services at low or no cost to users, but the real price is the vast amount of personal data they provide in return (Hulsey and Reeves, 2014; West, 2019). Curran (2023) even argue that issues of privacy are systemic (thus not removable) in surveillance capitalism: its imperatives to datafy every aspect of social life and connect all this data with a large set of stakeholders (data brokers, data vendors, data suppliers, data analysts, developers, marketers, advertising agencies, etc.) (van der Vlist and Helmond, 2021) make the system intrinsically 'fragile' and so prone to breakdowns, data breaches, data hacking, etcetera - with obvious negative consequences for users' privacy.

Beyond privacy, the use of personal data has raised concerns about discrimination through algorithms and Big Data. Issues related to bias and unequal treatment have been documented in various areas, including employment, healthcare, mobility, and insurance, often along lines of ethnicity, gender, or disability (Winter and Ono, 2015; Janssen and Kuk, 2016; Eubanks, 2018; Favaretto et al., 2019; Tanninen, 2020; Tzanou, 2022; Charitsis and Lehtiniemi, 2023). Finally, in an admittedly dystopian fashion (Breckenridge, 2020), Zuboff comes to suggest that surveillance capitalism is bringing about a hyper-rationalization of the social order, reducing human «volition into reinforcement and action into conditioned response» (Zuboff, 2019b: 378) - this with the ultimate scope of making social behavior standard enough to be easily datafied, predicted, and controlled (Caliandro et al., 2024).

User data constitutes one of the main interests of platforms, as they can extract significant economic value from it. This focus is difficult to limit, as appropriate regulation is hard to define and slow to implement. As a result, significant risks to user data protection have emerged in recent years.

2.2 Digital data and researchers: ERC limitations but mainly limited tool

The way digital data can be used and is used in the research domain is significantly different from its use in the commercial sphere. There are two main reasons for this: the first is ethical/organizational, which has already been discussed in relation to the role of RECs, and the second is technical. Concerning the technical limitations to the use of digital data in social science research, it is important to consider that, prior to 2018, researchers could rely heavily on public APIs (Application Programming Interfaces), especially social media APIs. APIs provided valuable tools for social science research by granting access to vast amounts of publicly available user data (Lomborg and Bechmann, 2014). Researchers could collect data on user interactions, trends, and behaviors across platforms like Twitter, Facebook, and Instagram, allowing the study of social dynamics, public opinion, political discourse, and cultural trends on a large scale. APIs enabled the retrieval of posts, comments, likes, and follower networks, facilitating the analysis of communication patterns, sentiment, and information dissemination (Rieder et al. 2015).

However, in 2018, the Cambridge Analytica scandal led companies to impose stringent restrictions on the use of APIs. The Cambridge Analytica scandal involved the misuse of personal data from millions of Facebook users without their consent. In 2014, Cambridge Analytica, a British political consulting firm, obtained data from users through a personality quiz app on Facebook, collecting personal information from millions of their friends as well. Cambridge Analytica used this data to build detailed psychological profiles of users, which were then employed to influence voter behavior in political campaigns, including the 2016 U.S.

presidential election and the Brexit referendum. The scandal, revealed in 2018, sparked outrage over data privacy and led to significant scrutiny of Facebook's data practices, prompting regulatory changes and legal action against both Facebook and Cambridge Analytica. Facebook, as well as other platforms, started limiting and restricting the use of APIs for allegedly protecting their users (Caliandro, 2021). This decision had a significant impact on research into digital behavior, with the limitations being termed "APIcalypse" (Bruns, 2019), and it forced researchers to reflect on conducting research "post-API" (Breuer et al., 2023; Caliandro, 2024). Scholars have pointed out that these platform-imposed restrictions, framed as privacy-enhancing measures, have primarily increased platform control, making them the only entities capable of conducting extensive analyses of digital data, which, as noted earlier, is geared toward economic value extraction (Bruns, 2019; Christner et al., 2022).

Recently, the European Union has been working to counter the growing trend of digital platforms further restricting researchers' access to relevant digital information under the guise of protecting user privacy. The recently established Digital Services Act (DSA), under Article 40, paragraph 4, states that

> upon a reasoned request from the Digital Services Coordinator of establishment, providers of very large online platforms or of very large online search engines shall, within a reasonable period, as specified in the request, provide access to data to vetted researchers who meet the requirements in paragraph 8 of this Article, for the sole purpose of conducting research that contributes to the detection, identification, and understanding of systemic risks in the Union (Official Journal of the European Union, 2022).

The requirements listed in paragraph 8 specify that, to obtain "vetted researcher" status, researchers must be affiliated with a research institution, as defined in other EU directives, be independent from commercial interests, disclose the funding of their research, manage data security accordingly, and commit to making the research results publicly available free of charge. Additionally, researchers must be investigating what the DSA defines as systemic risks. According to Article 34, these risks include the dissemination of illegal content online, any actual or foreseeable negative effects on the exercise of fundamental rights, civic discourse, electoral processes, and public security, as well as issues related to gender-based violence, the protection of public health and minors, and serious negative consequences for a person's physical and mental well-being (Joint Research Centre, 2023). However, it is still not clear how these dispositions of the DSA for researchers will actually work (Ohme et al., 2024).

Therefore, some alternatives for continuing doing research with digital data in the "post-API era" have been progressively developed.

2.2.1 Research strategies for facing technical limitations in the post-API era

After the closure of most of the social media APIs (Caliandro, 2024), few alternatives remained for researchers, and those available were less effective and more costly. One option is partnering with the platforms that generate the data, though researchers typically have limited access to the vast amounts of information available. Another option is purchasing data from third parties, such as data resellers or social media monitoring companies, which also comes with high costs and limited visibility into the data - this also comes with the risk of broadening what boyd and Crawford call the 'academic digital divide' (boyd and Crawford, 2012). As a matter of fact, corporate services providing social media data are proliferating in the last few years (see Brandwatch, Phantom Buster, Apify, etc.).

Better research options in the post API era involve the use of scraping and tracking. Scraping is an IT technique that consists in collecting data directly from the HTML code of a target web page. Through scraping one can, basically, capture everything that appears on a screen, and it can be implemented by programming an ad hoc software using Python or R (Anselmi, 2024). Usually, scraping requires high IT and programming skills, which the average social researcher usually does not possess (Caliandro et al., 2024). To overcome this specific issue, research groups have been developing their own scraping solutions, such as some of the tools by Digital Methods Initiative (DMI), led by researchers at the University of Amsterdam. Their most recent tool, 4CAT, is designed to facilitate the analysis and processing of data from online social platforms through a user-friendly web interface, eliminating the need for programming or web scraping skills. It natively supports platforms like 4chan, Telegram, and Tumblr, with the option to add additional data sources using its Python API. Another useful tool from the DMI is Zeeschuimer. It is a browser extension that monitors internet traffic while browsing social media platforms and collects data about the items seen on the web interface - (of course of the user who installed it). This tool is particularly useful for studying platforms that resist conventional web scraping and works with platforms such as TikTok, Instagram, X/Twitter, LinkedIn, and others. However, scraping is not without ethical concerns. While the practice is not inherently illegal, many social media platforms and websites strongly oppose it, primarily because it can place significant stress on their servers.

Automated scripts designed to extract entire pages often generate a high volume of server requests, creating a legitimate risk of overwhelming the servers and potentially causing site outages. Another ethical issue arises from the ability of scraping tools to bypass privacy settings, potentially accessing information that users did not intend to make public. Additionally, scraping may enable researchers and developers to collect data that platforms deliberately restrict, thereby infringing on the rights and interests of site owners. Despite these concerns, some scholars defend the use of scraping as a viable method for studying online environments (Bainotti et al., 2021; Fiesler et al., 2020).

As another option to gather digital data for research after the closure of APIs, tracking involves the use of specialized apps or software installed on participants' digital devices to monitor and record various digital activities. This method enables researchers to observe patterns of smartphone use, browsing behavior, and website navigation in real time. Tracking offers key advantages in social research, particularly by allowing access to data that would otherwise be difficult to capture, such as the frequency of smartphone access or the exact duration a user spends on specific apps. It also provides granular data, eliminating the inaccuracies common in self-reported methods like surveys or self-tracking sheets, where participants might not accurately recall their digital behaviors (Garavaglia et al., 2023).

An available software that follows the tracking approach is Screenomics. This software captures a screenshot every five seconds when a digital device is in use, providing insightful information on a wide range of digital activities, independent of the platform, software, or device being used, without requiring users' intervention (Ohme et al. 2024).

Furthermore, tracking principles and methodologies have been also applied in research that exceeded media consumption, focusing for instance on smartphone use. For instance, Garavaglia and colleagues (2023) installed RescueTime on research participants' smartphones which was able to record which apps/websites participants accessed, when and for how long, providing very granular and relevant information on the usage patterns of this kind of technology.

Despite their advantages compared to the other post-API data gathering strategies that require collaboration with digital platforms or purchasing data from third parties, these two approaches still have technical and methodological limitations. For instance, with respect to scraping, the different policies of websites and platforms still limit the amount of data that can be downloaded (Christner et al., 2022; Breuer et al., 2023). Concerning the tracking approach Ohme and colleagues (2024) pointed out how establishing proper and rigorous research based on tracking «requires substantial expertise and effort. Researchers must develop or obtain the tracking software, recruit and consent the participants, and manage what are often very large data sets in accordance with strict privacy-preserving protocols» (p. 139). Furthermore, ethical issues persist, including the previously discussed concerns related to scraping: the potential excessive burden of requests placed on website servers, the collection of data that users may not wish to share, the possible violation of platform policies, and the risk of accessing data considered personal through tracking.

Several contributions have advocated for greater involvement of users in data collection as an additional strategy to address these ethical concerns, while also tackling the technical challenges associated with conducting research on digital data (Christner et al., 2022; Breuer et al., 2023; Caliandro, 2024). The approach of data donation aligns with this perspective.

3. THE OPPORTUNITIES OF DATA DONATION

Scholars reflecting on the concept of data donation recognize that current academic interest in digital data is limited by legal, ethical, and technical issues, which challenge the opportunities that could arise from studying such materials (Araujo et al., 2022; Ohme and Araujo, 2022). Data donation can be understood as the «user-centric approach in which research participants donate their existing digital trace data to researchers» (Ohme et al., 2024: 128). There are several practical approaches to implementing data donation. For example, users can record their online activities through specific plug-ins or tools like the previously described Zeeschuimer. Alternatively, users can donate the usage reports that are automatically generated by most smartphones each week. Furthermore, leveraging Article 15 of the EU's 2018 General Data Protection Regulation (GDPR), users can download a copy of their personal data from platforms like Facebook and X (formerly Twitter), called Data Download Package (DDP), and donate it to researchers (Boeschoten et al., 2022; Ohme et al., 2024).

These strategies offer several advantages from a research perspective. First, the information gathered is richer than what could be obtained through alternative methods, including those previously described. Data provided through data donation is even more detailed than the information once available through APIs before their widespread closure. Additionally, data donation directly involves participants, requiring their informed consent due to the active role they play in the process. This ensures that users can choose which data to donate and which to keep private (Ohme et al., 2024). To take advantage of these benefits, scholars have developed software tools for data donation, such as Port, which also focuses on user control and selection of specific data for donation. Port requires participants to request a digital copy of their personal data from platforms like Facebook, Instagram, or Google Search in the form of DDP, which platforms are legally obligated to provide under GDPR. After receiving their DDP, participants save it to their personal device, where only the relevant data points for the research are locally processed and extracted. Participants review the extracted data, and if they agree, they consent to donate it. Only after this consent is given, the data is sent to a designated storage location, where it becomes accessible to researchers for analysis (Boeschoten et al., 2023).

Another tool is the Open-Source Data Donation Framework (OSD2F). OSD2F provides a web-based interface where participants can follow step-by-step instructions for downloading their data from selected platforms, view their DDP contents, select which data to share or exclude, and then donate the chosen data to a specific research project. In the background, OSD2F performs pre-processing steps to minimize the data before it is made available to researchers (Araujo et al., 2022).

In conclusion, we can argue that, even if post-API research techniques, such as tracking or scraping may raise ethical concerns with respect to the gathered data, they turn out to be respectful of users' privacy when they are compliant with the protocol of data donation. In fact, participants are asked to sign an informed consent, autonomously collect data from their own digital devices and then submit them to the research team. On top of that, consider that each participant can freely decide not to donate her data, even though she already downloaded it as well as previously signed an informed consent and agreed to its conditions. As demonstrated in Port's or OSD2F's workflow, users are directly involved in downloading their personal data. If they feel uncomfortable donating data from a particular platform, they can simply choose not to do so. Additionally, a data-minimization approach can be applied, where researchers help participants extract only the data necessary for the research, excluding irrelevant information from the dataset to be analyzed (Ohme and Araujo, 2022). Furthermore, at the crossroads of advantage for researchers and participants, data donation methods offer the chance to ensure that participants are aware of how their data is going to be used and expressed actually informed consent due to previous chances of confronting with the research team, as well as the option of exclude some data from the analysis as previously mentioned. In this way a user-centric approach to the research is fully leveraged (Ohme et al., 2024).

Despite its significant advantages from both research and ethical standpoints, data donation has some limitations, as pointed out by Ohme and colleagues (2024). One major issue is the limited sample size. Since data donation requires direct participant involvement, it is unlikely that a research project would engage a very large number of users, thus reducing the amount of available data. While APIs once provided vast datasets that enabled big data analysis, data donation is better suited for more nuanced projects involving qualitative approaches. Another technical limitation, though arguably less significant, is that the data gathered through donation is less structured than the data previously available through APIs, which were more organized and ready for cleaning and analysis in a big data context. Additionally, the digital skills required to download personal data may present a barrier for some participants. For instance, older adults with limited digital skills may find the process of downloading DDPs challenging (Pizzul et al., 2024). However, this issue can be mitigated through active collaboration between researchers and participants from the early stages of data collection (Kmetty and Németh, 2022; van Driel et al., 2022). For example, it is possible to organize sessions in which researchers assist participants throughout the different steps of the data donation process (Pizzul et al., 2024) and/or provide them with ad hoc video tutorials featuring instructions for collecting and storing data from their own devices (Punziano et al., 2024). In addition to the limitations related to those who are technically able to donate data, there is a further constraint concerning individuals' willingness to participate in data donation (Gomez Ortega et al., 2023). This is also connected to participants' ability to choose which data to donate or withhold, as previously discussed. As a result, there is a potential risk of self-selection bias among participants. Nevertheless, in line with the ethnographic principles underpinning the most recent evolution of digital methods - specifically the addition of the "follow the users" approach (Caliandro, 2024) - if a user chooses not to be followed, this decision must be respected. This dynamic, in different forms, also occurs in more traditional research methods, where individuals may decline to participate in an interview or refuse to complete a survey. Furthermore, the issue of working with partial and poorly comparable data is primarily a concern within quantitative research—particularly when the aim is to make comparisons between individual users or identify correlations between variables to produce generalizable results. The situation is quite different in qualitative research, which often focuses on providing broader descriptions of digital communication processes. For example, Caliandro et al. (2021, p. 11) used participants' smartphone log data “as signals to orient further qualitative explorations”; since the log data indicated heavy use of WhatsApp, they focused their face-to-face interviews on participants' everyday practices with the app.

Lastly, research projects based on data donation do not allow (or at least make it hard) to implement those ‘classical’ digital methods analysis (relying on APIs) aimed at mapping entire platforms or large portions of them (Marres, 2015). These kinds of studies have been crucial to cast a light upon and raise academic and public awareness about the so called ‘information disorders’ (i.e., fake news, conspiracy theories, hate speech, etc.) (Rogers, 2023) - and especially on the scale of their circulation and diffusion. As a matter of fact, research on information disorders not only contributed in developing ‘societal defenses’ (see the proliferation of digital literacy, debunking and fact-checking initiatives), but also forced platforms to take serious steps to contrast such phenomena (Matamoros-Fernandez et al., 2021). Of course, future research will continue to investigate fake news, but (probably) the focus of the investigation will shift more toward the consumption of problematic content, rather than their global diffusion.

4. CONCLUSION

The influence of RECs has been widely criticized in social science, particularly by those employing qualitative approaches. Critics argue that these bodies are often guided by criteria, paradigms, and approaches suited for biological and medical disciplines, which are difficult to transfer to the social science domain (Bosk, 2007; Schrag, 2011; Roth and von Unger, 2018; Van Den Hoonaard, 2019; Brown, 2023). Ethical issues, and thus the role of RECs, become even more problematic when digital data is involved, as traditional, non-digital principles do not fully apply to the management and handling of digital data (Caliandro, 2021). While this issue has been extensively discussed, particularly by those interested in digital methods (Caliandro and Gandini, 2017; Caliandro et al., 2024), the intersection between digital data and RECs evaluation has not been widely explored. To address this gap, we refer to a practical example from our own research on digital literacy and required empirical adjustments by the competent REC to reduce what were perceived as potential privacy violations. Starting with this example, we reflected on the double standard that characterizes private and academic interests regarding user data. In the private sector, driven by platforms following the surveillance capitalism model, user data is extensively analyzed for economic value extraction with limited boundaries despite a growing interest in data protection. In contrast, technical limitations imposed by these same platforms with closure of APIs, combined with ethical restrictions required by RECs, significantly reduce the potential activities of researchers dealing with digital data.

Therefore, following the closure of APIs, another layer of restrictions seems to be imposed on social researchers: that of RECs. This introduces the notion of a "digital data double closure," in addition to the "digital data double standard." It seems quite paradoxical that social researchers—who are generally well-trained in ethical matters and whose primary goal in collecting social data is to enhance social knowledge (Mertens and Ginsberg, 2009; ESRC, 2022)—are increasingly restricted in their access to data, while digital platforms, whose main objective is economic profit, face virtually less limitations on the quantity and quality of data they can collect from citizens, nor on their ability to sell this data to third parties (Reviglio, 2022).

To overcome some of the limitations set by this double standard and to ease the double closure, recognizing the importance of ethical evaluations in scientific research, including in the social sciences, we do not promote reducing the role of RECs. It is important to emphasize once again that the arguments we have been developing are in no way opposed to the existence of ethics committees, nor are we suggesting their ineffectiveness or advocating for their abolition. On the contrary, we believe in the need to strengthen them by promoting the establishment of more discipline-specific or ad hoc committees that are better equipped to address the specific needs of various fields, or at least by ensuring diverse expertise and sensibilities within the same REC. On the one hand, such committees should be more attuned to and knowledgeable about the unique principles, dynamics, and professional ethics that govern social research, which often differ from those in biomedical or natural sciences. On the other hand, they should be aware of the pervasive logic of surveillance capitalism and the significant power asymmetries embedded within it, which can shape research outcomes due to the current limited access to data provided by platforms following the closure of APIs. Strengthening ethics committees in this way would ensure that they do not contribute to further restricting the study of digital data beyond the limitations already imposed by private platforms. Moreover, it would help address the double standard we have been describing, by not further limiting the use of digital data for collective knowledge generation compared to the one for private economic value extraction. In this way, Research Ethics

Committees (RECs) could play a more active role in the social science research process involving digital data—research that often seeks to challenge the power dynamics of digital platforms, whose practices are frequently far from ethical. Greater involvement from RECs is fully aligned with the data donation strategy we have described, which emphasizes the active role of users in controlling their personal data. Beyond addressing some of the limitations inherent in post-API research (Araujo et al., 2022; Boeschoten et al., 2022; Ohme and Araujo, 2022), data donation also serves as a valuable method for fostering participant engagement with their personal digital data in a more participatory, informed, and empowered manner, consistent with the principles of digital methods (Halavais, 2021; Caliandro, 2024). In this co-constructed approach to research on digital data—grounded in collaboration between researchers and participants—RECs that adopt more discipline-specific sensitivities and perspectives could find a renewed role. They could further support the development of research projects and help address the growing obstacles to knowledge production posed by the increasing inaccessibility of digital environments, a restriction driven by platforms seeking to consolidate power and control.

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A NEW WAVE OF SOCIAL MEDIA APIS RESTRICTIONS
A decade of challenges for digital social research

by *Suania Acampa*[*]

Abstract

Research on digital phenomena is crucial for understanding the complex social processes unfolding online, particularly on social media platforms. Historically, APIs have enabled large-scale data collection, facilitating studies on critical issues such as disinformation, hate speech, and political polarization. However, since 2018, increasing API restrictions have significantly hindered independent research, raising concerns about academia's ability to conduct replicable, large-scale studies. This paper examines the evolution of API restrictions on significant platforms, focusing on Meta (Facebook and Instagram) and Twitter (now X) and the role of European regulations such as the General Data Protection Regulation (GDPR) and the Digital Services Act (DSA), analyzing their impact on digital social research to balance privacy protection and research accessibility.

Keywords

API Restrictions; Digital Social Research; Digital Data; European Regulations

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1. INTRODUCTION

Currently, research "on" and "with" digital media is crucial for understanding emerging social phenomena that evolve within online spaces. Social media platforms have become environments where complex phenomena unfold, shaping individuals' daily lives and influencing global sociopolitical processes. In studying these phenomena, social media Application Programming Interfaces (APIs) have long been among the key tools for collecting and analyzing data. They have enabled large-scale data collection to analyze qualitative and quantitative socio-political phenomena.

API access has enabled researchers to explore user interactions, map social networks, track information diffusion, and study phenomena like disinformation (Walker et al., 2019; Taeihagh, 2021), hate speech (Bastos e Mercea, 2019), and political polarization (Farkas et al., 2018). In addition to this, specific API-based data collection tools, such as Netvizz (Rieder, 2013) and 4CAT, have allowed researchers without advanced programming skills to conduct research, effectively democratizing digital research.

Since 2018, API access has become increasingly restricted, particularly affecting academia's ability to conduct large-scale, replicable studies (Bruns, 2019; Perriam et al., 2020). This raises crucial questions about the future of research and the possibility of independently monitoring social media without leaving information control solely to the platforms (Ananny e Crawford, 2018).

In parallel with the restrictions imposed by the platforms, European regulation also plays a decisive role in defining access to data for research. The General Data Protection Regulation (GDPR) and the Digital Services Act (DSA) are two key regulations that influence access to social media data in Europe. The GDPR, in force since 2018, limits using personal data for research, introducing constraints on consent, data collection, and anonymization (Art. 6; Art. 9; Art. 17 GDPR). Although these measures are fundamental to guarantee users' privacy, they represent a challenge for digital social research, which must balance privacy protection with the possibility of accessing relevant data to study phenomena of public interest. The DSA, on the other hand, marks an important step towards greater transparency and accountability of digital platforms (Perriam et al., 2020). It imposes on platforms the obligation to provide regulated access to data to qualified researchers. However, the practical implementation of these rules presents difficulties and challenges related to the cooperation of platforms and the actual application of the provisions.

This paper explores the impact of APIs restrictions on digital social research, emphasizing the need to balance privacy protection with data access. The restriction in access to data could lead to a phenomenon of data-driven determinism (Kitchin, 2014), in which research questions are adapted to the available data rather than addressing the complexity of social phenomena that develop in digital environments through research guided by solid cognitive and theoretical objectives. This situation reduces the ability of researchers to offer a critical and independent perspective on online social dynamics. It also hinders platform transparency and prevents a deeper understanding of the phenomena shaping our digital societies.

The aims of this paper are threefold: (1) to investigate the role played by APIs in digital social research; (2) to retrace the cyclical closures of access to APIs of the main social media platforms and the alternative solutions they have proposed to researchers; (3) to discuss the role of European regulation in managing access to platforms' data and compare it with the policies of the platforms. Through a critical analysis of current European policies and platform policies, this work aims to promote a discussion on the current state of digital social research in light of the new wave of closures imposed by the platforms and the possible ways of collaboration between academia and proprietary companies to promote ethical and transparent use of data; thus, contributing to a broader reflection on the future of digital social research.

2. DIGITAL SOCIAL RESEARCH AND APIS: PAST OPPORTUNITIES AND FUTURE CHALLENGES

For many years, digital social research has relied on APIs to collect semi-structured and unstructured data from digital platforms, especially social media.

These APIs have equipped researchers with tools to explore socio-technical structures and cultural processes arising from users' daily platform interactions (Venturini, Rogers, 2019), opening new perspectives for analyzing complex phenomena. APIs have facilitated access to large amounts of data that were relatively easy to access before the Cambridge Analytica scandal. This ‘little revolution’ as defined by Caliandro (2021: 226), has allowed researchers to collect detailed and large-scale information using intuitive interfaces created thanks to the collaboration between developers and researchers that have quickly become a fundamental source of information to understand many of the urgent challenges of global society (Venturini e Rogers, 2019). An important example of this collaboration is represented by a project developed by the Digital Methods Initiative of the University of Amsterdam, under the guidance of Bernard Rieder, called 'Capture and Analysis Tools for Social Media Research' (CAT4SMR), which includes a series of tools designed to collect and analyze data from social media intuitively. This project includes two successful applications developed by Rieder: Netvizz, developed in 2010, which allowed researchers to extract data from Facebook, such as posts, comments, friend networks, and group data. The second app is 4CAT, which was developed in 2019 to support collecting and analyzing data from social media in an open-source, flexible, and user-friendly way. These and many other applications have been progressively limited by the changes made by the companies owning the platforms to their APIs, until the definitive suspension after the Cambridge Analytica scandal. The current cemetery of APIs and interrupted tools demonstrates how these tools have represented a precious resource in the toolbox of the digital researcher.

These tools allowed research to be conducted using 'natively' digital data, in line with Rogers's (2013) Digital Methods approach, without the need for advanced programming skills, effectively democratizing access to data for digital social research.

From a methodological point of view, this access to data presented both strengths and weaknesses. On the one hand, according to some scholars, the use of APIs has allowed us to overcome the rigid and traditional distinction between qualitative and quantitative methods (Russell, 2013) highlighted by the fact that digital objects (posts, links, clicks, photos, tweets, etc.), their metrics and their connections, could be interpreted qualitatively but also analyzed quantitatively in the context of more extensive networks. On the other hand, free access to APIs has raised concerns about the risk of researchers' dependence on big social data, thus exposing digital research to a vulnerability that comes from the changes and restrictions imposed by the platforms. Since 2018, companies such as Meta and X (formerly Twitter) have cyclically limited access to these interfaces, weighing heavily on research that depends on these interfaces to collect data continuously, making the future of many long-term research projects uncertain (Perriam et. al., 2020). These restrictions limit academic research in general and directly impact the ability to monitor phenomena such as disinformation or hate speech. Researchers have historically relied on API access to track the spread of misleading content, identify coordinated manipulation campaigns, and analyze the role of social media in radicalization processes. For example, studies analyzing disinformation during elections (Giglietto et al., 2020) or extremist propaganda networks (Miranda et al., 2022) have examined these phenomena using social media data. As API restrictions tighten, researchers may struggle to conduct similar large-scale real-time analyses. Without systematic access, researchers are forced to rely on smaller datasets, making it harder to detect large-scale trends and draw generalizable conclusions. Moreover, the inability to analyze entire conversations and interaction networks hinders a comprehensive understanding of how hate speech spreads and reduces researchers' ability to assess the effectiveness of platform policies or regulatory interventions to counter it.

This has exposed research to large technology companies' commercial and political logic. Social media data is one of the most important areas of the data market and is constantly growing (Kinder-Kurlanda & Weller, 2020; Chew & Gunasekeran, 2021; Manovich, 2012). After the closure of the APIs, the data has been made available mainly for commercial purposes and is accessible to large marketing and advertising companies (Bruns, 2019). In this regard, a very interesting work by Puschmann and Burgess (2014) analyses the growing control Twitter exercises over users' data through its platform. While initially, Twitter had presented itself as an open platform concerning the closures that Meta was starting, the evolution of its business model led to a subsequent closure of access to data, progressively limiting the amount of data available (for free) through its API and reserving privileged access to commercial partners (Puschmann e Burgess, 2014).

This policy has excluded independent researchers and created a sharp divide between those who have the technical and economic means to access data and those who do not. This process aligns with a broader dynamic of centralizing control over digital data by large technology platforms, which exploit the economic value of data collected through users' daily activities (Marciano et al., 2020; Chen et al., 2022). Freelon (2018: 666) highlights the significance of open API access in digital research, coining the term 'post-API era' to mark the critical turning point caused by platform API closures. This shift has created new challenges for researchers, especially those who do not have the resources to negotiate access or develop alternative data collection methods such as scraping, a data collection method that consists of extracting information from web pages using automated tools or by writing custom scripts in programming languages such as Python or R. The academic world is, therefore, the one that has suffered the heaviest consequences, and although researchers have been offered alternative data access options, these - as will be explored in the next paragraphs - have not proven adequate to guarantee a supply of data independent of the commercial interests of the platforms themselves (Punziano et. al., 2021).

The end of free API access has triggered several trends in digital social research (Acampa, 2024): the first is migration towards easy data (to collect), therefore websites or platforms that are less restrictive on access to APIs, and the possibility of data scraping. This fuels the (mistaken) idea that any platform is helpful for indiscriminately investigating a specific digital phenomenon. Each platform has its own structural and affordance peculiarities and a different pervasiveness in people's daily lives, which differs by age group and can change from country to country. This triggers the rise of research based on data-driven epistemological approaches in which research questions are adapted to the available data. This situation not only limits the ability of researchers to provide a critical and independent view of online social dynamics but also reduces the transparency of platforms to the detriment of an in-depth understanding of phenomena. This authoritarianism in accessing data could transform the opaque platforms into authentic 'black boxes' (Pasquale, 2015) that escape their responsibilities towards legislators and the public. The second consequence is a return to forms of direct data collection: this forces the researcher to work on small data sets and observe the platforms' dynamics through the same interfaces of the actors he studies (Marres, 2017; Rogers, 2018). In the data collection practice, the risk is that the researcher is influenced by algorithmic recommendations that affect the display of content and profiles (Bucher, 2018; Noble, 2018). The third consequence is the encouragement to deliberately violate the platforms' Terms of Service (TOS) (Freelon, 2018) or to use other unofficial data collection tools, which often clash with the platform's policies. This practice responds to the idea that (in some cases) the benefits for society derived from the violation of the TOS outweigh the damage to the platform (Rogers, 2018; Venturini & Rogers, 2019). A concrete example of these new issues concerns the use of tools such as StorySaver to collect stories from Instagram, which are not accessible via official APIs (Caliandro, 2021) or directly using scraping techniques using HTML code (Bainotti et. al., 2021). The alternative of web scraping on social platforms is problematic, not only from a legal point of view but also from a practical one: the strict controls initiated by the proprietary companies and the implementation of anti-scraping techniques make it difficult (maybe impossible) to complete the collection. Therefore, even if data were collected, their quality and completeness could be compromised since they are often partial, fragmented, or limited by the technical restrictions imposed by the platforms themselves.

In this 'post-APIcalypse' era, as defined by Bruns (2019: 2), digital social research must face the challenge of finding alternatives that do not bend to the commercial interests of the platforms and that allow researchers to conduct studies on digital phenomena without depending exclusively on direct access to data from platforms or being forced to violate their terms of service (TOS). At the same time, it is necessary to adopt an epistemological approach that is pluralistic, pragmatic, and at the same time critical (Amaturo, Aragona, 2019) that reflects not only on the ethical implications of alternative data collection practices but also looks at the quality of the data collected to ensure reliable results and meaningful interpretations.

2.1 Overcoming the API Challenge: Methodological Approaches for Digital Research

Although not about APIs, some scholars have discussed epistemological and methodological approaches that could become practical and alternative solutions to overcome APIs' limitations in digital research in the future. Each approach exploits the potential of digital environments to collect data, understand real-time behaviors, and directly involve users in the research process.

According to Rogers (2018), with the closure of APIs, it is necessary to rethink digital methods, shifting the focus from APIs to new, more independent ways of collecting data, such as direct observation of users' practices or collaboration with alternative networks. Caliandro (2021: 235)., in this regard, proposes to shift the focus from 'follow the medium (Rogers, 2018) to 'follow the natives'. This approach suggests observing and leveraging users' natural methods to manage their data. Researchers can adopt everyday tools and practices digital users use, such as content-saving apps or tracking software, to explore new digital dynamics.

One methodological solution may be that of 'interface methods' (Marres & Gerlitz, 2016), which focus on analyzing interactions and structures of digital platforms, directly observing how interfaces (web pages, applications) influence users' behaviors. This approach suggests that the interface of a platform is not just a passive tool but an active mediator that organizes and guides users' interactions with data and information. The basic idea of interface methods is that digital platforms reflect social behaviors and shape them through algorithms, ranking mechanisms, automatic suggestions, and other processes. Therefore, studying how interfaces influence such behaviors can offer crucial information on how digital platforms produce social effects. In this context, we do not access the structured data provided by APIs but analyze how platforms manage and present content. For example, analyzing Facebook news feeds can reveal important information on the mechanisms determining online content's visibility and circulation. Added to these approaches are "trace" (Salganik, 2019: 75) methods, which focus on studying digital traces left by users during their online interactions. Users' actions, such as a like, a comment, or a search on the platform, generate a digital trace that can be analyzed to understand behaviors and social dynamics. Salganik (2019: 47) explores how these traces can be used, for example, for the practice of 'search query': when people use search engines, they leave valuable traces in the form of search queries by analyzing the most frequent search terms, researchers can obtain indications about collective concerns, interests, and behaviors in real-time, offering a vast database from which to draw information. However, a central problem in this approach is related to interpretation: user searches do not always represent concrete behaviors or stable opinions. However, they can be performed in an exploratory or random manner. Similarly, one of the main opportunities the Semantic Web offers is the ability to integrate data from different sources and create interconnections between them, improving the analysis of digital social dynamics (Halford et al., 2013). Using ontologies and metadata, the Semantic Web allows us to give context to data and enrich them with additional information: it could help, for example, to better understand network dynamics or emerging social phenomena since data are organized in ways that allow the discovery of hidden patterns. However, implementing the Semantic Web also brings challenges, such as collaborating with computer science experts to manage technological complexity and correctly interpret the results of advanced analyses.

Digital experiments (Salganik, 2019: 151) are also interesting. They allow manipulating variables in a controlled online environment and observing users' reactions and behaviors in real time. A classic example is the Emotional Contagion Experiment conducted by Facebook in 2012 to study the influence of emotions in the news shown to users (Kramer et al., 2014). This experiment, which involved millions of users, manipulated the news feed to show more positive or negative content to observe how it affected the users' mood.

Finally, crowdsourcing could be a valid strategy for collecting data in a participatory and decentralized way. It foresees that many people voluntarily contribute their data, such as information about their online activities, consumption habits, or opinions. Platforms that integrate these approaches can invite users to participate by providing data voluntarily, thus making it possible to collect valuable information more democratically and openly.

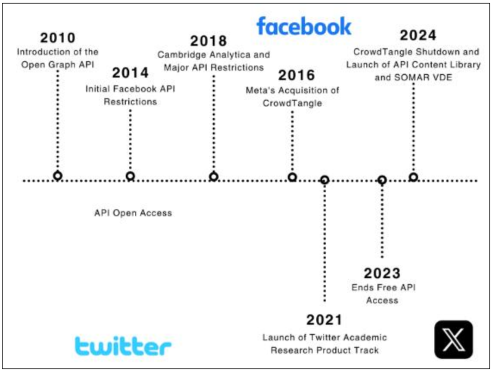
The current context of digital research, therefore, requires a rethinking of methods (Caliandro, 2021). The future of research will necessarily have to integrate innovative approaches that guarantee ethical and transparent access to data while promoting the ability to adapt to the continuous changes in digital platforms and the global technological landscape.

According to Rogers (2018), although a series of proposals have been put forward to change the landscape of AI-based digital research, to date, academic production based on the use of data from proprietary platforms is larger than that which uses alternatives.

3. The Waves of Main Social Media Platforms' API Restrictions

In recent years, major social media platforms have imposed increasingly strict API restrictions, citing privacy protection and data misuse concerns. This section examines how these restrictions evolved on Meta (Facebook and Instagram) and Twitter (now X), highlighting their impact on digital social research. Figure 1 summarizes the main moments of the restriction's evolution.

Figure 1. Timeline of API restrictions



3.1 The Meta Case

The introduction of Facebook's Open Graph API in 2010 marked a significant turning point in accessing social media data. This API allowed developers and third-party companies to access a wide range of Facebook user data to improve integration and interoperability between Facebook and other web services; thus , it transformed social media into a global social network and allowed developers to connect their applications directly with the platform. Through the API, developers could access different types of user data, including profile information (name, age, gender, location, friends list, etc.); interests and activities (pages "liked", events attended by the user, groups to which the user belongs); interactions (published posts, comments, reactions, shares, and messages; connection data (social graphs showing connections between users, such as mutual friends and shared interactions). This global network has offered social researchers a powerful tool to study various digital phenomena. Facebook began restricting API access in 2014, with severe limitations following the Cambridge Analytica scandal in 2018. This turning point significantly reduced the availability of social media data for research, raising concerns about the ability to monitor online dynamics independently.

Some scholars criticized the platforms for using user privacy as a justification for restricting access to data, arguing that these decisions may also be motivated by a desire to reduce external control and accountability over their operational practices (Freelon, 2018).

In response to these criticisms and the growing debate over platform transparency, Facebook has undertaken several initiatives to facilitate access to data for academic research purposes. It is trying to balance the research needs and user privacy protection. Among these initiatives are the partnership with Social Science One and the integration of CrowdTangle[1].

Social Science One is an initiative launched in 2018 by Facebook in collaboration with high-profile researchers and academics from Harvard University and Stanford University. The project aimed to create a model for collaboration between academia and platform companies that would allow transparent and controlled access to social media data for research. SSO proposed providing researchers

[1] The information on the two initiatives and the data collection process comes from the official websites (now closed) and from the actual use of the services in data collection for many studies conducted by the author.

with secure and controlled access to large, pre-packaged datasets, such as user interactions with political content and campaign ads during elections. This access was subject to strict protocols to prevent abuse and ensure the data was used ethically. An independent review board was responsible for evaluating research proposals, ensuring that studies were conducted according to rigorous ethical standards and that the results were published independently of Facebook's wishes. However, the project encountered numerous difficulties in meeting its promised goals: many researchers complained about delays in accessing the data and limitations in the quantity and quality of information available. Some datasets have never been made available or only partially available (King, Persily, 2019). This has produced a certain mistrust on the part of the academic community regarding the control exercised by the platform on the project, particularly about the selection of the available data and, therefore, the influence on the research results (Bruns, 2019). Furthermore, using pre-packaged datasets, even very large ones, to investigate different digital phenomena raises many doubts linked to data accuracy and reliability problems[2].

Data collection from platforms is one of the most controversial points to address in digital research because this data is not always stable over time. Some elements vanish, and others appear. This refers to the concept of 'interactive complexity' (Rogers, 2018: 560) since some objects collected at a precise moment (for example, likes) can be influenced by new elements that are introduced later (for example, reactions). Therefore, if we wanted to examine likes over time to determine feelings or preferences, the drops or increases in this metric could depend on changes made to the platform's algorithm and the actual change in users' opinions. Furthermore, data can vary due to settings desired by legal and political contingencies or restrictions imposed by national regulations: national authorities could ask platforms to eliminate or limit the circulation of particular content, for example, political content with extremist positions. Therefore, to comply with government requests, the platform does not make particular content available in the country that made the request, but this does not mean that they cannot be seen elsewhere. These examples make one clear: Social Science One's proposal to provide researchers with prepackaged datasets to study digital phenomena

[2] There is no talk of representativeness as it is taken for granted that social media platforms "don't represent all people" (Boyd, Crawford, 2012), but rather a highly specific subset.

raises numerous problems. The critical issues concern not only the quality and stability of the data but also the methodological implications that influence the research that can be conducted on such datasets. As seen, the data collected can be influenced by external factors such as algorithmic changes or government restrictions, which complicates a reliable and coherent reading of the digital phenomena under examination.

The second initiative was CrowdTangle (CT). This tool was born as an independent startup and later acquired by Meta in 2016. CT was designed to monitor and analyze content that spreads on social media, focusing on platforms such as Facebook, Instagram, Reddit, and, to a certain extent, Twitter. CT was created to help publishers, journalists, and researchers investigate how content spreads on the platforms mentioned and the engagement it gets, providing detailed data and metrics on user interaction. Unlike SSO, CT did not provide access to pre-packaged datasets but provided direct access to public and aggregated data, useful for monitoring trends and analyzing large-scale phenomena, but with limitations regarding the depth of the possible analyses. The data researchers could obtain through CT was limited to public content, such as posts published by pages, public groups, and verified profiles, but the text data of comments to these posts was excluded. Regarding comments, the only information available was the number of comments that a given post had obtained. With CT, Facebook's goal was to respond to the growing demand for data access by researchers since CT provided aggregated and public data that allowed (in addition to monitoring engagement) also historical tracking and, therefore, visualizing how certain posts or themes performed over time, facilitating longitudinal data analysis. The tool's novelty was the ability to perform searches by keywords, hashtags, specific pages, and other variables, allowing customized queries for detailed studies. CT has been particularly valuable for all those studies that are based on monitoring and analyzing the spread of disinformation content and tracking its impact on the public (Giglietto, 2020), but also to monitor the spread of hate speech by identifying the communities most active in promoting extremist content (Miranda et. al, 2022); to trace the evolution of social movements, such as Black Lives Matter (Kim, Lee, 2021) or climate change (Alperstein, 2021); to studies on online political polarization by identifying interaction patterns that contributed to the creation of information bubbles (Soares & Recuero, 2021).

The shutdown of CrowdTangle in August 2024 further strained the relationship between social media platforms and the academic community. A report by the Coalition for Independent Technology Research[3] (2024) found that 88% of surveyed researchers feared that such closures would significantly hinder their work, forcing many to revise or abandon their projects.

Meta has recently launched a new initiative called API Content Library[4], in collaboration with the Inter-University Consortium for Political and Social Research (ICPSR) in collaboration with the Inter-University Consortium for Political and Social Research (ICPSR) which is responsible for ensuring, through an independent review process, that data access is granted to projects that have passed an ethical review process and to accredited researchers who are part of recognized academic institutions. This provides two data access possibilities: the API Content Library and the Social Media Archive Repository (SOMAR) Virtual Data Enclave[5] (VDE).

These solutions address different needs of academic research. The API Content Library has a user-friendly interface. It offers more flexible access to public data. It is useful for macro studies of social dynamics and public discourses but significantly restricts the number of cases that can be extracted. However, access to the Content Library is limited, especially for journalists, and only a tiny percentage of the tens of thousands of CT users have been granted access (Coalition for Independent Technology Research Report, 2024). SOMAR's VDE, on the other hand, allows for more complex and detailed research that also involves the use of non-public data. With access to historical data, the VDE enables longitudinal studies that track changes in user behavior over time, analyzing the evolution of interactions and preferences individually. SOMAR's Virtual Data Enclave (VDE) introduces a novelty in using platform data for research purposes: access is regulated and controlled. Accessing the data exclusively within the virtual enclave, a protected and isolated environment where researchers must conduct their analyses is possible. Every interaction within the VDE is monitored to ensure compliance with security guidelines. Data cannot be downloaded or exported from the VDE, and the review committee must approve any results to be disclosed before being included in a research report; they cannot be shared with

[3]Available at the link: https://independenttechresearch.org/survey-metas-shutdown-of-crowdtangle-bad-for-the-public-interest/

[4]Available at the link: https://transparency.meta.com/it-it/researchtools/meta-content-library/

[5]Available at the link: https://socialmediaarchive.org/pages/?page=FAQs

anyone until approved. Restrictions on data analysis also concern the use of advanced analysis techniques[6] that could, for example, generate results at the individual level, compromising the privacy of users and increasing the risk of personal identification.

The regulated and monitored nature of data access through the VDE entails numerous constraints that can reduce the autonomy of researchers: the fact that each interaction is monitored and the results must pass a review process before being disclosed limits the analytical freedom of researchers and increases the risk of implicit censorship. One of the most worrying aspects concerns the impact on the replicability of studies. This is a crucial principle in scientific research, allowing other scholars to verify, reproduce, and deepen the results obtained. The restrictions imposed by the protected environment of the VDE – such as the prohibition on data export and the limited use of advanced analysis techniques – hinder the access by independent researchers to the data necessary to replicate a study, exacerbating an already existing problem in the field of research on digital environments.

3.2 The Twitter Case

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Twitter has historically been a valuable source of data for researchers interested in studying online social dynamics, political interactions, and information diffusion (Zimmer, Proferes, 2014). Due to its public nature and ease of access to data via the API, Twitter has been used to monitor events in real-time, analyze user behavior, and study phenomena such as content virality and the propagation of fake news (González-Bailón, Wang, 2016). In 2018, Twitter began to limit the number of API requests that could be made to prevent platform abuse, such as the phenomenon of BOTs and the manipulation of public conversations (Zubiaga, Ji, 2014). Although justified by

[6] It is prohibited: a) any attempt to combine VDE data with other external datasets to identify specific individuals; b) the use of spatial analysis techniques that operate on geolocation data at a very detailed level (e.g. GPS coordinates); c) analyses that use temporal data with a high level of resolution (e.g. exact timestamps of each interaction); d) the use of unsupervised or supervised machine learning algorithms on sensitive data (e.g. predictive analytics to determine personal or behavioral attributes); e) user profiling models based on behavior, interaction and preference data; f) social network analyses with connections at the individual level.

security needs, these restrictions represented the first sign of the platform's distancing from the academic community. A direct response to researchers' criticism of the restrictions was the 'Twitter Academic Research Product Track' project, launched in January 2021 as part of a new initiative to make data easier for academic research. Compared to standard API accounts, the Academic Research Product Track program allowed accredited researchers to send significantly more API requests—up to 10 million monthly tweets, versus the 500,000 limits for standard users. This allowed them to collect and analyze large amounts of data about specific events, social and political trends, or other phenomena of interest. Access was still limited to public tweets, meaning researchers could not analyze direct messages, protected tweets, or other forms of non-public interaction. However, it did have a temporal advantage: researchers could access the entire archive of public Tweets going back to the platform's inception in 2006. This was particularly valuable for longitudinal and historical studies requiring long-term data analysis. To access the program, researchers had to submit a detailed application that included a description of their research project, institutional affiliation, and the purpose of the study. Twitter evaluated these applications to ensure that the projects met ethical standards and that the data would not be used for commercial or non-scientific purposes. The project was open only to researchers affiliated with academic institutions, excluding independent researchers and investigative journalists, who often conduct critical studies on social media. Despite this, the 'Twitter Academic Research Product Track' project represented an important step towards greater transparency and support for academic research; however, with Twitter's change of ownership and corporate policies that began in 2023, the project's future soon became uncertain. In fact, in 2023, Twitter announced the end of free API access, introducing data collection fees.

By introducing high API costs[7] , Twitter has significantly restricted independent research, disproportionately affecting scholars with limited financial resources. This decision has made data access increasingly exclusive, forcing many research projects to be scaled down or abandoned (Freelon, 2018; Tufekci, 2014).

While both companies (Meta and X) still have to find a balance

[7] The basic package costs $100 per month and gives you access to 10,000 posts, while the Pro package costs $5,000 per month and gives you access to up to a million posts. Available at the link: https://developer.x.com/en/docs/x-api/getting-started/about-x-api#item1

between privacy protection and support for academic research, the relationship between the scientific community and the platforms reflects distinct priorities and business models: while Facebook has tried to create institutional partnerships and structures for data access, albeit with many limitations and criticisms about the slowness and selectivity of the data provided; Twitter - which initially offered more open access - has since introduced significant restrictions and high costs, drastically limiting independent research. In the end, while representing a step forward in data access for digital social research, the platforms' proposals could ultimately accentuate the gap between privileged researchers (who manage to gain access to data and overcome review processes) and those excluded from these opportunities. Furthermore, they could push researchers to increasingly focus on studies that respect constraints imposed by the platforms, thus limiting the independence of research and orienting the topics of study towards what is permitted or easy to analyze within the technical and regulatory restrictions imposed by the platforms.

Though platform-imposed restrictions have limited data access for research, European regulations like the Digital Services Act and GDPR have introduced tools to balance transparency and privacy, setting clear guidelines for researchers accessing user-generated data.

3.3 The European Regulation on Access to Social Media Data: Digital Services Act and GDPR

In recent years, European regulation has taken on an increasingly central role in regulating access to data from digital platforms, including academic research. In particular, the General Data Protection Regulation (GDPR), but most importantly, the most recent Digital Services Act (DSA), introduces rules for researchers who want to access user-generated data on social media. These regulatory tools aim to ensure transparency, security, and respect for privacy while imposing rules on how the data can be used for investigative purposes.

Although there are no specific articles for social media data in the GDPR (which came into force on 25 May 2018), several provisions impact the use of this data for research. Article 6 requires that the processing of personal data must take place with the explicit consent of users, which complicates data collection without direct authorization. Article 9 establishes that sensitive data, such as political opinions, are subject to restrictions. Restrictions on consent and processing of sensitive data are particularly relevant for using social media data, as many pieces of information, such as political interactions or personal preferences, may fall into protected categories, forcing researchers to be extremely cautious. In the end, Article 17 on the right to erasure allows users to request the removal of their data, influencing the availability of datasets over time. At the same time, Article 15 (right of access) grants individuals the right to access their personal data. In line with the principle of transparency, this provision allows users to obtain a copy of the data held by platforms, allowing them to understand how such data is used. Article 20 (right to data portability) grants individuals the right to receive data in a structured, commonly used, machine-readable format. At the same time, these rights provide an opportunity for researchers to analyze anonymized data while respecting users' privacy. Indeed, thanks to the mechanism of *data donation*—a practice in which individuals voluntarily share their personal data with researchers for scientific purposes—researchers could collect anonymized datasets for research purposes, thus contributing to the advancement of knowledge without compromising the privacy and protection of the individuals involved.

The Digital Services Act (DSA) - approved in 2022 - is one of the most important documents in terms of regulating researchers' access to social media data. The document was created to regulate the activities of online platforms and search engines, promoting a safe and transparent digital environment. It mainly applies to providers of very large online platforms and search engines (VLOP and VLOSE) to create a uniform and clear regulatory framework to improve accountability, transparency, and security in the online environment while protecting users' fundamental rights. In this document, the figure of the researcher, on the one hand, is recognized as a key subject for analyzing online phenomena and promoting greater transparency in the digital ecosystem; on the other hand, his activity is strictly regulated. The regulation introduces an obligation for large online platforms to provide "qualified researchers" with access to relevant information necessary to study online phenomena such as disinformation, systemic risks, and the impact of algorithms. This provision, provided for in Article 40, facilitates independent analysis of platforms, helping to reduce information asymmetries between large digital companies and the public and between platforms and regulators. The DSA allows researchers to monitor the influence of algorithmic systems, offering the possibility of better understanding how content moderation and recommendation mechanisms work and how these can affect systemic risks online. Furthermore, the DSA allows researchers to access publicly available data on platforms without obstacles. It allows them to monitor user interactions with public content, such as pages and groups, improving the understanding of collective behavior online.

Platforms themselves are encouraged to actively collaborate with researchers through voluntary commitments and codes of conduct to provide broader access to data. This approach increases the transparency of platforms and allows for a more comprehensive analysis of the risks to society arising from online activity in a framework that promotes responsibility and security in the digital world. In parallel, the DSA ensures strict privacy protection, thanks to the integration with the GDPR, establishing that any access to data, including for research purposes, must comply with personal data protection regulations. The data that researchers can access must be anonymized or pseudonymized unless this compromises the purpose of the research, thus ensuring that users' privacy is always protected. The regulation prohibits researchers from accessing information that allows the direct identification of users, protecting the most sensitive personal data. Furthermore, platforms can limit access to data if sharing compromises trade secrets or the security of the service, introducing protection for the legitimate interests of digital companies. The DSA also requires researchers to take rigorous measures to ensure the security and confidentiality of the data they access, requiring them to adopt technologies and procedures that comply with data protection regulations. This includes implementing technical systems such as data vaults, which allow for the secure sharing of information without compromising the confidentiality of personal data or commercial information. In the end, researchers must obtain approval from the competent authorities to access data, which introduces additional control to ensure that only legitimate and proportionate research requests are granted access to sensitive data. In this way, the DSA seeks to balance the promotion of transparency of online platforms with the protection of users' privacy. A key aspect of this balance is the proportionality of data access requests: they must be proportionate to the research purposes and not exceed what is necessary to achieve those objectives. This principle, set out in Recital 97 and Article 40, ensures that access to data is controlled and targeted, reducing risks to users' privacy. However, the DSA also imposes strict control on researchers, who must comply with high confidentiality and security standards, limiting the use of data to specific research purposes.

Following the definitive closure of CrowdTangle in August 2024, the European Commission asked US tech giant Meta[8] to provide more details on the measures the company intends to take to continue to comply with its obligations under the DSA and allow researchers to access the data. It also requested more information on the new content library and application programming interface, including its eligibility criteria, application process, data that can be accessed, and functionalities. Already in April 2024[9], the Commission had opened proceedings against Meta regarding the company's failure to provide effective tools for real-time third-party monitoring of elections and public debate. This requirement is particularly relevant given the European elections.

The European Commission has also opened a formal investigation into X[10] (formerly Twitter) for possible breaches of the DSA, in particular in areas such as risk management, moderation content, misleading interface design (in particular "blue checks"), and advertising transparency. Particular attention is paid to the effectiveness of X's measures to counter the spread of illegal content and information manipulation, as in the case of recent controversies related to disinformation spread on the platform about global conflicts. As part of this investigation, the Commission also examined the platform's data access policies, which fail to comply with the DSA's requirements regarding transparency and researchers' access to data.

4. CONCLUSIONS

Access to social media data will continue to be a central theme for digital social research. As highlighted in the previous paragraphs, the so-called 'post-APIcalypse' era (Bruns, 2019: 2) requires rethinking research methods and adopting new approaches to overcome the limitations imposed by platforms while maintaining compliance with

[8]Available at the link:https://digital-strategy.ec.europa.eu/en/news/commission-sends-request-information-meta-under-digital-services-act-2
[9] Available at the link:https://ec.europa.eu/commission/presscorner/detail/en/ip_24_2373
[10] Available at the link:https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6709

current regulations and privacy protection. The increasing difficulty in accessing data limits researchers' ability to study digital dynamics independently, highlighting the urgency of finding alternative solutions.

The introduction of the Digital Services Act (DSA) and the GDPR represents a step towards a more transparent regulatory framework; however, these regulations fail to fully address the challenges that digital social research faces. While European regulations aim to balance transparency and data protection, platforms continue to impose severe restrictions, controls, and high costs, creating a significant gap between regulatory intent and real-world implementation.

This gap hinders independent research, limiting opportunities for replicable and in-depth analysis of digital phenomena. It is, therefore, essential to think about new strategies that ensure fair and responsible access to platform data, overcoming the barriers created by recent restrictions. Although the DSA and the GDPR recognize the importance of social research in understanding digital phenomena and improving public policies, these regulations still fail to ensure adequate recognition of the researcher's figure by large platforms. Strengthening the implementation of these regulations is necessary to support academic research more effectively.
To address this challenge, legislators must collaborate with platforms; this cooperation could include agreements that facilitate structured and transparent access to data reserved for recognized research institutions in compliance with European regulations. Although Social Science One and CrowdTangle's experiences have shown limitations, they demonstrate that a dialogue is possible if platforms actively collaborate and that public policies create an adequate structure to support such collaboration.

It is therefore urgent to explore, on the one hand, new forms of partnership between academia and the technology industry, promoting models of mutual trust and transparency, as suggested by Venturini and Rogers (2019); on the other hand, research areas should focus on the ethical implications of broader access to data, underlining (if there was still a need) the public value of the knowledge generated by this type of research. It is also crucial to investigate new methodological approaches that ensure data anonymization and address the risks associated with unethical use, as well as to outline strategies that respect users' rights and ethical responsibility in digital research. For example, the GDPR's potential to enable data donation practices represents an opportunity to bridge the gap between privacy protection and research needs. By empowering users to share their data voluntarily under ethical and legal frameworks, the GDPR facilitates independent, privacy-preserving research.

Data donation has already been successfully implemented in other sectors, such as health research, where individuals voluntarily provide medical data for studies on diseases and treatments. A similar model could be adapted to social media research, allowing users to donate their interaction data (e.g., posts, comments, engagement history) in a controlled and anonymized manner. Platforms could integrate user-friendly consent mechanisms, enabling individuals to contribute to research projects while maintaining privacy safeguards. Implementing these solutions would require collaboration between researchers, regulators, and technology companies to ensure ethical compliance while maximizing the availability of valuable data for social research. In conclusion, although researchers are called upon to answer many of the questions that arise in studying digital phenomena, the current scenario often makes this task impossible. Academia still does not have adequate access to the data needed to provide complete answers, leaving many questions only partially investigated. Phenomena such as misinformation, hate speech, and political polarization, which develop on social platforms, should be a wake-up call for legislators to pressure technology companies to open their data and make it freely and transparently available for research.

In addition, it is increasingly urgent to understand the algorithmic functioning of these environments, a need that clashes with a further element: that of corporate secrecy. What we know today about the algorithmic functioning of social media and its distorting consequences we owe to those rare cases of whistleblowers (Acampa, 2022). This need becomes increasingly difficult to achieve at this rate, despite the impositions of the Digital Services Act and the recognition of the researcher's role in this algorithmic transparency process. The lack of adequate data to evaluate risks and benefits often leads to incomplete results, which raises more questions than answers.

If access to data remains under the total control of Big Tech, the future of independent digital research—and, consequently, the public's ability to understand and regulate social platforms—will be at serious risk.

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STUDYING ALGORITHMS IN SOCIAL SCIENCES: A SYSTEMATIC REVIEW

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Abstract

In recent years, the discourse surrounding algorithms and artificial intelligence has been extensively addressed in the social sciences. The dimensions of algorithms discussed by social scientists are numerous, both in terms of themes and in the techniques and approaches used to study them, with the ANT perspective proving particularly valuable as a framework for interpreting the human-machine relationship. This work aims to provide a systematic review of these elements through a bibliometric examination and an in-depth analysis of articles published in 2024. Our objective is to address the gap in the existing literature and offer a comprehensive resource that will contribute to advancing future research in this interdisciplinary field.

Keywords

AI, algorithm, bibliometric analysis, digital methods

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1. INTRODUCTION

The most significant transformations affecting contemporary society in recent years have been driven by algorithms and artificial intelligence (AI). It is difficult to imagine a field of human activity untouched by the technological revolution driven by AI implementation. Technological mediation extends to the productive sector, politics, education, and social relations. Algorithms and AI are now pervasive: they influence how we access information, make decisions, and communicate. AI has been applied in a wide range of fields, from education to healthcare and beyond. Its impact is transforming industries and enhancing human capabilities worldwide. However, while AI offers enormous opportunities, significant challenges also emerge. Its impact on society is not always positive or neutral. Far from being "invisible" and purely instrumental technologies, algorithms and AI profoundly influence individuals and society, whether positive or negative, depending on how they are designed and used. The growing influence of AI is also evident in regulatory efforts. The introduction of the General Data Protection Regulation[1] (GDPR) in Europe was one of the first attempts to regulate the use of algorithms to ensure transparency and the protection of personal data. More recently, the European Union has proposed the AI Regulation to ensure the development of safe systems, particularly in high-risk sectors such as healthcare and transportation. These regulatory efforts respond to concerns about the responsible use of AI, balancing technological innovation with individual rights.

In the academic sphere, the risks and implications arising from artificial intelligence (AI) and algorithms have also begun to receive growing attention. Alongside studies aimed at technological development, innovative and critical approaches are emerging, analysing the interaction between AI, society, and individuals. Among these, a particularly significant contribution comes from the socio-technical approach inspired by Bruno Latour's work, which examines the networks of relationships between human and non-human actors.

Despite the increasing recognition of this perspective, there remains a lack of systematic analysis assessing whether and how the Actor-Network Theory (ANT) perspective has influenced these discussions. Moreover, although ANT serves as a direct or indirect reference in this body of research, its methodological impact remains largely unexplored.

This paper aims to fill this gap by analyzing the key themes in the academic literature on the social implications of AI and algorithms,

[1] Available at https://european-union.europa.eu/index_en

investigating whether and how the Latourian approach emerges in theoretical and empirical applications. Given the increasing academic focus on the risks and opportunities of AI, as well as the need for a critical framework that moves beyond purely techno-centric perspectives, this study has a twofold objective: first, to identify the key themes explored in social science research and assess the extent to which the socio-technical approach inspired by Latour's work is present; and second, to explore and analyze the empirical methods employed in studies that, in various ways, draw upon the socio-technical framework of ANT. Addressing these two questions will help elucidate how the Latourian perspective enriches theoretical debates and translates into concrete methodological tools for investigating the relationships between AI, algorithms, and individuals.

2. THE CONTRIBUTION OF ANT IN THE STUDY OF AI

The Ant perspective has significantly contributed, radically challenging the previous image of algorithms and AI as efficient and neutral tools. The Actor-Network Theory (ANT) (Latour & Woolgar, 1979; Callon, 1984; Law, 1992) views social, material, technological, and scientific domains as profoundly intertwined. ANT emphasizes the role of non-human actors—referred to as "actants"—within social processes. In this framework, actors are not defined by intentionality but by their ability to bring about change and alter the status quo (Latour, 2007). From an ANT perspective, AI and algorithms are seen as products or effects of a heterogeneous network of constantly evolving relationships between human and non-human actants (Latour, 2007; Halford et al., 2010). In this sense, AI and algorithms can be considered non-human actants endowed with authority, functioning in an often opaque manner that may embed particularistic perspectives or erroneous learnings. Within this framework, two key lines of inquiry into the relationship between AI, humans, and society can be identified: the first examines the role and agency of non-human actors, while the second focuses on the experiences and perspectives of human actors.

In the first research stream, we find studies on algorithmic biases, aiming to demonstrate how algorithms can systematically discriminate specific vulnerable categories, such as women, people of colour, or individuals with disabilities. Algorithmic bias happens due to poorly designed codes or training data incorporating biases. A well-known example is Amazon's hiring algorithm, which excluded women due to being trained on data reflecting gender-biased hiring practices. Algorithmic biases can also result from programming or design errors; this was the case with the Italian Ministry of Education's algorithm for assigning teaching posts, which sparked widespread protests due to its poor functioning. These biases, along with the opaque functioning of AI, are of concern because they can sometimes impact people's lives, alter the perception of specific categories, or affect how individuals engage with sociality and even understand the world. This phenomenon is often referred to as "algorithmic authority." Facebook's algorithm can be mentioned to illustrate how collective phenomena can be triggered by simple algorithmic logic. YouTube's censorship algorithm, instead, has been shown to influence content creators' perceptions of precariousness due to its opaque functioning. On individuals, these biases can produce harms of allocation or harms of representation (Crawford, 2017). The former has economic repercussions, while the latter acts at a cultural level. Allocation harms occur when a system unfairly distributes opportunities or resources. In contrast, harms of representation happen when systems reinforce stereotypes or diminish specific groups. YouTube's censorship algorithm, for instance, has been shown to influence content creators' perceptions of precariousness due to its opaque functioning.

The second line of inquiry focuses on human actors and has emerged in response to the technological determinism implied in some AI studies, which viewed human subjects as passive in their interactions with AI. The rediscovery of human agency occurred stepwise, with the foundation being studied on algorithmic awareness. Algorithmic awareness refers to users' understanding and recognition of how algorithms operate and impact various aspects of daily life. This awareness is unevenly distributed among the population and has led to a new form of digital divide. Awareness is a prerequisite for the development of "folk theories" (DeVito, 2017). The concept of "folk theories" refers to the informal, often simplistic explanations people develop to make sense of complex systems, such as algorithms. Platform users engage daily with AI algorithms, and in some cases—mainly when the platform's functioning affects whether or not they achieve their goals—they develop theories to make sense of what happens and to understand their actions or strategies. These folk theories are used for various reasons, including attempting to tame or subvert algorithms and AI by repurposing them for unintended uses. These practices are called "algorithmic resistance" and represent an advanced form of algorithmic awareness. Such practices have been documented in contexts like delivery platforms (Tuomi et al., 2023) or Instagram influencers (Bonini, 2022), where subjects are more aware of what is happening and, thus, more inclined to develop such strategies.

Three points need to be made regarding the critical scholarship on these issues. First, while this reflection highlights key contributions, the study of AI through the lens of Actor-Network Theory (ANT) is not confined to the themes addressed here. Other research explores additional aspects, such as human and non-human actors' power of translation within the network. Second, the two strands mentioned focus on a central element in the broader debate on AI, particularly in understanding how awareness can serve as an antidote for citizens to mitigate the adverse effects of AI. Furthermore, within these two strands, we find studies employing diverse and sometimes innovative methodologies, reflecting this field's richness and methodological pluralism. The last point to consider is that while ANT generally follows a network-based approach, this does not imply that all studies inspired by this paradigm necessarily adhere to this strategy. Some research diverges from classical network analysis, adopting alternative methodological frameworks and, in some cases, innovating the instrumentation used to study socio-technical dynamics. This variation highlights the adaptability of the socio-technical perspective and its potential to generate novel research designs that go beyond conventional network analysis.

3. RESEARCH DESIGN AND ANALYSIS STRATEGY

Based on the premises presented in the previous paragraphs, our research questions can be summarized as follows:

> 1. Which macro-themes are the social sciences focusing on in the study of algorithms? To what extent are these themes inspired by the Latourian perspective?
>
> 2. Which empirical approaches are emerging in the study of algorithms? Are there innovative approaches?

To address the research questions, the work was divided into two parts. In the first part of the study, a bibliometric analysis was conducted. In the second part of the work, through an in-depth analysis of articles published in 2024, we examined the techniques used for studying AI.
Bibliometric analysis can be defined as:

> A popular and rigorous method for exploring and analyzing large volumes of scientific data […]. Its popularity can be attributed to (1) the advancement, availability, and accessibility of bibliometric software and databases such as Scopus and Web of Science (2) and the cross disciplinary pollination of the bibliometric methodology (Mukherjee et al., 2021: 1).

Bibliometrics offers comprehensive analyses of scientific literature on a given topic by employing various tools to synthesize the state of the art in a specific field of study and highlight emerging research trends (Page et al., 2021). It is important to present a comprehensive bibliometric analysis on the two research themes of this work, as over the years, systematic reviews on algorithms and AI have predominantly been conducted within STEM disciplines. Few reviews in the social sciences have focused on specific aspects, such as algorithm audits (Bandy, 2021) and decision-making algorithms (Mahmud, 2022). To provide a broader perspective, this study aims to offer a systematic review through a thorough bibliometric examination.

The dataset was constructed on 01/10/2024 using data export tools from Scopus and WoS. In relation to both AI and algorithms, the bibliometric research conducted so far has not only been concentrated in STEM fields but has also been limited to a single database (idem). For this reason, both themes were analyzed simultaneously. It is frequently recommended to use both Scopus and Web of Science simultaneously in bibliometric analyses, as their strengths complement each other (Caputo and Kargina, 2022) (Sánchez et al., 2017). Google Scholar was not included in the analysis because, despite offering broader coverage across all disciplines, a significant portion of its sources and materials come from unknown or less verifiable origins (Leydesdorff et al., 2016). Additionally, its records are not easily compatible with those from more structured databases like Scopus and Web of Science. The keywords for collection are in the table below (Tab. 1).

Table 1. Extraction query

Concept	**Data-base**	**Query**
AI	Scopus	TITLE-ABS-KEY ((“artificial intelligence”) OR (“ai”))
	WoS	TOPIC ((“artificial intelligence”) OR (“ai”))
Algorithm	Scopus	TITLE-ABS-KEY ((“algorithm*”))
	WoS	TOPIC ((“algorithm*”))

Regarding the type of document, only articles were included in the analysis. Contributions were restricted to those published in English. Given the objective of research, only articles categorized within the social sciences were selected. Additionally, to ensure that the contributions considered were firmly situated within the domain of social sciences, a secondary filter was employed, including only articles published in peer-reviewed social science journals[2]. The specified time frame ranged from 2013 to 2024. The bibliometric analysis was conducted on articles from 2013 to 2023. The in-depth analysis of empirical methods focused on the years 2023 and 2024. Specifically, for 2024, all available articles were analyzed, while for 2023, the 100 most-cited articles (in descending order) were examined. For both years, those whose content proposed empirical methods inspired, even indirectly, by the socio-technical approach were selected. In Tab 2 a table of inclusion criteria.

Table 2. Inclusion criteria

Type of document	Articles
Language	English
Time Frame	2013 to 2024 (bibliometric); 2023-2024 (in-depth analysis)
Discipli-nes	Social Sciences; Communication; Sociology; Social Issues; Cultural Studies; Social Work; Women Studies; Family Studies; Anthropology

[2] The journal “Sustainability (Switzerland)” was excluded, despite its focus on social issues, because preliminary analyses showed that only a small portion of its articles were centered on social science topics

Journals	Algorithmic Cultures Essays On Meaning Performance And New Technologies; Algorithmic Society; American Journal Of Sociology; Annals Of The American Academy Of Political And Social Science; Annals Of Tourism Research; Big Data And Smart Digital Environment; Big Data And Society; Big Data Society; Canadian Journal Of Communication; Children And Youth Services Review; Cogent Social Sciences; Communication Culture Critique; Communication Methods And Measures; Communication Research; Communication Research And Practice; Communication Today; Communications European Journal Of Communication Research; Continuum Journal Of Media Cultural Studies; Convergence; Convergence The International Journal Of Research Into New Media Technologies; Critical Inquiry; Critical Sociology; Critical Studies In Media Communication; Cultural Studies; Current Issues In Tourism; Digital Journalism; Economy And Society; Educational Communications And Technology Issues And Innovations; Environment Development And Sustainability; Ethics And Information Technology; European Journal Of Communication; European Journal Of Cultural Studies; Feminist Media Studies; Frontiers In Communication; Frontiers In Sociology; Futures; Global Media Journal Canadian Edition; Hermes Journal Of Communication; Human Behavior And Emerging Technologies; Humanities And Social Sciences Communications; Humanities Social Sciences Communications; Information Communication And Society; Information Communication Society; Information Society; Information Technology Tourism; Interaction Studies; Interdisciplinary Science Reviews; International Journal Of Communication; International Journal Of Cultural Studies; International Journal Of Hospitality Management; International Journal Of Human Computer Interaction; International Journal Of Population Data Science Ijpds; International Journal Of Qualitative Methods; International Journal Of Tourism Research; International Review Of Information Ethics; Internet Policy Review; Jasss The Journal Of Artificial Societies And Social Simulation; Javnost The Public; Journal Of Advertising; Journal Of Communication; Journal Of Hospitality And Tourism Insights; Journal Of Hospitality And Tourism Technology; Journal Of Information Communication Ethics In Society; Journal Of Information Technology Politics; Journal Of Informetrics; Journal Of Mathematical Sociology; Journal Of Safety Research; Journal Of Social Computing; Journal Of Travel Research; Journalism; Journalism And Media; Journalism Mass Communication Quarterly; Journalism Practice; Journalism Studies; Learning Media And Technology; Media And Communication; Media Culture And Society; Media Culture Society; Media International

	Australia; Network Science; New Media And Society; New Media Society; Online Social Networks And Media; Pnas Nexus; Poetics; Policy And Internet; Political Communication; Popular Communication; Profesional De La Informacion; Quality And Quantity; Quality Quantity; Routledge Advances In Sociology; Sage Open; Science Technology Human Values; Scientometrics; Social Indicators Research; Social Media And Society; Social Media Society; Social Network Analysis And Mining; Social Networks; Social Research; Social Science Computer Review; Social Science Quarterly; Social Sciences; Social Sciences Basel; Societies; Socio Economic Review; Socio Economic Systems Vol 2; Sociological Methodology; Sociological Methods Research; Sociology Compass; Sociology Of Health Illness; Studies In Big Data; Surveillance Society; Sustainability Switzerland; Technology In Society; Television New Media; Theoretical And Practical Issues Of Journalism; Theory And Society; Theory Culture Society; Tourism Analysis; Tourism Economics; Tourism Management; Tourism Management Perspectives; Triplec Communication Capitalism Critique; Work Employment And Society; Zygon.

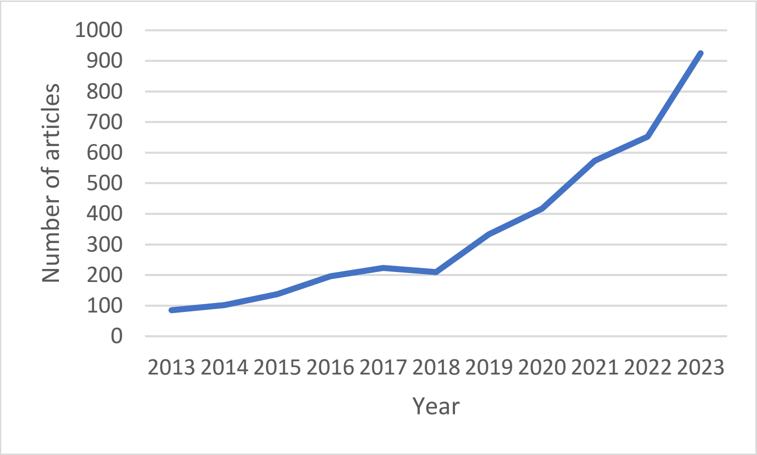
A total of 4762 articles were collected. This number was reduced after cleaning operations, which involved eliminating duplicates and removing records with missing information. The final number of articles in the dataset was 3982.

The bibliometric analysis was conducted using Bibliometrix, a comprehensive package designed for quantitative bibliometric research, developed in the R programming language. This package features the user-friendly Biblioshiny interface, used for this work. Bibliometrix is widely acknowledged for its robustness and versatility, proving particularly effective in analyzing datasets derived from multiple databases, as demonstrated in the present study (Aria & Cuccurullo, 2017; Arruda et al., 2022). In the second part of the work, the techniques used in the study of AI were classified based on the role of AI and human actors in the production of data relevant to the research.

4. STUDYING AI: BIBLIOMETRIC AND TOPIC ANALYSIS

From the annual production graph of articles, it can be observed that in 2013, 85 articles were published on artificial intelligence and algorithms. Production has grown steadily, reaching 223 articles in 2017 and showing continuous growth in the following years. There is an annual growth rate of 26.96%. This trend reflects a growing interest in these topics, which have become increasingly central to the social sciences. This growth can be interpreted through the concept of "datafication" (Van Dijck, 2014), which describes how social practices also occur online, making it necessary for social sciences to study them (Van Dijck et al., 2018).

Figure 1. Annual production

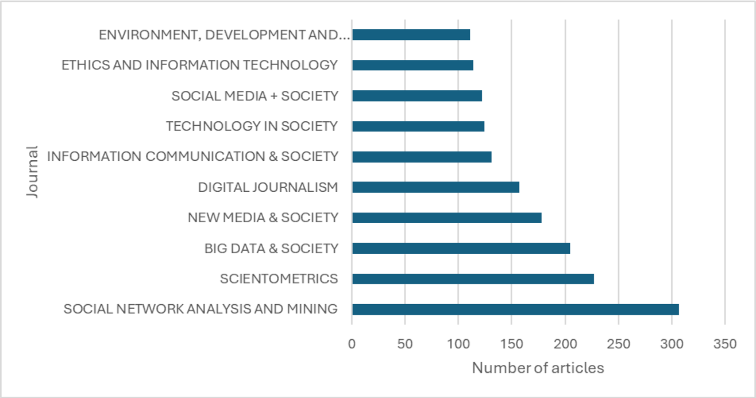


The two most relevant sources are *Social Network Analysis and Mining* (307 articles) and *Scientometrics* (227 articles). The fact that the aim of these two journals is more oriented towards technical and empirical approaches, such as the use of data mining techniques, social network modeling, and quantitative analysis of science, suggests that the social sciences' interest in artificial intelligence and algorithms has developed mainly from an empirical and computational perspective[3]. These journals fully qualify as social science journals, but they also discuss algorithms as tools, not just as objects of research. In these journals, the emphasis is placed on tools and methods for data analysis, rather than on critical reflection. This implies that the inspiration behind the techniques is not necessarily socio-technical; rather, it is more likely to be purely technical. After these first two journals, a significant thematic diversification and attention to critical dimensions can be observed. Journals such as *Big Data & Society* (205), *New Media & Society* (178), and *Digital Journalism*[1] (157) offer a more reflective and interdisciplinary contribution,

[3] For a detailed understanding of the journals' characteristics, please refer to their Aim and Scope pages

focusing on the ethical, cultural, and social implications of data and algorithm usage. Moreover, journals covering topics related to the environment, digital ethics, and the responsible use of technology are emerging, highlighting a wide range of themes that the social sciences are addressing.

Figure 2. Top 10 most relevant resources



From the analysis of the most frequent words[4], a significant focus on social networks emerges, with "social network" appearing 353 times, followed by terms such as "platform" (84 occurrences) and specific references to platforms like "Facebook" (66) and "Twitter", "YouTube" (65). These occurrences clearly indicate that literature focuses on digital platforms. In second place is the term "ethics" (101 occurrences), which is particularly interesting as it highlights that, in addition to interest in technical aspects, there is likely a strong concern for the ethical implications of the use of algorithms and artificial intelligence. Among the most frequent words, "covid-19" (49) also appears, which can be interpreted in several ways. The first interpretation is that the pandemic is mentioned as it caused the inability to conduct research in physical fields, thus increasing the number of occurrences of the word. A second interpretation is that covid forced many in-person activities to move online, opening many opportunities to study social phenomena previously carried out differently. A third interpretation concerns the massive increase in phenomena such

[4] For the text-based analyses, a stop-list was constructed, containing the words used in the query and all the words and expressions referring to types of algorithms and technical procedures. Lemmatization was also performed.

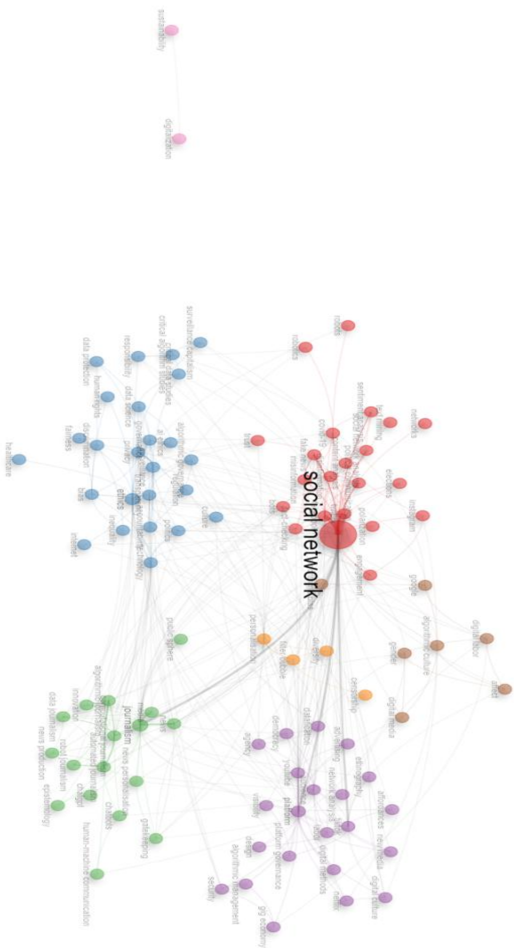
as disinformation and conspiracy theories during the pandemic (Bianchi, 2023). Words like "algorithmic culture" (31), "algorithmic governance" (29), and "bias" (29) signal a lesser but present interest in themes associated with the field of "critical algorithm studies" (Moats and Seaver, 2019).

Table 3. Author Keywords Occurrence. Occurrence > 40

social network	**353**
ethics	101
journalism	89
platform	84
facebook	66
twitter	65
youtube	65
surveillance	59
personalisation	51
technology	51
privacy	50
covid-19	49
social network analysis	47
tiktok	46
datafication	45
sentiment analysis	44
transparency	44
computational journalism	43
automated journalism	42

In this section of the work, we will identify the themes and the relationships between them in the literature on algorithms within the social sciences. To achieve this goal, we will use a social network analysis conducted using Bibliometrix on the authors' keywords will be presented. This involves analyzing the relationships between the keywords chosen by the authors. Each keyword is represented as a node, and the connections between keywords form links. The result is a semantic network that highlights the main themes through the keywords that characterize them and any relationship between them. The clusters have also been renamed with labels that summarize the content of each cluster[5].

Image 1. Social Network Analysis of Authors' Keywords



[5] Louvain was the clustering algorithm used. Normalization was performed using the Jaccard index. Repulsion strength = 0.5; minimum number of nodes = 2.

The red network node, renamed "social networks and analysis techniques", dominates the network, reflecting the importance of platforms in the debate on algorithms and AI. In addition to terms typically associated with social networks, such as polarization, misinformation, fake news, and fact-checking, some of the favored techniques for studying social networks also appear, such as content analysis, sentiment analysis, and text analysis. These techniques have experienced a strong surge due to the study of social networks and have been refined to levels never seen before (Zimmer & Proferes, 2014) also due to COVID, which appears in the same cluster (Cinelli et al., 2020). In this cluster, an empirical dimension emerges; however, it does not draw inspiration from a socio-technical approach. The techniques mentioned are, in fact, limited to textual statistical methods applied to content extracted from social networks.

The second cluster considered is the blue cluster - labeled as "ethics of algorithms" - which seems to highlight terms related to the broader concept of ethics. Among the words in this cluster, we find algorithmic governance, bias, responsibility, discrimination, inequality, and fairness—central concepts in discussions about the ethics of algorithms. It is now well-known that algorithms can perpetuate biases, such as those based on race or gender (Noble, 2018). The presence of the word healthcare probably signals the under-researched yet necessary topic of algorithmic bias and the use of AI in the medical field, as well as its possible impacts on patients (Henwood & Marent, 2019). Also present in this cluster are critical algorithm studies, critical data studies, and data science, which refer to the flourishing fields of research in sociology that aim to study algorithms as socio-technical objects (Aragona & Felaco, 2020). Addressing the ethics of algorithms inherently places the topic within an ANT perspective, even if not explicitly stated. This perspective recognizes that algorithms are not neutral artifacts, but rather sociotechnical constructs embedded with biases and discriminatory logics. These biases should not be seen merely as technical flaws but as the result of interests and power dynamics inscribed into algorithmic design. Furthermore, this topic highlights how algorithmic ethics should not be conceived as an abstract normative principle but as the emergent outcome of a network of interacting actors, both human and non-human.

The green cluster, "algorithm and journalism", concerns the macro-theme of journalism. This cluster is one of the two with the most connections to the red cluster, indicating a relationship between journalism and social networks through AI and algorithms. Automated journalism, robot journalism, and data journalism are some of the words found in this cluster, alongside terms that open important ethical and social implications,

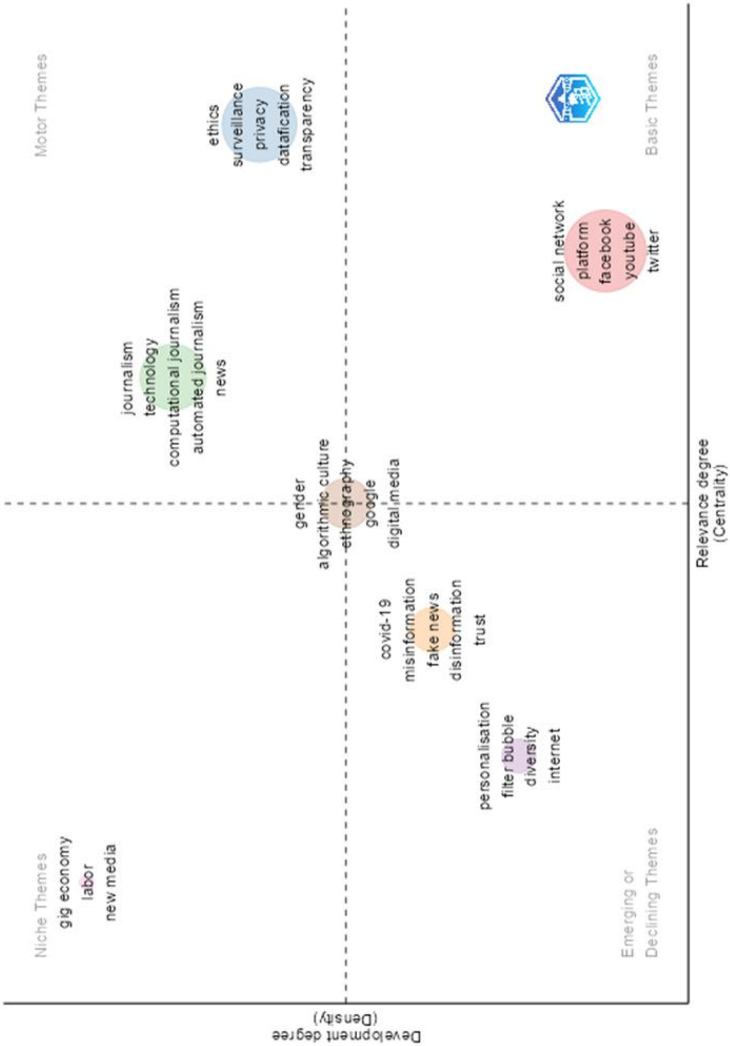
such as the phenomenon of gatekeeping. This concept refers to the selection of news disseminated to the public, which, while previously managed by journalists, has now been transformed by algorithms. It is, in fact, personalization algorithms that compose users' news feeds (Carlson, 2019). It is also interesting to note the presence of the word ChatGPT, increasingly used for producing articles without human intervention (Pavlik, 2023). In a certain sense, this cluster aligns with a Latourian perspective for studying algorithms, problematizing them in relation to their interaction with human actors. In a certain sense, even if not explicitly, this cluster aligns with a Latourian perspective for studying algorithms, as it problematizes them in relation to their interaction with human actors. ANT allows journalism to be analyzed not merely as a human activity but as a network of both human and non-human actors (journalists, readers, algorithms, platforms). Algorithms function as actants that influence the circulation of news, redefining the logic of gatekeeping (Carlson, 2019).
The purple cluster, the second most connected to the red cluster, gathers terms related to social networks, such as TikTok, but also other platforms like Netflix. It is renamed "digital platforms and governance". Again, we see techniques and fields of study involved with these platforms, such as network analysis and ethnography. The difference between the two clusters lies in concepts such as affordances, digital culture, platform governance, and algorithmic management, which reflect an interest in how digital platforms regulate and manage their users through the broad use of algorithms.

The red cluster, on the other hand, focuses on how algorithms influence the distribution of information, using less qualitative and theoretical approaches. In this sense, the interaction between human and human actors is less prominent, with the focus shifting primarily toward the management dimension.

The orange cluster, renamed "social network issues" and brown clusters, labeled "cultural reflections", occupy an intermediate position in the semantic network, suggesting that they function as "bridges." The orange cluster, composed of words like diversity, filter bubbles, personalization, and censorship, mirrors the themes of both the red and green clusters, connecting topics from both social networks and journalism. The brown cluster, meanwhile, includes terms like Google, gender, digital media, affect, and algorithmic culture. It thus refers to empirical dimensions found in the red cluster and more theoretical reflections present in the blue cluster.

In addition to the main clusters, there is a peripheral cluster. The pink cluster, represented by the two words sustainability and digitalization, is completely isolated from the rest of the network, suggesting that these topics, although relevant, are not yet well integrated into the main debate on algorithms and AI.

Image 2. Thematic map of Authors' Keywords



Among the analyses proposed by Bibliometrix, the thematic map allows us to observe the evolution of the main research topics, dividing them into four distinct quadrants based on their centrality and density. Centrality measures the importance of a theme in relation to other themes in the corpus. The more central a theme is, the more connections it has with other themes. Density measures the maturity of a theme, that is, how internally developed the theme is. A theme with high density is autonomous, well-defined, and robust (Aria and Cuccurullo, 2017). The output of this analysis is a map divided into four quadrants: driving themes, basic themes, emerging or declining themes, and niche themes.[6]

The motor themes, positioned in the upper right quadrant, are central and well-developed, indicating that they are fundamental to the field and the subject of extensive studies. In this quadrant, we find a group composed of ethics, surveillance, privacy, datafication, and transparency. These themes are crucial for the debate on algorithms and AI in the social sciences. In line with Zuboff's (2019) literature on surveillance capitalism, the theme of privacy is closely linked not only to surveillance but also to transparency and ethics. The fact that these are well-developed themes indicates that numerous studies and extensive debates have been conducted. Some authors, including Zuboff herself, argue that interest in the topics addressed in this work arose following the Cambridge Analytica scandal, which raised global concerns about the use of personal data and the algorithmic manipulation of public opinions (idem). If the debate on the topic opened because of such concerns, it has since become particularly stable.

The second group of words in this quadrant is composed of journalism, technology, computational journalism, automated journalism, and news. This cluster reflects a significant interest in the role of algorithms in journalism and news. Computational journalism (Coddington, 2015) refers to the use of algorithms to automate the collection and distribution of news, while automated journalism refers to the automation of writing without the need for direct human interaction (Diakopoulos, 2019). The field of journalism is thus undergoing significant changes, certainly of interest to the social sciences. The topic is undoubtedly related to the themes of ethics and transparency, belonging to the adjacent cluster, but it also tends to develop distinctly.

In the basic theme quadrant, in the lower right, we find highly relevant topics, but less developed compared to motor themes because they are less autonomous. The cluster composed of social network, platform, Facebook, YouTube, and Twitter is the only one in this quadrant. All the words refer to digital platforms, one of the preferred objects of study in

[6] Louvain was the clustering algorithm used. Repulsion strength = 0; minimum number of occurrences per cluster = 4.

the social sciences over the past decade, but almost never in an autonomous way: platforms are studied extensively but often in relation to other concepts in digital sociology.

In the lower-left quadrant, known as emerging or declining themes, we find two clusters: the first composed of COVID-19, misinformation, fake news, disinformation, and trust; the second composed of personalization, filter bubble, diversity, and internet. Regarding the first, these topics related to AI and algorithms emerged strongly during the pandemic, when digital platforms played a key role in spreading disinformation - even about the pandemic itself - opening numerous debates about how algorithms function as factors in the dissemination of fake news (Bianchi, 2023). The second cluster refers to the effects of algorithms on the visibility of online content and the creation of filter bubbles through recommendation algorithms. Diversity is an important theme in this context, reflecting concerns about how algorithmic personalization can reduce the variety of content (Bruns, 2019). It is plausible to consider the themes present in this quadrant as declining rather than emerging, since COVID-19 is no longer an emerging and central event, thus taking away the strong interest in misinformation and filter bubble topics.

The only niche theme, present in the upper-left quadrant, consists of the words gig economy, labor, and new media. This theme is well-developed but not central, meaning that it represents a well-explored research area but with few connections to other topics. The gig economy appears because of the launch of platforms like Uber, Deliveroo, or Bolt—relatively new media—prompting part of sociology to study how these use algorithms to manage workers (Scholz, 2016). This theme, although having developed a strong theoretical framework to the point of being a stand-alone theme, likely does not use references similar or equal to the other themes related to algorithms and artificial intelligence.

It is curious to observe that at the center of the map, there is a word cluster composed of algorithmic culture, ethnography, gender, Google, and digital media. These themes are in an intermediate position, connected to motor themes as well as emerging themes, to niche themes as well as basic themes, making interpretation difficult.

This bibliometric overview highlights a significant gap in the adoption of approaches rooted in the Latourian perspective, a limitation that is evident in both theoretical reflections and empirical investigations. The absence of theoretical engagement suggests a missed opportunity to explore the socio-technical entanglements and networked relationships that define algorithms and AI. On the empirical side, there is a noticeable lack of methodological innovation inspired by Latour's insights. Furthermore, the review also reveals a broader disinterest in developing or applying specific techniques to study algorithms and AI. There is a complete absence of specific interest in the techniques employed in studying algorithms and AI, regardless of the underlying theoretical inspiration.

5. STUDYING AI: THE APPROACHES USED

This paragraph aims to identify the approaches employed in empirical research that can be directly or indirectly associated with the perspective of ANT on AI and the human-AI relationship. This body of research can be categorized into two main strands: those that focus on the data produced by AI, and those that focus on the human actor. Specifically, 29 studies have been identified that explicitly focused on AI. In this approach, the data is generated by prompts on various topics, aiming to uncover the embedded logic within algorithms. A significant portion of this research deals with algorithmic bias, which remains a central issue in AI discussions. Studies on bias examine algorithmic outputs to identify discriminatory logic, often affecting specific groups such as people of color or women. It is also worth noting that some studies have analyzed AI-generated outputs to assess technology's ability to contribute to qualitative research. A notable example in this field is the study by Ulloa and colleagues (2024), who systematically queried four search engines (Google, Bing, Baidu, and Yandex) from three different locations, using two browsers and conducting the queries in two waves. They used both gender-neutral terms (e.g., "person," "intelligent person") and gendered terms (e.g., "woman," "intelligent woman," "man," "intelligent man") to access the top 100 image results. The findings confirmed that, similar to other forms of media, search engine images perpetuate biases to the detriment of women. Within this strand of research, there is a notable tendency to apply experimental design. In the aforementioned study, it is evident that the control variable is represented by gender. It is also worth noting that some studies have analyzed AI-generated outputs to assess technology's ability to contribute to qualitative research. These studies have attempted to understand how AI-generated content can be leveraged to provide insights or assist in research across various domains (De Paoli, 2024; Rice et al.,2024). Regarding the approaches, it can be said that the vast majority of studies within this strand adopt an auditing perspective (Aragona and Felaco, 2020), analyzing the algorithms through third-type content analysis tools. This type of analysis involves interrogating the output of AI (as a cultural product) using analysis grids, similar to questionnaires.

Seventy-one studies were identified with reference to the second line of research. The first notable aspect is that qualitative approaches dominate this field. Many studies have employed interviews, observations, or ethnographic methods. Regarding quantitative approaches, the most commonly used tool is a questionnaire, which is occasionally incorporated into experimental research designs. In other words, the methodologies employed in most of these studies align with traditional research tools. However, innovation in these procedures emerges in contexts in which data are produced. Some studies, for instance, have utilized walkthrough or scroll-back methods to generate research-relevant data. In one study, data collection involved automated tracking authorized by the students themselves.

6. CONCLUSIONS

The study aimed to understand (a) which macro-themes the social sciences are focusing on and to what extent themes are inspired by the Latourian perspective, (b) which empirical approaches are emerging in the study of algorithms and if there are innovative approaches. Referring to the first research question, the growing interest in this topic within the social sciences reflects a profound transformation in how we study contemporary digital society. In particular one of the most evident research interests concerns social networks, particularly in relation to phenomena such as disinformation, filter bubbles, and information gatekeeping, especially during significant events like the COVID-19 pandemic. These platforms act as critical sites for understanding the dynamics of information flow and their impact on public perception and behavior. Another major theme that has emerged involves the ethical use of algorithms and the study of algorithms to uncover the contents of "black boxes" (Pasquale, 2018). This reflects a growing need within the social sciences to achieve greater control and transparency from those employing algorithms and artificial intelligence. Overall, the bibliometric analysis suggests a significant diversification in terms of the themes related to AI and algorithms within the social sciences, leading us to reflect on an increasing interdisciplinarity in the field. Despite this significant diversification, there does not appear to be a strong influence of the ANT theory, except in relation to the topics "algorithm and journalism" and "ethics of algorithms", which partially prompt a reflection on algorithms as socio-technical objects. This observation should encourage social scientists to engage more deeply with socio-technical perspectives, as they provide valuable tools for unraveling the complexities of algorithmic systems and their embedded power dynamics. The ANT approach can have significant applications both within and beyond the academic sphere. For instance, as highlighted in the "ethics of algorithms" cluster, this perspective would encourage deeper reflections on algorithmic discrimination, fostering a more interdisciplinary approach to algorithm design. Bringing together social scientists, humanities scholars, and developers in the construction of algorithms would help move beyond a neutral or purely technical view of these systems (Aragona & Felaco, 2020). Furthermore, adopting an ANT perspective to analyze the feedback loop (Mansoury et al., 2020) between algorithms and users could be particularly valuable for designing more informed regulations on algorithmic governance. Algorithms should not be regarded as neutral entities, and citizens must be made aware of the continuous and reciprocal influence that exists between them and algorithmic systems (Zarouali et al., 2021).

In answer to the second question it can be said the techniques used in the analyzed research revealed a predominance of classic social science tools such as interviews, observations, and questionnaires. However, within this body of research, there has also been an increasing use of experiments, which is particularly effective in analyzing AI because of the possibility of isolating and testing specific variables in controlled environments. An element of innovativeness is not so much in the techniques analyzed as in the context of data production. Technique such as walk-through or automated tracking, as well as the observation of interactions between humans and machines, represent new frontiers for data collection. These approaches make it possible to capture social phenomena in situations where artificial intelligence actively intervenes, generating new opportunities for the study of socio-technical dynamics and showing how social research maintains strong ties to its traditional roots but, at the same time, is enriched by innovative approaches that exploit the peculiarities of human-AI interaction.

Beyond their application in AI studies, these methodological advances offer valuable insights for broader social research. Techniques such as automated tracking, walk-through methods can be applied to various social phenomena beyond automated systems. For instance, automated tracking can be used in ethnographic research to analyze movement patterns in urban spaces, educational settings, or workplaces, offering insights into how individuals interact with infrastructures, learning environments, or hybrid work models. Similarly, walk-through methods, traditionally used for digital platforms, can be adapted to narrative research, helping investigate experiences with bureaucratic processes such as housing applications or access to social services. By extending these methodologies beyond AI studies, social research can uncover new dimensions of human behavior, institutional dynamics, and socio-political transformations. This demonstrates how social sciences can integrate innovative data collection strategies to explore a wide range of issues beyond automation and artificial intelligence.

It is crucial to acknowledge the limitations of this study. First, there may be inconsistencies in the results if reproduced. The database was compiled on October 1, 2024, meaning the data reflects that specific date. For instance, by the time a reader accesses the information, the article count might have changed, as some contributions may be retracted for various reasons, such as data manipulation, incongruent results, plagiarism, or copyright infringement. Another limitation of bibliometric analyses that must be highlighted is the inability to fully capture a topic due to the absence of a perfect query capable of encompassing the entire subject under investigation. The query terms used may not cover all relevant publications, leaving gaps in the analysis. This research can be seen as a first step, and future studies could include a more robust analysis using the PRISMA framework (Page et al., 2021), along with deeper qualitative investigations. In addition, it would be valuable to extend the analysis of techniques used in AI and algorithm studies to previous years, rather than limiting the scope to the most recent year. This would provide a more comprehensive view of the evolution of methods over time.

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ALGORITHMIC FEEDBACK LOOPS IN SOFT SCIENCE DISCIPLINES.

An application of the systematic literature review on the evolution of definitions from 2000 to 2023

by *Gabriella Punziano, Giuseppe Michele Padricelli, Antonio Vettori**

Abstract

In today's digital society, consumer cultures and practices have been reshaped by digital platforms. Cultural entertainment consumption, such as movies and music, is now largely mediated by platforms like Netflix, Spotify, and YouTube, which use AI-driven algorithms to recommend, filter, and rank content dynamically. This article presents a longitudinal study of scientific literature to examine how the concept of feedback loops has been addressed. It explores how this recursive process - where outputs influence new inputs - has evolved and been interpreted differently across soft and hard sciences over time.

Keywords

Feedback loop, Prisma SLR, algorithm role

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1. INTRODUCTION: MULTIPLE WAYS TO CONCERN SCIENCE

Scientific inquiry has long been centered on fundamental questions about what science can achieve and how its mechanisms operate. Scholars and intellectuals have historically debated these issues, leading to the emergence of multiple paradigmatic perspectives that have shaped the evolution of scientific thought. Despite their differences, these perspectives converge on the idea that science is characterized by a structured system of codes, techniques, and methods—essential tools that bridge theoretical frameworks with empirical observation (Kuhn, 1962; Popper, 1959). This methodological foundation serves as a key criterion for distinguishing scientific knowledge from other forms of understanding.

Over time, different conceptualizations of science have emerged, reflecting diverse epistemological orientations and disciplinary applications. The classification of scientific approaches has evolved in response to shifts in reflective and experimental fields, accommodating new ways of interpreting and engaging with reality (Latour, 1987; Feyerabend, 1975). These evolving frameworks highlight the dynamic nature of scientific knowledge, illustrating how methodologies and paradigms adapt to new discoveries and societal needs.

In this regard, the epistemological perspective, through Merton's (1973) contribution to the sociology of science, outlines a fundamental path to follow in systematizing the distinction between "sciences". The ability to measure objects, referents, and units of analysis using standardized measurement units has always been the only discriminating element useful in distinguishing, or rather dividing, sciences into few broad families. However, over the years, new systematizations and increasingly sophisticated classifications have emerged, directly linked to the role of the researcher and the mechanisms they can follow based on the objects they observe, deconstruct, and analyze. Following Wu et al. (2022), we now distinguish, for example, between *hot and cold sciences*, as well as *hard and soft* sciences.

The first distinction, based on the temperature metaphor, categorizes sciences according to their state of discovery advancement and the empirical evidence reported in studies. The advancement of evidence is directly proportional to temperature, which serves as an indicator of theoretical solidity. Within this distinction, Latour (1987) systematizes the concept of the "*black box*", that is, a portion of cold, closed knowledge that the researcher is responsible for opening and discovering to *heat it up*. The opening of black boxes and the change in temperature of theoretical frameworks within them contribute to the accumulation process that Kuhn (1962) already identified as the driving force behind scientific revolutions. In these terms, the process of destruction does not necessarily imply a paradigm shift but rather intervenes in clarifying the ambiguity or making explicit a theory (or parts of the concepts underlying it) through consensus-building and debate within the scientific community.

On the other hand, the distinction between hard and soft sciences, according to Nelson (2002), stems from the unequal evolution of scientific knowledge. The distinction between hard and soft sciences aligns with the longstanding debate between natural and social sciences. According to Storer's work *The Hard Sciences and the Soft* and further discussed by Shapin (2022), soft sciences are often seen as adhering to non-scientific criteria. Dang (2018) notes that hard sciences tend to follow a single paradigm that scholars adhere to. In contrast, soft sciences do not always share a single paradigm, leading to multiple, sometimes conflicting, approaches. However, this division does not fully capture the complexity and knowledge structures within various disciplines, though it serves as a helpful starting point for understanding the diversity of academic fields.

A key aspect of the common discourse surrounding this distinction is a qualitative evaluation of the sciences. Shapin (2022) points out that hard sciences have traditionally been regarded more positively for their methodological rigor, while soft sciences have often been seen as quasi-scientific. This perception often relates to individual views on what constitutes science. Despite the persistence of this view, it is gradually fading, especially as the future of the sciences becomes increasingly interdisciplinary.

The so-called digital turn and the pervasiveness of objects, devices, codes, and languages in everyday social life can, to some extent, be considered one of the most recent scientific revolutions (Knell, 2021), capable of reshaping theoretical frameworks in communication, economics, and society as a whole.

In this sense, interdisciplinarity emerges as an essential ingredient in approaching the theme of digitalization *tout court*, both from a technical and a social perspective. In this way, research heritages and connections between hard and soft sciences themselves contribute to narrowing the gap between them, especially in addressing processes and objects currently confined within so-called black boxes, such as feedback loops and, by extension, algorithms and recommendation systems.

Thoroughly studying these processes, with particular attention to the coexistence of these two perspectives, is crucial for understanding the mechanisms that connect hard and soft sciences. Through a longitudinal analysis based on a Systematic Literature Review this study covering scientific productions on the topic of feedback loops from 2000 to 2023, aims to shed light on the transfer of concepts, definitions, models, and interpretative capacities to soft sciences.

2. ADDRESS FEEDBACK LOOPS: THE INNOVATIVE PRACTICES OF CULTURAL CONSUMPTION

Since the so-called "digital turn", cultures and consumption practices have been in the middle of a significant remediation process for several years. The increasingly pervasive presence of platforms dedicated to the consumption of audiovisual cultural products, such as Netflix, Spotify, YouTube, and others, has undoubtedly, according to Poell et al. (2021), challenged the habits of cultural consumption in cinema, music listening, and TV series viewing. In this sense, social research has kept up, focusing on the opportunities for access to and consumption of audiovisual products by questioning the processes of searching, enjoying, and recommending entertainment products.

One of the most interesting aspects of the reflection on this topic can be summarized in the definition of the feedback loop process. According to Airoldi, Beraldo and Gandini (2016), these processes are characterized by an interaction between users and the recommendation systems of these platforms, generally never made public. Operating in the context of what Beer (2022) defines as a "recursive society", it is necessary to aim at understanding the possibilities of permeating reality through algorithmic logic. This is done while considering that data and outputs are not only the results of a direct action produced by the user (ibid) but also a product shaped by platform logic and thus by the digital traces left online by users that is, by previous feedback (intentional or not) that has shaped previous consumption actions in a potentially infinite loop.

Feedback loops are evident in these contexts. For example, on TikTok, videos that receive a high number of views, likes, and shares tend to be further promoted by the platform's algorithm, thus reaching a wider audience. This feedback encourages users to create similar content to gain visibility and engagement, fuelling a cycle in which the most popular content becomes increasingly visible and dominant.

Feedback loops on platforms like YouTube and Netflix are often tied to personalized recommendations. The algorithms analyse users' viewing behaviour to suggest new content. However, there are also more critical aspects of feedback loop application. For instance, if a user has specific and limited preferences, the algorithm might further narrow the variety of recommended content, creating a filter that limits the diversity of cultural experiences.

In summary, feedback loops play a key role in the consumption of cultural products on social and streaming platforms. They shape the content presented to users and influence their consumption choices. These cycles can significantly affect cultural diversity, user opinions, and social dynamics online.

The fluidity of cultural consumption practices today is associated with the increasingly pervasive presence of users on streaming platforms and the use of search and consumption tools facilitated by digital mediatization (Airoldi and Rokka, 2022). The materiality and ownership of cultural products in physical formats (DVDs, Blu-rays, CD-ROMs, etc.) are being replaced by services tailored to users' preferences: an adaptation of supply to demand, facilitated by the role of the algorithm.

According to Airoldi and Rokka (2022), every cultural product involves what is known as articulation, a moment when the perspectives of those who produce a product and those who consume it must meet. Today, this articulation also involves the so-called algorithmic training: a non-human intermediary that operates between the production and consumption process in a non-neutral, authoritative, and recursive way. However, this should be considered a dialectical process because, on the one hand, the algorithm controls and constrains the user based on its outputs, while on the other, the algorithm itself must adapt based on the user's behaviour something that can be understood through the concept of the feedback loop.

Nowadays, TikTok and YouTube are two significant platforms for this new way of consuming cultural products (Denicolai and Farinacci, 2020; Rico Kuntag and Sijabat, 2023).

The first is a Chinese social network, known as Douyin in the Asian country, which originally launched as Musical.ly in 2016 and was later rebranded as TikTok in 2018 by ByteDance. This company acquired it from founders Aleix Zhu and Luyu Yang in 2017 for approximately 750 million euros. It has become one of the most used social platforms, especially among teenagers, with 1.2 billion monthly active users worldwide. Its primary purpose is the sharing and viewing of short videos, up to a maximum of ten minutes. The innovative feature introduced by TikTok, which was quickly adopted by other social networks, is the “For You” page. This is the main screen displayed when the app is opened, showcasing multimedia content suggested by the algorithm based on the user's preferences through an analysis of viewing times, comments, shares, and likes. In this sense, almost all of the user's experience and video consumption is based on what the algorithm deems close to the consumer's preferences. Other sections, such as the profiles followed, are comparatively less influential. Nevertheless, it is important to highlight that despite the algorithm's pervasive role in shaping the user experience, the diversity of the "For You" page between different users, even those in close proximity, demonstrates that it is primarily the algorithm that adapts to the user, rather than the other way around.

YouTube was founded in 2005. Today, according to data published by Google and commented on by Forbes, it is one of the crown jewels of the tech giant and is managed by Alphabet. Nearly 10% of its revenue comes directly from this platform. Although it is now an integral part of the Google ecosystem, YouTube was initially created by three young men, Chad Hurley, Steve Chen, and Jawed Karim, who were working for PayPal at the time. The primary function of YouTube is to share and view multimedia content uploaded by other users. These include video blogs, movie trailers, reviews, gaming, and music. Indeed, several studies show that the sharing of music videos is predominant on the platform (Airoldi et al., 2016). The interface is not solely based on content users search for or channels they subscribe to; it also suggests recommended content on the homepage and the video being played. These recommended videos are generated by an algorithm that considers numerous factors but mainly creates a pattern of shared viewing (Airoldi et al., 2016). In other words, when examining a specific video that the user is watching, the platform suggests other videos that other users subsequently watched with a similar viewing pattern.

An illustrative study was conducted by Airoldi, Beraldo and Gandini in 2016, titled *Follow the Algorithm*, which investigates the dynamics behind related and recommended videos. These are determined not only through a computational process but also by the collective behaviour of users who contribute to categorizing audiovisual products. Although the algorithm of the Google-owned platform is not public, this categorization is based on the frequency of co-viewing between the currently playing video and those recommended in the sidebar. The study aims, through a mixed methods approach and a combination of network analysis with content analysis, to form clusters of videos, demonstrating that on the one hand, these clusters follow genre-based logic—songs of the same genre are grouped together while other clusters are defined by contexts or listening moments, such as music for meditation, relaxation, or children's music.

As previously mentioned, what emerges is an environment where cultural consumption changes not only in its form of fruition but also in how it is re-presented, while still adhering to historical and cultural categorizations like musical genres. In this sense, feedback loops become clearer, representing a phenomenon that connects human actors with network actants, such as algorithms. It is a balancing phenomenon that, on the one hand, mitigates the influence of the algorithm—at least considering the media narrative that emerges—but, on the other, allows users greater ease in content consumption, no longer chosen independently but based on what aligns with previously detected tastes.

What has been clarified so far briefly outlines the foundations of the feedback loop concept, centralizing the social sciences debate on the behavioural and algorithmic dynamics related to the consumption of cultural products online.

What is the starting point for a critical reflection on this topic? How has the debate evolved before reaching its current state of advancement? How have the scientific trajectories, spanning both soft and hard sciences, been influenced over the years by reflections on the user-algorithm relationship?

3. THE ALGORITHMIC FEEDBACK: A SYSTEMATIC LITERATURE REVIEW

The Systematic Literature Review (SLR) considered those studies published on the topic of algorithmic feedback over the past twenty-three years, covering the period from 2000 to 2023. The aim was to provide an overview of the evolution of publications across all fields, with a particular focus on those related to the humanities or soft sciences, which were then subjected to content analysis. Describing how this topic has been addressed in the research field over the years meets two main knowledge needs. The first is aimed at a transdisciplinary understanding of the definition and framing of the subject matter across various disciplines, from hard sciences to soft sciences; the second is to delve deeply into the field of social sciences. This approach is further supported by the fact that the concept of feedback originated in cybernetics, and its evolution as an interdisciplinary subject has faced a challenging path toward institutionalization.

The peculiarity of the SLR lies in treating the literature as a scientific process. Lamé (2019) states that by applying concepts from empirical research, the SLR becomes a more transparent and replicable process, consequently reducing the distorting effects that researchers might face.

The term "systematic" here refers to a step-by-step protocol to ensure that the objectivity of the research is protected from potential researcher biases (Sharif et al., 2019). This protocol consists of specific steps to be followed:

- definition of the question (it must be useful and significant, considering variables such as previous studies or the real need to use the systematic literature review approach);
- determination of study types (involves selecting the studies to be included in the review, which can be determined through a hierarchy of studies that follow a more structured approach or by choosing the study type most appropriate to the research question);
- literature search (can be done through databases such as Web of Science, Scopus, PubMed, etc., which often serve as the starting point for an SLR and may vary depending on the research discipline);
- results checking (presence of biases can compromise the integrity of the results, and thus these aspects need to be monitored. Various tools should be used to ensure proper control, such as an initial screening to eliminate duplicates and generally check the relevance of the selected studies);
- critical evaluation (an essential phase, without which the study would be unreliable, serving to systematize the study rather than to engage in criticism for its own sake);
- synthesis and interpretation of results (to synthesize and analyze the extracted data, this can be done using statistical methods (meta-analysis) where appropriate, or through a qualitative approach and narrative synthesis when the studies under review are more heterogeneous);
- dissemination of results (carried out through drafting a report and subsequent publication. This phase must be considered from the outset, not only at the end of data synthesis and interpretation. This step is crucial because it ensures that the research is as accessible as possible to the intended audience).

Lamé (2019) further notes that this approach also presents challenges, such as its limited adoption by researchers, as it partially hinders the ability to synthesize and accumulate results.

The SLR is a process that can consider a large amount of information and studies. One of the most significant aspects is its ability to distinguish and understand the difference between actual knowledge and what we perceive as knowledge. This discernment is made possible by analyzing and comparing studies with similar populations and research topics. This approach is more suited to answering specific questions and testing hypotheses than traditional literature reviews. In fact, the SLR is not comparable to a mere discussion of the literature but is a valid scientific tool; systematic and traditional reviews aim to satisfy different knowledge needs and should not be seen as alternatives but rather as approaches that can also complement each other. This method may also involve a statistical study approach, such as meta-analysis, which uses specific statistical techniques to synthesize the results of numerous studies into a single quantitative estimate. A systematic review should be conducted when it is necessary to provide a comprehensive overview of the evidence in a research area to facilitate future advancements on the topic; when the field of inquiry is still emerging and there are not yet enough registered and published studies; or when, as in this case, the field of study is well-established with a large number of published studies. In this study, the SLR can be used to summarize and simplify the already abundant amount of data produced (Petticrew and Roberts, 2005).

3.1 The PRISMA approach

The application of the SLR in this study followed the typical characteristics of the PRISMA model.

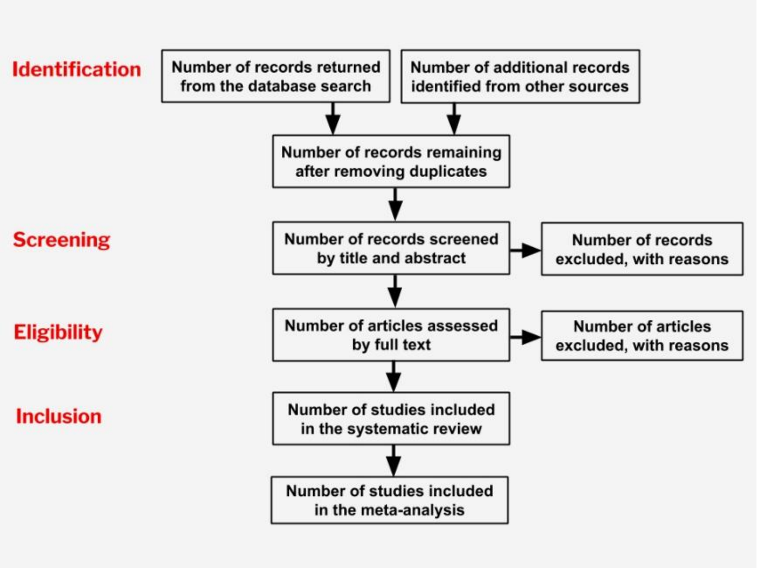
The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is a reporting checklist designed to guide the conduct of a Systematic Literature Review through a series of predefined steps. It was introduced in 2009 and initially published by an international network of researchers primarily from medical disciplines.

Page, McKenzie et al. (2021) developed the PRISMA checklist that consists of 27 items, which are considered essential steps for successfully conducting a systematic review. These items can be divided into different sections (Table 1): *title, abstract, introduction, methods, results, discussions, and other information.*

Table 1 – SLR phases in PRISMA approach

Title
The first crucial point is to identify the report from the title with the term systematic review, so that the research can be more easily found and categorized.
Abstract
The abstract should consist of a detailed summary of what has been discussed within the review. It should specify the research objectives and the questions the review aims to answer, clearly outline the methods used, such as eligibility criteria, where the information was collected, including the number of studies in the report, any potential risks of bias, and a general synthesis and interpretation of the results.
Introduction
The two key points are the motivations and objectives. The first phase must consider the existing knowledge on the topic of investigation, while the objectives relate to the questions the review aims to answer.
Methods
In this section, the process followed for the SLR should be clearly outlined. This section includes the eligibility criteria, the sources from which the information is derived, the search strategies, the data selection process, risks, synthesis methods, and the evaluation of risks and results. One of the tools used in this step is the PRISMA flowchart (Figure 1), which provides a clearer view of the inclusion and exclusion process of articles at all its stages.
Results
The results are presented both through a written description and the inclusion of tables and graphs. The selection of studies and their characteristics, the risk of bias in the selection, the evidence emerging from the selected publications, and the syntheses are clearly outlined.
Discussion
The discussion provides a general interpretation of the results, considering any limitations and the implications of the findings for practice and future studies.

Figure 1. Prisma Flow Diagram (from www.edanz.com/blog/prisma-flow-diagram)



The data collection was conducted through the selection of academic works on the topics of feedback loops, algorithms, and artificial intelligence. More specific terms that are still related to the central theme, such as cybernetics, recommendation systems, and machine learning, were also included.

The consideration of these search terms is due to the fact that, as mentioned, the origin of the concept of feedback can be traced back to cybernetics. As an interdisciplinary concept, cybernetics became institutionalized following extensive debates between approaches aligned with the social sciences and those rooted in engineering (Carradore, 2013).

The data collection procedure was carried out using the Web of Science (WOS) portal, a citation database that allows researchers to gather indexed and categorized scientific articles based on a search query. As previously mentioned, the time span ranges from 2000 to 2023. This time frame was chosen to ensure comprehensive coverage of the evolutionary process of the web, from the emergence of what is known as Web 2.0 up to 2023, the last year for which the source provides complete coverage of published works.

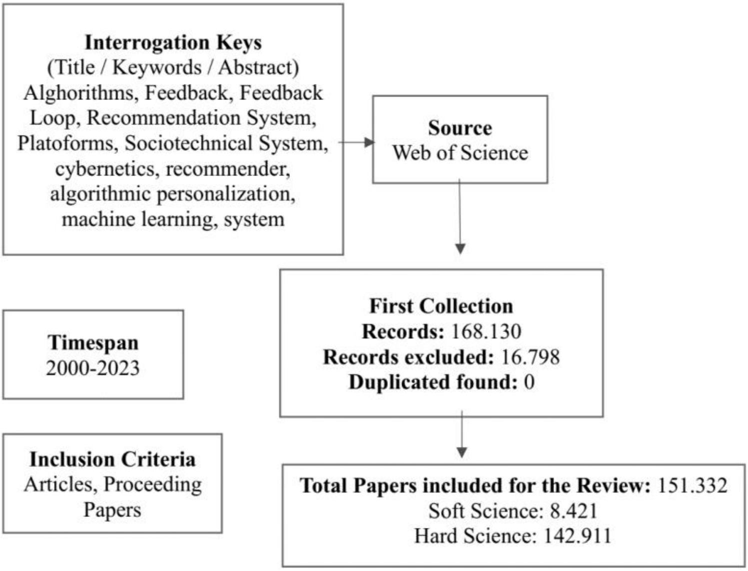
After running the query, 168,130 records were identified. This dataset was then refined by excluding publications outside the 2000-2023 time frame, reducing the dataset to 156,556 records. An additional inclusion criterion was applied based on the publication type, further narrowing the dataset to 151,332 records, focusing solely on peer reviewed articles and proceeding papers from any discipline. The choice to select these two types of publications was driven by their higher number, allowing for a more substantial sample, as well as the fact that both types typically undergo a certain degree of peer review.

A particular type of scientific article and proceeding paper holds significant importance in the context of academic conferences. These publications serve as a key means of disseminating research findings and new ideas within the scientific community, offering researchers in the social sciences and other fields an opportunity to share their results.

The final dataset (the processing of which is outlined in Figure 2) includes all articles that contained one or more terms—either isolated or combined—specified in the search query in their title, abstract, or keywords.

Each article collected in the final dataset is not exclusively attributable to a single keyword from the query but rather to a combination of these words. The selection of each individual keyword in the query is based on a direct connection to the central theme. The process began with a review of the relevant literature to identify useful terms, followed by test queries on the Web of Science database. These tests involved multiple attempts to combine each selected word with the term "feedback loop". The final query resulted from the set of combinations that yielded a substantial number of peer-reviewed articles, which were subsequently included in the dataset. Some keywords initially identified through the literature review, such as "Artificial Intelligence", did not return peer-reviewed scientific outputs that fell within the time frame defined for this study. In fact, the connection between "feedback loop" and "artificial intelligence" primarily led to more recent publications that exceeded the established temporal limit. The closure of this time frame in 2023 corresponds to the threshold within which Web of Science database ensures full coverage and record updates.

Figure 2. Data collection process (our elaboration)

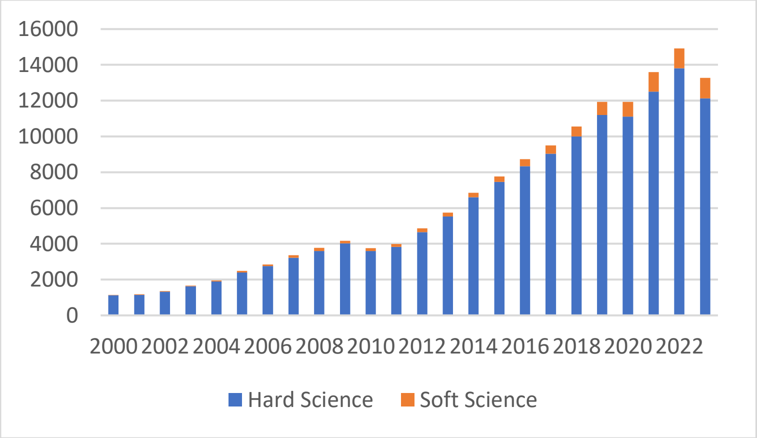


4. THE TEMPORAL TREND BETWEEN HARD AND SOFT SCIENCE

The empirical part of this study aims to understand how social sciences have addressed this topic and how their treatment has evolved. To achieve this, it is useful to apply typical sociological research methods, which often include diachronic analytical approaches to better understand changes in a phenomenon over time. This approach aligns with longitudinal studies, which are “based on the classic strategy of identifying specific units that are observed, surveyed, or exposed to the same stimuli repeatedly over time” (Caputo, Felaco, Punziano, 2017: 25). For this purpose, the dataset was segmented according to different disciplines using the categorization provided by the source, known as “WOS Categories”. The disciplines were then grouped into “hard sciences” and “soft sciences”. The soft sciences subset includes fields such as: *Anthropology; Archaeology; Art; Behavioural Sciences; Business and Business Finance; Communication; Cultural Studies; Development Studies; Economics; Education and Educational; Research; Ethics; History and Philosophy of Science; Hospitality, Leisure, Sport, and Tourism Humanities Multidisciplinary; Information Science and Library Science; Language and Linguistics; Law; Management;*

Philosophy; Political Science Psychology (Applied, Clinical, Experimental, Mathematical, Multidisciplinary, Social); Public Administration; Public, Environmental, and Occupational Health; Social Issues; Social Sciences (Biomedical, Interdisciplinary, Mathematical Methods); Sociology. This categorization resulted in two subsets: one containing publications from disciplines classified as hard sciences (142,911 records) and another from disciplines classified as soft sciences (8,421 records). A temporal analysis of publication trends was then conducted, with an initial summary in Figure 3. This figure displays a stacked column chart showing how the total number of publications has generally increased each year since 2000, except for the periods between 2009-2010 and 2022-2023. The division between publications in hard sciences and soft sciences is highlighted by different colors in the graph, revealing a substantial predominance of publications from hard sciences. The goal is to determine whether, in recent years, soft sciences have overtaken hard sciences in their focus on this topic, and to see if similar or different trends emerge between the two approaches. The initial hypothesis suggests that the topics of feedback loops and algorithms have gained more prominence in soft sciences in recent years. Figure 3 illustrates how, for both approaches, the number of publications generally surpassed the previous year's output almost every year. However, this visualization does not account for the initial disparity in attention given to each discipline.

Figure 3. Annual publication in hard and soft science (made by Microsoft excel)



To explore this last point in greater depth, the same descriptive inspection is replicated, focusing exclusively on the scientific production related to soft sciences.

Given the high sensitivity of the research area variable and the large number of categories in which it is operationalized, a reclassification of categories was carried out to avoid an overly fragmented analytical synthesis. In this process, the disciplines were grouped into five new categories:

- Human and Social Studies, which includes publications in the fields of anthropology, sociology, education, history, and linguistics.
- Psychology
- Communication and Cultural Studies
- Business and Economics, which includes publications in the fields of economics, finance, and business organization.
- Government and Law, which includes publications in the fields of law and political science.

Looking at the figure 4, in addition to observing a continuous upward trend in the number of publications per year, it is possible to discern the consistent proportionality in production across the different disciplines. Furthermore, another interesting aspect emerges, which becomes even more evident in Figure 5, where the count is standardized for each research area relative to the total number of works published each year. This aspect concerns the identification of the years in which each research area first appeared.

At the beginning of the timeline, total production was exclusively dominated by human and social studies, as well as business and economics. However, as the timeline progresses, psychology first and then studies on communication processes gradually claim a share of research production on the topic. It is only from 2007 onward that a decline in production within the social studies area is recorded. In the same period, there is a growing focus on communication studies, along with the emergence and consolidation (although still modest compared to other research areas) of research on the topic within the field of Government and Law.

Regarding this last aspect, it is not difficult to formulate research hypotheses linking the increase in scientific production on these topics to the rising attention to regulation and legal aspects, which have been central to much of the public and political debate. Isolating and conducting an in-depth qualitative analysis of articles in the Government and Law area published in these years presents a valuable opportunity for future research developments. This would allow for verifying the initial hypothesis and further exploring the role of algorithms and artificial intelligence in public and political decision-making processes, as well as delving into the sensitive issue of data protection and identity security in the digital space.

Figure 4. Annual publication in soft science

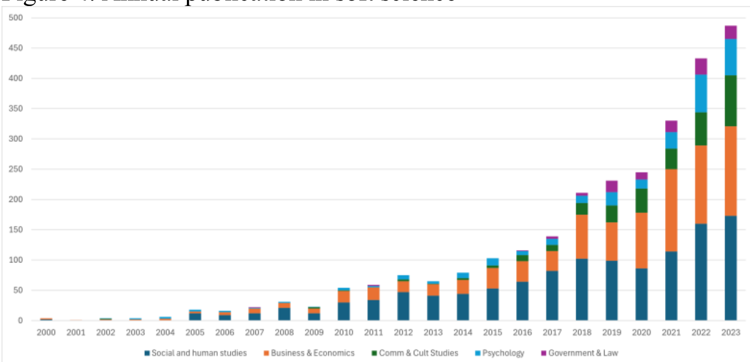
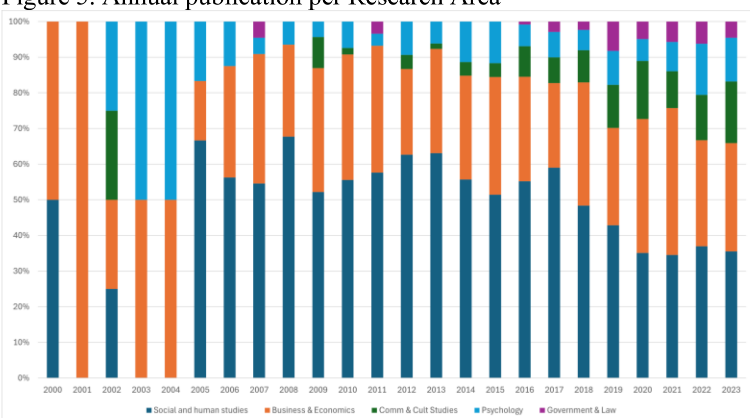


Figure 5. Annual publication per Research Area



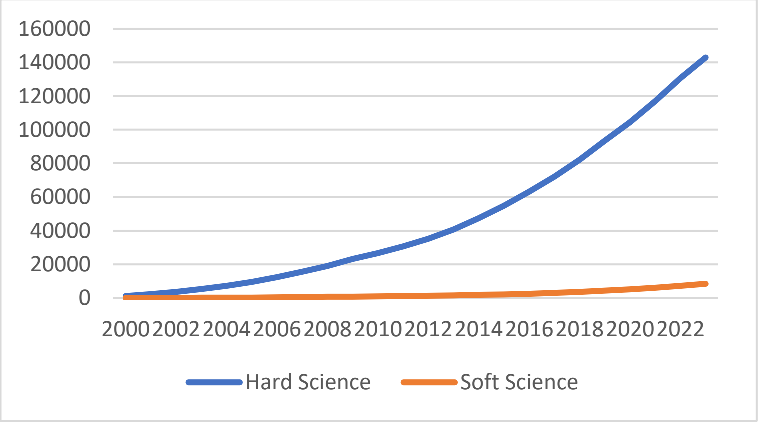
In light of this, another way to better address the limitations of absolute growth comparisons, is the employ of index numbers, a statistical measure used to express relative changes in a data series with respect to a reference or base value. The base value can be fixed—meaning changes are compared to a specific fixed time—or moving, where the comparison is made with the immediately preceding time period. Index numbers serve as a method for comparing different magnitudes over time or across distinct data sets, normalizing variations relative to a common reference point (Predetti, 2006).

To calculate an index number, the value of a variable at a given time is divided by its value at a reference time, multiplied by 100 to obtain a percentage value. The interpretation of an index number depends on its relation to 100:

- an index number greater than 100 indicates an increase relative to the base period;
- an index number less than 100 indicates a decrease relative to the base period;
- an index number equal to 100 signifies no change from the base period.

In the case of publications across hard sciences and soft sciences, the year 2000 was selected as the starting point for data collection. This year is significant for technological advancement, both from a technical perspective and a social one. Using 2000 as the reference year, Figure 6 displays the growth of publications starting from that year, illustrating the predominance of hard science disciplines in absolute numbers.

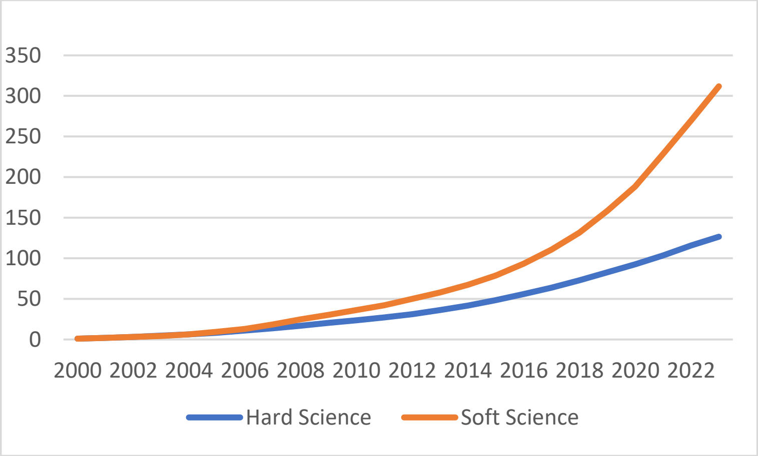
Figure 6. Absolute growth of publication from 2000 (made by Microsoft Excel)



By relating the growth to the starting point, and thus using fixed-base index numbers where the base is the number of publications in the year

2000 for both hard sciences and soft sciences, it is possible to see in Figure 7 the greater growth in publications within soft science disciplines.

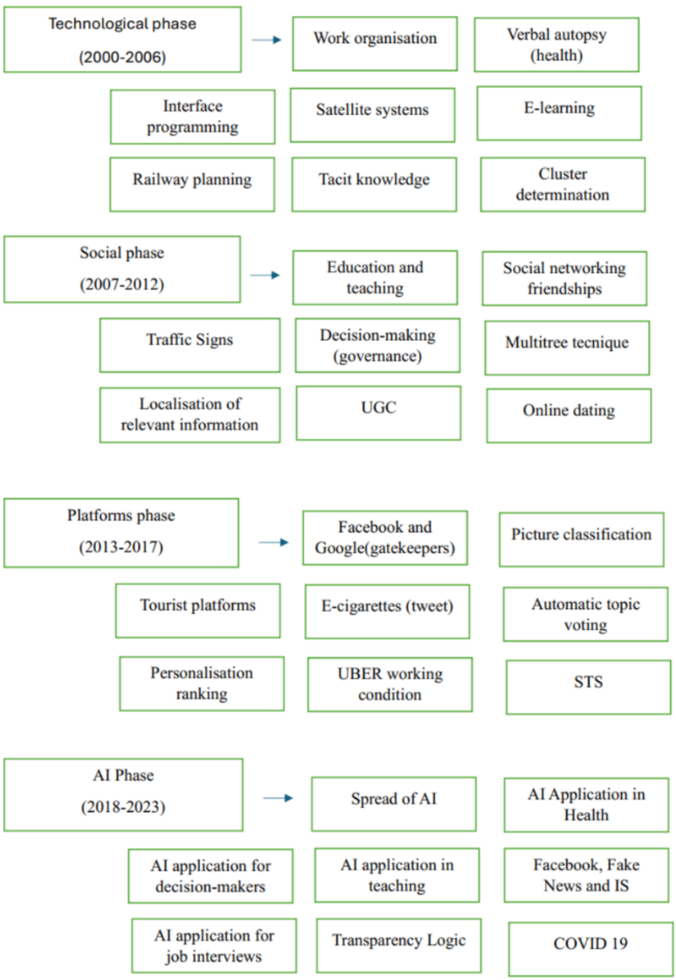
Figure 7 – Relative growth of publication from 2000 (made by Microsoft Excel)



As of 2023, this growth has been approximately 2.5 times higher for soft sciences than hard sciences. This number confirms our initial hypothesis that there has been a growing interest in the research topics within disciplines associated with the soft science approach.

This growth increased more significantly starting in 2007, with another surge in 2018. To understand the reasons for this growth, we reviewed the titles and abstracts of 120 papers—five articles categorized under soft sciences with the highest number of citations for each year (2000–2023). An interpretive analysis emerged from this, which is schematically represented (Figure 8), where temporal phases are associated with keywords from the articles published during those years.

Figure 8. Temporal phases of the most cited publications



Four chronological phases have been identified: the technological phase (2000-2006), the social phase (2007-2012), the platform phase (2013-2017), and the artificial intelligence phase (2018-2023).

- In the first phase, referred to as the technological phase, a large number of papers emerge that, in addition to addressing soft science disciplines, also touch on topics related to hard science fields such as engineering, computer science, and medicine. This phase is characterized by highly technical subjects, focusing on the design of devices capable of autonomously performing tasks. Examples include the scheduling of train timetables, the design of techniques to establish appropriate clusters in scientific studies, and a range of studies related to medical disciplines. The social-human factor is less prominent but not entirely absent in this phase, as some studies address topics such as product selection in online shopping, aided by automatic ranking systems—an anticipation of the next phase.
- In the second phase, referred to as the social phase, there is increased focus on topics more closely related to social aspects, such as education, decision-making, online product sales, and social networks. Themes such as user-generated content (UCG) emerge, which place human activity at the center of algorithm design and automated recommendation systems. There is a notable rise in studies that explore online environments more closely, particularly those of a collaborative nature, where social activity is essential to complete the network underpinning these contexts.
- In the third phase, referred to as the platform phase, the trend from the previous phase continues, with a stronger focus on social topics, more aligned with soft science, compared to hard science. During this phase, numerous studies emerge focusing on digital platforms, which, through the interplay of technology and human elements, become a dominant force in the online environment. These studies examine the role of gatekeepers like Facebook and Google, the influence of platforms within the information system, and platforms such as Yelp and Uber, addressing themes such as user reviews and the working conditions of platform drivers. In addition to being a central topic, platforms have also become essential for data collection. This phase sees the emergence of studies using user-generated data from social platforms to conduct research through digital methods, such as using tweets to understand the phenomenon of electronic cigarettes.
- In the fourth and final phase, referred to as the artificial intelligence phase, numerous articles emerge where the application of AI in various fields takes center stage, from healthcare to Industry 4.0, to the creation of collaborative filters, and to the issue of the information system on platforms like Facebook, particularly how

issues like misinformation and fake news are addressed. Algorithms are viewed as actors in society, fully integrated into the digital environment. AI is also associated with topics such as healthcare, policymakers, job interviews, and education. Moreover, the social component is predominant in studies questioning algorithmic awareness, tied to issues like the digital divide (Gran, Booth, and Bucher, 2020).

In conclusion, the increased attention given by soft science disciplines to algorithmic feedback and recommendation systems is linked to a greater focus on the social issues these technologies entail. The two moments of greatest growth are closely connected to the widespread diffusion of online environments, where users play a major role in activities, starting from the social phase of our study, and to the spread of AI technologies. These not only spark technological interest but also raise social concerns regarding their implications for society, such as ethical questions about certain applications or the opportunities they present.

5. THE EVOLUTION OF DEFINITIONS IN THE SOFT SCIENCES THROUGH THE APPLICATION OF LDA AND ACL

Recognizing the significant rise in interest in this subject in recent years—particularly within the soft sciences compared to the hard sciences—the next step in this research is to analyze how academic engagement with this topic has evolved. Using content analysis, we aim to highlight the changes that have occurred over time and across disciplines, determining whether different soft science disciplines interpret the same phenomenon differently from hard science disciplines. Content analysis is a set of techniques that enables the breakdown of information (e.g., a text) into its simplest constituent components. This analytical approach can partially be placed within the framework known as the Bag-of-Words method (Bolasco, 2013), a coding technique that disregards the order of words and their roles in the text, aiming to simplify the computational processing of a text.

Every day, documentary traces are produced, and with the advent of the internet, these traces have multiplied exponentially, forming what is known as Big Data. The substantial increase in documents has made content analysis a fundamental approach in contemporary research methods. The main purpose of using documents is to understand the worldview or interpretation of a particular actor (users, researchers, political figures, organizations, etc.) who produced the trace. It is important to recognize that documents are social products that convey the viewpoint of the person who produced them. In other words, documents are not neutral, as they stem from specific cultures, have particular purposes, and are thus influenced by context and individual characteristics (Amaturo and Punziano, 2013).

An essential aspect of content analysis is the data collection phase, which precedes the coding and classification of the unit of analysis and the analysis itself, culminating in the presentation of results. In the data collection phase, the researcher focuses on the following:

- data access: The researcher must determine whether the documents are institutional (and thus whether there is an archive and whether it is accessible) or private. In the latter case, the researcher must figure out how to obtain access, whether through direct contact, payment, or the use of an archive;
- data selection: The researcher must also decide how much and which part of the documentation to analyze, as well as consider the originality of the document—although this concern has become obsolete in the case of digital documents.

These two steps were carried out following the assumptions of content analysis as an inquiry (Losito, 1993), a type of content analysis that, in this case, falls into the third category (Rositi, 2000). Similar to the construction of a survey, the researcher interrogates the content, where, instead of sequentially posing questionnaire questions, a series of entries related to the collected content is considered. These entries «are nothing more than the variables to be inserted into the data matrix for analysis purposes» (Amaturo and Punziano, 2013: 144).

The operational definition phase, which underpins the process of constructing the empirical basis, involved dividing the content into 3 domains each containing a set of variables (Table 2):

1. general information;
2. publication information;
3. content information

The first domain includes the operationalization of variables related to *the language, the year and the geographical area of publication*. The second domain includes variables related to the *number of citations and the research area*. The third domain, finally, includes variables related to the *title, the abstract and the keywords* of each record.

Table 2 – The building of the empirical base

General Information			**Publication Information**		**Content Information**		
Language	Year of Publication	Geographical Area	Citation	Research Area	Title	Abstract	Keywords
Nominal variable	Ordinal variable	Nominal variable	Interval variable	Nominal variable	Text variables		

In the present research, after data collection, a corpus was constructed by concatenating the variables of the third domain, creating a single textual variable. This corpus was cleaned of natural noise resulting from the automatic data collection process. For instance, one publication was found to contain Spanish and Chinese text, despite being marked as English, and therefore the non-English sections were removed. Additionally, it was found that the acronym "AI" (which in our context refers to Artificial Intelligence) was used inconsistently, so studies using the acronym in an unexpected sense were manually excluded. This was achieved by observing the usage contexts of the acronym.

The corpus, generated using T-LAB software, was then processed using the Latent Dirichlet Allocation (LDA) algorithm (Blei et al., 2003), a bottom-up Bayesian procedure for topic modeling developed in 2003. This process is characterized by interpreting each document as a collection of topics, which in turn are determined by specific terms. These terms combine to form a topic, with the key feature of this process being the interchangeability of terms and topics within a document. In other words, LDA allows us to learn the distribution of topics from a collection of documents, enabling us to predict the topic distribution in a new document based on the terms it contains (Blei et al., 2003).

Subsequently, we applied Lexical Correspondence Analysis (LCA), a multidimensional analysis technique in which the minimal unit of meaning is the individual word or graphic form (Amaturo and Punziano, 2013). Once applied to a text, this procedure seeks and visualizes latent linguistic structures that express prevalent concepts or themes. The graphic representation produced by this approach is displayed on a factorial plane formed by two independent dimensions of meaning—factors—each representing a latent aspect of the association of the observed data. The dispersion of terms around the axes' origin shows the strength of the association. The farther a point (a word) is from the origin of an axis, the greater its contribution to that axis. The closer the points, the greater the interdependence between the categories represented by those points. Additionally, the value of the coordinates on the graph suggests the importance of a point relative to the axis. The proximity of words or word categories on the factorial plane indicates their combination or association within the text. In fact, the closeness of two terms on the factorial plane shows their similar use within the observed document. In contrast, the proximity of two documents on the plane indicates the presence of a similar vocabulary in both.

Next, a Cluster Analysis was conducted. This term refers to a set of data analysis procedures that group elements of a set into clusters based on their similarity and homogeneity. Clustering involves comparing objects based on their characteristics. The clusters adhere to two criteria: cohesion, meaning the statistical units in each group share similar characteristics, and separability, meaning different clusters are as distinct as possible.

The collected corpus consists of 8,051 documents, with each document containing the title and abstract of a specific publication. Afterward, the corpus underwent preprocessing, performed automatically by T-LAB software. This process reduced the heterogeneity of the corpus through lemmatization (i.e., reducing morphological heterogeneity), which involved removing numerical characters, punctuation, and stop words. Simultaneously, the software also cleaned lexical, reducing the text to minimal sense units and consolidating terms that shared the same semantic field.

Following this process, the corpus' size, denoted as N, was reduced to 1,674,150 tokens. Identical tokens were stacked, forming the vocabulary (V), which contains 42,526 types, of which 18,129 are hapaxes. Each type in the vocabulary is associated with a count of occurrences (i.e., how many times the token appears in the corpus). The type-token ratio (TTR) of the entire corpus indicates language diversity, with a value of 2.5%, below the 20% threshold, suggesting a collection sufficiently large to capture linguistic richness. The linguistic sophistication, indicated by the ratio between the number of hapaxes (words that appear only once) and the vocabulary size, is 42.6%, lower than the 50% threshold, and therefore considered acceptable.

In conclusion, the topic modeling returned the following themes:

1. Artificial intelligence (13%)
2. Algorithmic development (11%)
3. Algorithmic consuptiion (6%)
4. Data treatment (9%)
5. Health (7%)

6. Work and economy (10%)
7. Social Platform (9%)
8. Machine Learning (9%)
9. Recomendation and personalization (13%)
10. Eduation (12%)

5.1 Lexical Correspondence Analysis and Cluster Analysis

The themes that emerged constitute different perspectives on the same subject. To understand the relationships between topics and research areas, multidimensional analysis techniques are required, starting with Lexical Correspondence Analysis (ACL) (Benzecri, 1973; Lebart et al., 1998) and followed by Cluster Analysis (Lebart, 1994).

The results obtained through ACL represent two latent dimensions, called factors. These factors are crossed and represented on a factorial plane showing the topics previously described, the most representative terms of each topic, the active variables used for the analysis, and illustrative variables (Figure 11), which do not influence the construction of the factors. The active variables are the number of citations of the publication, the research area, and the topics outlined through topic modeling; the illustrative variables include the year of publication and the publication region. The total inertia extracted by the two factors is 18.21% (9.18% from the x-axis and 9.03% from the y-axis).

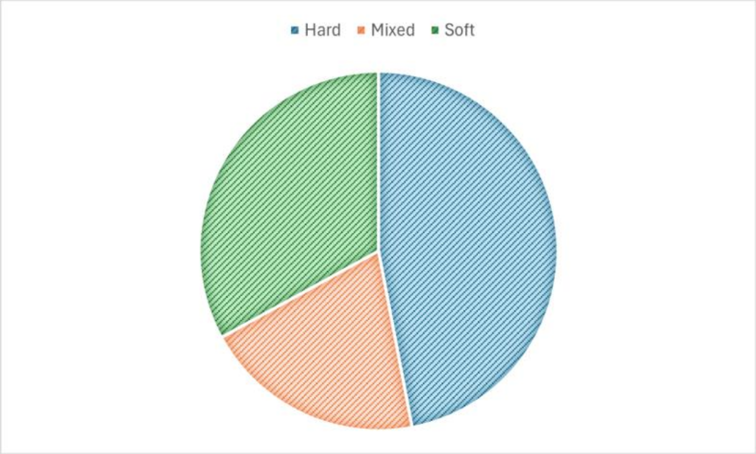
Specifically, regarding the active and illustrative variables, the number of citations (Table 3) is divided into quartile classes, each containing 25% of the entire corpus.

Table 3 – Number of citations in quartile classes.

Quartile Label	**number of citations**
FirstCit	0-1
SecondCit	2-4
ThirdCit	5-14
FourthCit	15+

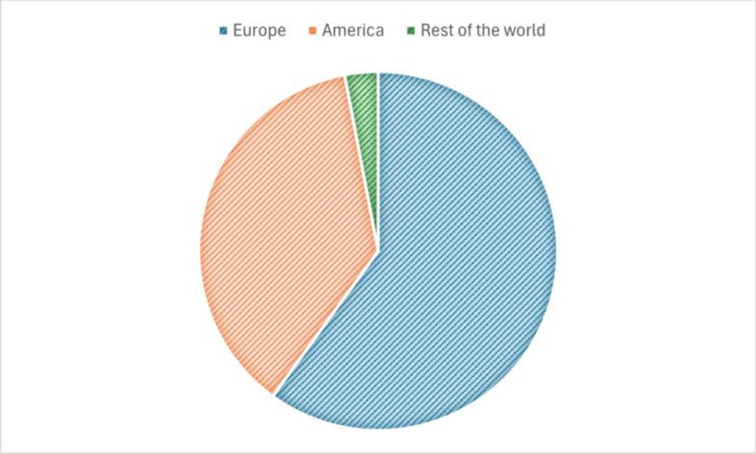
The research area (Figure 9) is divided into three categories: soft, mixed, and hard. “Soft” refers to a publication focused on a single discipline categorized as a soft science; “mixed” refers to a publication that spans two or more soft science disciplines; and “hard” refers to a publication that, besides covering at least one soft science discipline, also connects to at least one hard science discipline.

Figure 9- Scientific papers per research area



The region of publication was collected from WOS as the city of publication. To reduce data dispersion, cities were grouped by continent. Additionally, due to lower occurrences, Asia, Oceania, and Africa were grouped into a single category labeled "Rest of the World" (Figure 10).

Figure 10 – Scientific papers per geographical area



As shown in Figure 11, the first factor obtained relates to the social-technical sphere. On the positive semi-axis, publications focus on technical aspects of algorithms, recommendation systems, and feedback loops. On the negative semi-axis, publications discuss the social implications of adopting these technologies. The positioning of the research area confirms this factor points: soft science and mixed publications are shifted toward the negative semi-axis, while hard science publications are shifted toward the positive semi-axis. The social semi-axis is characterized by topics such as social platforms, algorithmic consumption, labor and economy, education, and artificial intelligence. These topics focus on the social consequences of applying certain technologies, such as changes in human relationships, social network dynamics, the spread of fake news, and the alteration of consumption patterns due to recommendation systems. Ethical and regulatory issues also arise from the increasing pervasiveness of AI in society. On the positive semi-axis, terms like “treatment,” “cancer,” “graph,” and “recommendation” describe more technical applications. Conversely, the negative semi-axis includes terms that represent the social nature of the phenomenon: “influencer”, “medium”, “brand”, “ethical”, and “political”.

The second dimension represents subjects on the positive semi-axis, reflecting the individual and personal use of algorithms and recommendation systems, with a sense of flexibility. The education topic characterizes this semi-axis, as publications discuss personalized curricula tailored to the specific needs of students. Key terms include “student,” “teacher,” “tutor,” “project,” “feedback,” and “personalize.” When discussing specific user demographics, the negative semi-axis concerns sectors, both disciplinary areas and target groups. The health topic characterizes this semi-axis, as publications focus on standardized treatment or diagnostic methods. Another significant topic is algorithmic consumption, reflecting the standardization of cultural consumption and the view of individuals not as unique but as part of a target group. Key terms include various diseases such as HPV, cancer, and diabetes, along with the names of popular social media platforms like YouTube and Twitter.

Figures 11- Factoral plan with active and illustrative variable illustrated (made by T-Lab)

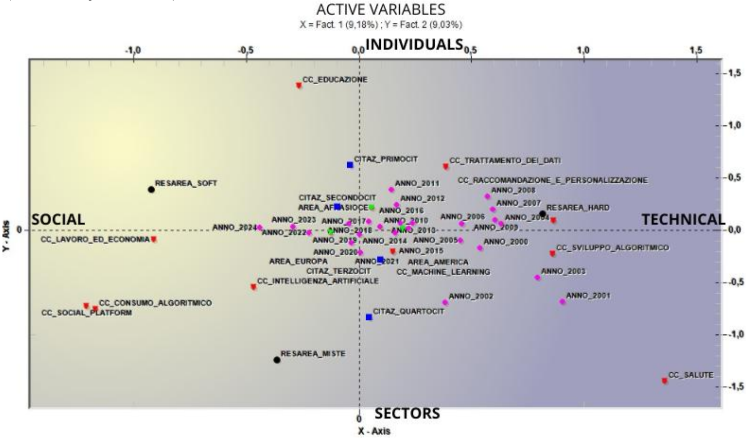
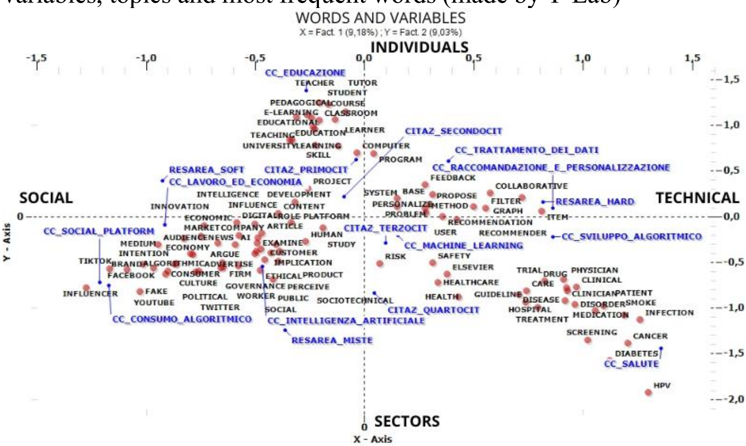


Figure 12 – ACL factorial plan with active variables, illustrative variables, topics and most frequent words (made by T-Lab)

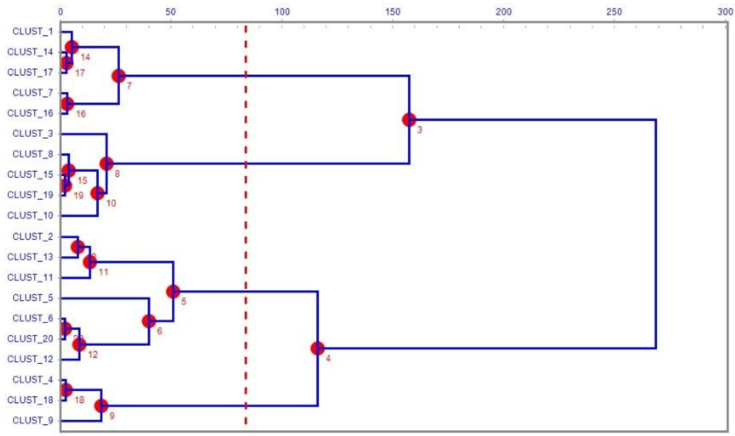


Having defined the latent dimensions of our plane, the objective is to systematize the findings, including the different interpretations and definitions of the same topic.

The reading of the key insights projected onto the graph is guided by the stretching of the temporal dimension on the graph. Observing the graph, it is possible to note how the four previously described temporal phases extend from the right side (which intersects individuals and sectors with the technical plane) toward the left side (which intersects individuals and sectors with the social plane).

To delve further into the analysis and further synthesize the information contained in the dataset, a cluster analysis was performed. A hierarchical clustering method was adopted, meaning that the number of clusters to analyse was not predetermined; instead, the optimal partition was chosen by cutting the dendrogram (Figure 13).

Figure 13- Dendrogram graph with three cluster partition (made by T-Lab)



Four clusters emerged (Figure 14), aligning with the quadrants of the factorial plane. Each cluster can thus be interpreted according to the semi-axes on which they are positioned, representing a conceptual sphere of our topic of investigation. These clusters reflect different interpretations and visions based on the context and the period when the analyzed documents were published.

1. *Cluster 1 (blue) - "Instrument in Design"***:** This cluster is characterized by the technical and subject semi-axes. The most representative terms include "user," "item," "recommendation," "propose," "filter," "model," "collaborative," "dataset," "method," and "retrieval." This cluster represents a design phase, with publications focusing on algorithmic development and recommendation and personalization systems. The technological applications are still in an experimental and investigative stage. The term "instrument in design" refers to both the technical and

conceptual phases, as the research topic is in an embryonic stage, with an ongoing search for appropriate scientific methods. The feedback loop is seen as a concept with unclear boundaries, still seeking optimal application. Algorithms are regarded as tools in the design phase.

2. *Cluster 2 (light blue) - "Technical Instrument":* This cluster is characterized by the technical and structure semi-axes and is strongly influenced by medical terms. The most frequent words include "patient," "health," "treatment," "screening," "clinical," "cancer," and "risk." Publications in this cluster are often highly cited and are positioned in the higher quartiles of citation distribution. This cluster illustrates how some disciplines, particularly hard sciences, have greater scientific prominence. The term "standardization" defines this cluster, as it reflects the search for a universal solution to a general problem, such as a disease. Algorithms are regarded as technical instruments for maximizing the results of a codified process, viewed as a technical tool for standardized processes.
3. *Cluster 3 (red) - "Social Instrument"* : This cluster is characterized by the social and subject semi-axes, predominantly related to education. The most common terms include "student," "learning," "course," "teaching," "program," "university," and "skill." The term "individualization" can summarize this cluster, as publications focus on algorithmic applications for customizing education to individual student needs. The feedback loop is treated from a social perspective but still considers individual needs. Algorithms are seen as technical tools applied in social contexts, though the cooperation between the user and the algorithm remains separate and not dynamic.
4. *Cluster 4 (pink) - "Social Actor"*: This cluster is characterized by the social and structure semi-axes. The defining terms include "medium," "consumer," "AI," "news," "social," "economy," and "digital." The term "massification" summarizes this cluster, where consumers are considered target groups. Feedback loops in social networks and platforms are central here, reinforcing the concept of filter bubbles (Pariser, 2011). Algorithms are regarded as social actors in digital environments, participating in processes of socialization, cultural consumption, and information dissemination. The interaction between users and algorithms becomes nearly instantaneous, as seen on platforms like TikTok, where content adapts based on minimal user interactions.

Following this reading, we see how scientific production progressively moves from a purely technical approach to the topic (concerning the development and structure of algorithms and the underlying processes) toward discussions related to the application contexts of algorithms and their resulting effects.

In this sense, the information contained in the dataset is synthesized into a progressive perspective that centers on the relationship between individuals and algorithms. Consequently, it cannot exclude a discussion on the topic of agency and the (non) neutrality of algorithms.

Proceeding in an orderly manner, it is possible to virtually overlay on the plane the three constitutive elements of the embedded process related to human agency (Klinger and Svensson, 2018), originally elaborated by Emirbayer and Mische (1998): *iteration, practical evaluation, and projectivity* (Figure 14).

Starting from the technical side, where the first two temporal phases are located, all aspects related to the connections between agency and the past (iteration) and agency and the present of individuals (practical evaluation) emerge. These aspects are evident in scientific productions focused on algorithmic innovation in terms of development and its possible implications for individual statuses and conditions over time (data processing, recommendations, and personalizations). This type of production aligns with the need to discuss patterns and selective models which, according to Emirbayer and Mische (1998), concern the opportunities to "sustain identities, interactions, and institutions over time" (p. 971). Initially, these discussions revolve around "algorithmic calculations, how they are designed to select, recognize types, locate categories, sort and rank big/thick/trace data from the past" (Klinger and Svensson, 2018, p. 4660).

If, on this side of the process, the discussion on algorithms focuses on their static and purely structural aspects (primarily addressed by fields related to hard sciences) the discourse shifts as we follow the temporal dimension and move toward the social side of the plane, where the last two phases are located.

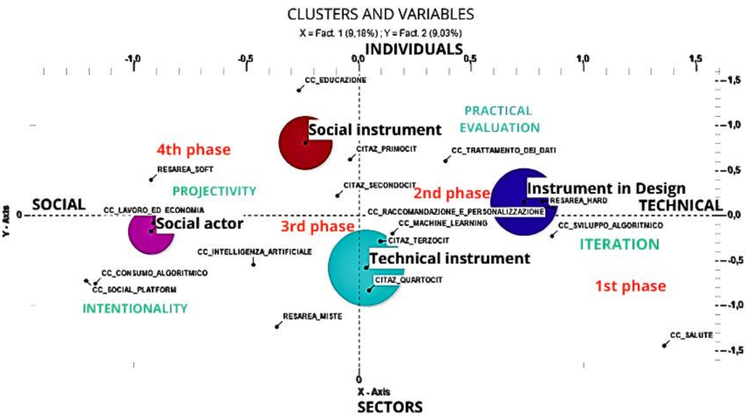
On this side of the plane, as mentioned, we find all elements of scientific production predominantly related to the field of soft sciences, which only partially concern structural aspects (such as artificial intelligence). Instead, they focus mainly on algorithmic applications in terms of context (work and economy, social platforms).

From this, a reading emerges that aligns with the third element of projectivity, corresponding to all possibilities of forecasting and commercial strategy applied even to social platforms, based on digital traces left online and the profiling and recommendations generated through the aforementioned processes of iteration and practical evaluation.

In light of the dataset's synthesis, there arises a need to further focus on the non-neutrality of the algorithm, understood as a series of processes capable of autonomously making decisions. If we also consider the fourth element of *intentionality* (Mitcham, 2014) it becomes necessary to interpret algorithmic logic as a complex process connected both to its application context (fields of intervention, media logics, etc.) and to human intervention. A process that, following Latour's (1992) contribution, possesses human, non-human, unhuman, and inhuman characteristics.

In conclusion, one crucial conclusion emerges clearly from this analsysis: today, it is essential to approach the study of this topic without neglecting the theoretical perspective of Actor-Network Theory (ANT) (Latour, 1992). The principles of ANT allow for a focus on the human-nonhuman relationship, enabling contemporary social researchers not only to explore digital technologies and devices but also to shed light on the role of algorithms and recommendation processes. This endeavour becomes possible by formulating the right research questions and drawing on the extensive body of literature produced on this topic over the past decades in the field of soft sciences, as empirically demonstrated in this work. These studies enable an appropriate categorization of processes and concepts linked to nonhumans and their agency, considering them as "Mediators" rather than mere "Intermediaries" (Sayes, 2014, p. 138). This role suggests moving beyond intellectual reductionism regarding their direct replacement of human actors, instead conceiving them as "transcendental conditions for our collectives, nor are they merely a black box that lines up other actors, nor are they merely placeholders for a human actor" (*ibidem*).

Figures 14 – Cluster superimposed on ACL factoral plan (made by T-Lab)



6. CONCLUSIONS

This work has explored how definitions and concepts related to the algorithmic feedback loop have evolved over time. Specifically, the changes in the field of soft sciences from 2000 to 2023 were analyzed. A Systematic Literature Review (SLR) was conducted to highlight the increasing interest in the topic and the resulting proliferation of publications, revealing that soft sciences experienced proportionally greater growth than hard sciences.

The temporal analysis identified four main phases: the technological phase (2000–2006), the social phase (2007–2012), the platform phase (2013–2017), and the artificial intelligence phase (2018–2023). These phases laid the groundwork for understanding the different perspectives that the same topic could take over time and across various disciplines.

Subsequently, ten topics were defined to systematize the various focal points of the publications, ranging from artificial intelligence to the application of algorithms in educational and healthcare contexts. Finally, the ACL and cluster analysis confirmed a division between a more technical scientific debate and a social vision, while also acknowledging the growing presence of interdisciplinary approaches that combine hard and soft sciences.

The interpretation of the cluster analysis highlighted different perspectives and views on the concept of the algorithmic feedback loop within our study sample. Four clusters were defined, bringing to the forefront the concept of an "actant," defined as "any entity that acts, regardless of its ontological status (human or non-human, concrete or abstract), size, scale (individual or aggregated), or specific characteristics" (Magaudda and Neresini, 2020). Feedback loops are processes that characterise the interaction between users and recommender systems (Airoldi, Beraldo and Gandini, 2016) and this leads to understand how the algorithms increasingly take on the role of active agents in society, embedded in a network of entities that, through their relationships, determine the observed effects. From this perspective, algorithms acquire a form of agency—the capacity to influence processes and actively participate in shaping them. This highlights how data and outputs are not merely generated by users but are also molded by the underlying logic of platforms. (Beer, 2022). This social role held by the algorithmic feedback loop, as explained in the social actor cluster, characterized by the most recent publications, strengthens the hypothesis that soft sciences are paying increasing attention to the topic, surpassing hard sciences in proportional growth from their starting point.

These initial conclusions, in turn, open up several other issues and challenges to address. Foremost among them is the methodological question: on the one hand, the paradigmatic directions to consider, and on the other, the set of research techniques and tools necessary and most helpful in pursuing the knowledge objectives set forth.

The study should not be considered conclusive; instead, it leads to other open questions and queries that will need to be investigated further. Notably, if the concept of algorithmic feedback loops has changed so drastically in recent years, it is reasonable to expect that it can change again, offering opportunities for further reflection and exploration. Attention should be drawn to the longstanding rivalry between the soft and hard sciences. Given the profound societal impact of algorithms (particularly on cultural diversity, user opinions, and online social dynamics) can reflections on this issue continue to follow separate disciplinary paths? Or is it now imperative that discussions bridge both paradigms to address the topic comprehensively? Ultimately, the results show how topics such as algorithms, recommendation systems, and feedback loops have undergone a conceptual shift. There has been a move from a strictly technical focus to increasingly emphasizing social and ethical aspects.

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THE USE OF ARTIFICIAL INTELLIGENCE WITHIN SOCIAL RESEARCH: A CLASSIFICATION PROPOSAL

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Abstract

Artificial Intelligence (AI) has recently been applied to different areas of behavioral and social sciences, offering significant benefits at various stages of the research process. Through a multi-channel strategy, it was analyzed the content published by AI experts and users to construct a classification of AI-powered tools functions and return a reflection on possible limitations and opportunities, focusing on the assistance these tools can provide within social research phases.

Keywords

Artificial Intelligence; Social research; Digital social research; Mapping AI

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1. THE USE OF AI IN SOCIAL RESEARCH

Artificial Intelligence (AI), understood as a field of study concerned with the development of "thinking" machines and related technologies (McCarthy, 2007), has only recently been applied to different areas of behavioral and social sciences (Robila, Robila, 2020). It should be noted that until a few years ago, AI was talked about mainly from a theoretical point of view (Prather et al., 2023); only in the last period, thanks to the increase in intellectual and financial investments by researchers and major technology companies, the changes linked to the AI diffusion are underway and have captured the collective awareness also from an instrumental point of view (Markowitz, Boyd, Blackburn, 2024), attracting considerable attention in recent years due to the strong impact that generative AI is starting to have on daily routines, on work routines, but in general on everyday life (Giordano et al., 2024). Nowadays, AI tools are also increasingly recognized as a powerful tool in the field of social research, offering significant benefits at various stages of the research process (Grossmann et al., 2023). Recently, several authors (Alowais et al., 2023, Li, 2023; Markowitz, Boyd, Blackburn, 2024) focused the attention on the ways in which AI can be leveraged to make social research more efficient, especially with regard to the use of digital technologies. To date, after all, it is difficult to find studies or research that have not included, at least in one of the research phases, the support of digital technologies – just think of querying online databases or using the main analysis software systems: the current socio-technological context is the result of a society completely immersed in the digital world (Lupton, 2014), where the distinction between online and offline social life has become increasingly porous (Pink, 2009) and where the "digital world" (Rogers, 2013; 2019), configured as an interdisciplinary dimension and a meeting point between all scientific sectors that question human behavior (Cavagnuolo, 2022), consists of the so-called Open and Big Data.

Nevertheless, in the social research community, the adoption of AI is not yet a common practice, because there are still many doubts about its use, like ethical constraints and large language models (LLMs) biases (Grossmann et al., 2023). In the ever-evolving landscape of technology, each new technology often encounters a phase of perceived perplexity: this initial condition is a natural response to the unfamiliarity of groundbreaking advancements. Just as the telephone, the internet, and smartphones once seemed daunting and complex, today's emerging technologies be it AI, virtual reality, or blockchain face similar skepticism and uncertainty. However, history has shown us that this perplexity is merely a steppingstone (Smiley and Fisher, 2022). Over time, as individuals begin to understand and adapt to these new tools, they gradually integrate them into their daily lives (Hamad and Jia, 2022). The initial barriers of comprehension and acceptance dissolve, paving the way for widespread adoption (Murthy and Mani, 2013). Reflecting on the trajectory of past technologies, it is possible to see a pattern: what was once revolutionary becomes routine. The same will hold true for today's innovations.

Researchers' reservations towards the transformative innovation linked to AI may be attributed to the perspective from which these new technologies are observed, analyzed, and ultimately perceived (Bewersdorff et al., 2023). For example, it is not well-known the relation between generative AI and AI-powered tools; this makes people worried that AI could replace researchers in the future (Frey and Osborne, 2017; Colombo et al., 2019). Generative AI, indeed, is capable of generating new content, such as text, images, videos, codes, etc., starting from previous examples or instructions; AI-powered tools, on the other hand, by taking advantage of a user-friendly interface, make it possible to take advantage of the benefits derived from AI without necessarily possessing technical knowledge in computer science or engineering. In this way, even software that was not designed to help social research can be used by a well-prepared social scientist and identified as tools that can improve social research quality. While some researchers may be hesitant to incorporate AI-powered tools and techniques into their work, in recent years lots of social researchers have been exploring the potential of digital technologies (Punziano and Amaturo, 2018; Capogna, 2023; Rogers, 2013, 2024; Es-haghi, Anitescu, Rabczuk, 2024) and therefore among some of them there is a growing recognition of the potential benefits that these technologies can offer, such as enhancing data analysis, improving research efficiency, and the ability to uncover novel insights (Perkins and Roe, 2024; Markowitz, Boyd, Blackburn, 2024). Indeed, AI can offer numerous opportunities to researchers (Alowais et al., 2023). This disparity between the potential of AI and its actual implementation within the field of social research could be due to the realities that researchers face in their daily work, particularly those working in academia (Hajkowicz et al., 2023). Academics in the social sciences often face significant constraints, such as limited funding, heavy teaching loads, and pressure to publish in high-impact journals, since career progression in the academic domain is inextricably linked to the production of scholarly contributions, which in turn facilitate the attainment of national teaching qualifications. Moreover, it is well established that researchers constantly navigate their daily lives amidst a myriad of challenges: they must balance a heavy workload, juggling teaching commitments, research deadlines, and navigating administrative bureaucracy on a regular basis (Bellè et al., 2015). These factors can make it challenging for researchers to dedicate sufficient time and resources to exploring new technologies like AI; indeed, even the adoption of AI-powered tools may require additional training and expertise that are not always readily available within the social science community. Consequently, some researchers may be hesitant to invest in these new technologies, preferring to rely on more familiar methods and approaches that are well-established within their respective fields; on the other hand, these circumstances create an opening for a specific application of AI as an assistant to researchers in various phases of their work (Chubb et al., 2021), not solely to conserve time and energy, but also for uncover novel insights that further the advancement of social research (Perkins and Roe, 2024). In order to support scholars who could benefit from the support of this software, this paper aims to provide a practical overview of the possible uses of AI-powered tools in social research.

2. METHODOLOGY AND REVIEW OF ARTIFICIAL INTELLIGENCE TOOLS

Based on these considerations, this study aims to develop a comprehensive classification of functionalities of AI software used in social research. This classification aims to categorize these tools according to the specific assistance they can provide at different stages of the research process (Corbetta, 1999; Dave and Patel, 2023; Tovar, 2023; Ali, 2024; Khalifa, Albadawy, Iqbal, 2024).

To facilitate the extraction of relevant AI tools, a multichannel strategy was employed. This strategy involved the use of various keywords[1] about the application of AI, which were input into leading search engines (such as Google, Bing, and Yahoo), academic databases (including Scopus, Web of Science, and Google Scholar), and prominent social media platforms (such as Facebook, Instagram, TikTok, and YouTube). The purpose of this approach was to systematically gather

[1] AI tools, Artificial intelligence tools, AI instruments, AI-powered tools, Intelligent System, LLM (Large Language Models), AI-driven software, AI-enabled applications, AI-assisted technology, AI automation tools, Intelligent automation, AI-based solutions, AI-powered platforms, AI writing assistant, AI-powered writing tools, AI-generated content, AI-powered document analysis, AI task automation, AI-powered scheduling, AI-powered email assistant, AI for workflow automation, AI transcription tools.

papers, tools, videos, and workshops from experts in the field[2], thereby elucidating the functions and potential of these AI tools.

Through this initial reconnaissance, approximately 350 AI tools were identified. Subsequently, through a manual coding of their functions, AI tools were organized into six overarching domains of expertise. These domains are pertinent to a wide range of contexts, encompassing both professional and everyday activities:

1. *Content Creation and Editing:* AI dedicated to content creation and editing refers to systems and algorithms designed to assist or automate the production and modification of multimedia content, including text, images, video, and audio. These AI systems can generate new works or optimize existing content, thereby enhancing the efficiency of the creative process.

2. *Analysis and Research:* AI systems focused on analysis and research are designed to process, interpret, and derive insights from large volumes of data across various domains. These AI tools leverage advanced algorithms, such as machine learning and natural language processing, to identify patterns, make predictions, and provide data-driven recommendations.

3. *Development and Innovation:* This type of AI, focused on development and innovation, is designed to facilitate the creation of new technologies, products, and processes. In development, AI assists in automating complex design tasks, improving efficiency in engineering processes, and enabling rapid prototyping. In innovation, AI enables the discovery of novel solutions, drives technological advancements, and fosters creativity by analyzing vast datasets and simulating potential outcomes. The integration of AI in development and innovation accelerates progress, reduces time-to-market, and supports cutting-edge research, making it a critical tool for advancing modern industries.

4. *Assistance and Support:* AI systems focused on assistance and support are designed to enhance human tasks by providing real-time help, automating routine activities, and offering personalized solutions across various domains. Utilizing natural language processing,

[2] "Experts" are defined as users on the main social media platforms who provide courses and publish content about the functionality and use of AI tools.

machine learning, and data-driven algorithms, these systems understand user needs and streamline workflows. In customer service, AI-powered chatbots and virtual assistants efficiently handle inquiries and solve problems. In professional environments, AI tools aid in decision-making, schedule management, and task automation, improving productivity and reducing human error. By integrating into everyday processes, AI enhances user experiences, optimizes operations, and facilitates seamless interaction between humans and technology.

5. *Commerce, Marketing and Finance:* AI systems focused on assistance and support are designed to enhance human tasks by providing real-time help, automating routine activities, and offering personalized solutions across various domains. Utilizing natural language processing, machine learning, and data-driven algorithms, these systems understand user needs and streamline workflows. In customer service, AI-powered chatbots and virtual assistants efficiently handle inquiries and solve problems. In professional environments, AI tools aid in decision-making, schedule management, and task automation, improving productivity and reducing human error. By integrating into everyday processes, AI enhances user experiences, optimizes operations, and facilitates seamless interaction between humans and technology.

6. *Leisure and Relationship*: AI systems focused on assistance and support are designed to enhance human tasks by providing real-time help, automating routine activities, and offering personalized solutions across various domains. Utilizing natural language processing, machine learning, and data-driven algorithms, these systems understand user needs and streamline workflows. In customer service, AI-powered chatbots and virtual assistants efficiently handle inquiries and solve problems. In professional environments, AI tools aid in decision-making, schedule management, and task automation, improving productivity and reducing human error. By integrating into everyday processes, AI enhances user experiences, optimizes operations, and facilitates seamless interaction between humans and technology.

Follow a specific example of use:

Table 1. AI domains mapping

AI domains	***Example of use in all fields***
Content creation and editing	Art, Audio, Avatar generation, Content Creation, Copywriting, Image Editing, Video Editing, Storytelling, Summarizer, Transcription, Presentation, Educational, Podcasting, Translation.
Analysis and Research	Digital Data Analys, Research, Search Engine, Spreadsheet.
Development and Innovation	Code Assistant, Build AI, Startup Tools.
Assistance and Support	Career, ChatBots, Plugins Tools, Coaching, Life Assistant, Healthcare, Legal Assistant, Productivity, Writing.
Commerce, Marketing and Finance	Business, Ecommerce, Marketing, Finance, Logo Generator, Gaming, Design, Real estate.
Leisure and Relationship	Fashion, Travel, Experiments, Gift Ideas, Astrology, Dating.

The AI tools corresponding to the six domains were subsequently analyzed using a content analysis as a survey (Losito, 1993; Faggiano, 2022), focusing on their functions and their hypothetical contributions to the various stages of research. Specifically, to provide both a summary of the types of AI applicable within research and subsequently a synoptic table outlining the specific indications regarding the stages where these tools can act as assistants, several variables were included in the analysis framework: *name, link, available version, monthly price, annual price, free functions, functions, common usage, hypothetical application within social research, support during the literature review phase, support in identifying hypotheses and research questions, support in the construction and testing of instruments, support during data collection, support during data analysis, support during dissemination, and researcher notes.*

Indeed, a key aspect of this work is the examination and placement of AI software within the various stages of social research (Dave and Patel, 2023; Tovar, 2023; Ali, 2024; Khalifa, Albadawy, Iqbal, 2024), aiming to establish an initial attempt at classification and to provide a reflection on the potential limitations and opportunities.

3. ARTIFICIAL INTELLIGENCE TOOLS APPLICABLE IN SOCIAL RESEARCH

Approximately 31% of the types of AI analyzed through the development of the content analysis framework were identified as potential assistants in academic social research. These findings enabled the construction of a mapping of AI types applicable within the context of social research. In this regard, a detailed overview of various AI tools designed for applications in social research is proposed. These tools are aimed at enhancing the efficiency, effectiveness, and creativity of research methodologies, thereby facilitating improved collection, analysis, and presentation of data. Each category of AI tool serves specific purposes, making significant contributions to the evolving landscape of social research.

The first category is *art tools*, which includes comics-based research and visual narratives. These innovative approaches promote creative methodologies that engage audiences effectively. Comics-based research utilizes visual storytelling to convey complex ideas, making findings accessible to a broader audience. By integrating imagery and sequential art, researchers can communicate outcomes more effectively. Visual narratives serve a similar purpose, allowing researchers to depict social phenomena visually. The integration of these art tools signifies a shift toward more inclusive and engaging research practices, enabling the participants to take an active role in the research process and the researchers to present data creatively and compellingly (Kuttner, Weaver-Hightower, Sousanis, 2020; Moretti, 2023).

The use of *avatars* is another critical development in social research. Avatars facilitate anonymity, especially in sensitive research contexts where participants may be uncomfortable revealing their identities. By generating virtual representations, researchers ensure confidentiality while promoting active engagement in the research process (Bente et al., 2010). This is particularly relevant for studies addressing sensitive topics, such as mental health. Furthermore, avatars encourage active participation by enabling individuals to interact in virtual settings, allowing for greater expression without real-world identity constraints. This sense of safety fosters richer data collection and enhances the quality of research outcomes. Furthermore, avatars can facilitate the active involvement of multiple subjects in social research (Zhang et al., 2020) and function as virtual tutors (Dede, 2009). Additionally, they can be employed for dissemination activities (Baker et al., 2020).

The *Build AI* category allows researchers to seamlessly integrate various research instruments, facilitating the development of customized tools tailored to specific research needs. This integration enhances the research experience by streamlining workflows and reducing redundancy. The ability to generate personalized instruments helps researchers design tools that directly address their objectives, adapting to the dynamic nature of research methodologies (Chaudhry, Wajid, Hussain, 2023).

Chatbots provide guidance and support across various tasks, helping researchers navigate databases, retrieve information, and suggest relevant literature. Immediate access to assistance streamlines the research process, allowing researchers to concentrate on analysis rather than spending excessive time searching for resources. In addition to information retrieval, chatbots can manage schedules and remind researchers of tasks, ultimately enhancing productivity and efficiency throughout the research process (Schneider and Walther, 2019; O'Neill, 2021).

In the realm of data science, *code assistants* play a vital role in helping researchers create and refine programming code. These tools offer guidance on best practices, troubleshoot errors, and suggest improvements, reducing the learning curve for those less experienced in programming. By simplifying the coding process, researchers can focus more on analysis and interpretation rather than getting bogged down in coding complexities. This support accelerates the development of research tools and enhances the quality of analyses, which is critical in a data-driven research environment (Ray and Ghosh, 2020; Moussa and Ragan, 2022).

AI tools for *content creation* provide significant advantages for researchers involved in producing digital materials, including reports and presentations. By automating content generation, researchers save time while ensuring their materials are well-structured and effectively communicate findings. For example, these tools can convert complex data into visually appealing graphics or summarize key findings, allowing researchers to focus on narrative and interpretation (Kumar and Gupta, 2021; Gürhan-Canli, 2022; Singh and Kumar, 2024).

In the field of data analysis, AI tools *assist researchers* throughout the analytical process, encompassing data collection, cleaning, and analysis. By automating data collection, researchers can efficiently gather large datasets from diverse sources. AI-driven data cleaning tools identify and rectify inconsistencies, ensuring the reliability and accuracy of datasets. Once the data is cleaned, AI tools facilitate advanced analytical techniques, helping researchers extract meaningful insights from complex datasets. The application of AI in data analysis extends to digital user behaviors, enabling researchers to analyze trends and derive conclusions that inform their research objectives. These tools are particularly useful for studies involving online users and digital data analysis. Researchers can also request AI to generate formulas based on inquiries, which can then be used in programs like Excel, R and Python (Khanna and Choudhury, 2022; Hussain, 2023; Ganaie and Aakanksha, 2023).

AI tools also play a crucial role in ensuring ethical compliance in social research. *Legal assistant* tools simplify the creation of privacy forms and legal documents necessary for primary data collection, such as interviews and surveys. By automating the drafting process, these tools help researchers adhere to legal and ethical standards while saving time and resources. This support is critical in protecting participants' rights and enhancing the credibility of the research (Gonzalez, 2023).

Another category of AI tools focuses on *cataloging and interrogating content*. Productivity and research tools facilitate the cataloging and querying of both online and traditional content. Researchers can catalog materials gathered from websites or papers and subsequently query them to collect, classify, visualize (e.g., through mapping), and analyze the content (Huang and Wu, 2022; Alfawzan and Qureshi, 2023). These tools are valuable not only for literature review phases but also for extracting texts and structuring analytical tools such as content analysis forms for inquiries or meta-analyses.

AI tools also enable document aggregation across multiple platforms, including *search engines* and specialized databases. This function allows researchers to access a broader range of literature and data sources. By automating document retrieval, researchers save significant time and effort, focusing more on analysis and synthesis. The ability to aggregate documents enhances literature reviews and helps researchers stay current with developments in their fields, ensuring their work is informed by diverse perspectives. In detail, search engine AI tools collect documents across various search engines, specialized platforms, and academic databases (Xie and Li, 2021; Huang and Wu, 2022; Jiang and Wang, 2022; Feng and Zhang, 2023).

AI tools for content synthesis are valuable for researchers seeking to distill complex information into concise summaries. These tools can process various content types, enabling effective summarization of papers and presentations. The ability to generate synthesis maps helps researchers visualize their findings and organize their thoughts, improving the clarity of their work. AI-driven transcription tools also enhance efficiency by converting audio or video content into written text.

This capability is particularly useful for transcribing interviews and lectures, allowing researchers to document spoken content without the burdensome task of manual transcription. In particular, AI summarizer tools are designed for synthesizing various content types (written, audio, video) to summarize papers, presentations, and generate maps or summary diagrams (Liu and Li, 2022; Radev and Fan, 2022). While transcription tools are useful for transcribing interviews, lectures, or conference presentations from any content type (written, audio, video) (Khan and Yang, 2022; Gao and Li, 2023).

Finally, AI tools for *translation and writing* assistance significantly enhance the quality of research output. Translation tools enable researchers to access literature in multiple languages, facilitating collaboration across linguistic barriers. Writing assistance tools help refine texts, correct errors, and improve overall writing quality, leading to clearer, more impactful research outputs. The combination of translation and writing assistance empowers researchers to produce high-quality work that resonates with a broader audience, enriching the field of social research. More specifically, translation tools provide simultaneous translation for any type of content (written, audio, video), proving beneficial in various research stages (Hassan and Haffari, 2021; Gao and Li, 2023). Instead, writing AI tools assist in writing, proofreading, and drafting, enabling the implementation or correction of written texts and the reformulation of notes and ideas (O'Reilly and Maher, 2022; Kumar and Singh, 2023; Zou and Zhang, 2023).

4. AI-POWERED TOOLS FUNCTIONS: A PROPOSAL OF CLASSIFICATION AND APPLICATION IN SOCIAL RESEARCH

The mapping presented shows that there is numerous software whose functions can help social researchers in their work; however, their use may require advanced technical skills (e.g. those related to programming) and this can make these tools difficult to access. For these reasons, it was decided to classify the functionality of only AI-powered tools, thus excluding software that required technical training (different from that typical of a social researcher) to be used. The choice to focus on AI-powered tools derives in part from the difficulty for social researchers to engage in parallel training on computer programming and on the other hand from the possibility of exploiting the advantages deriving from this type of technology thanks to the facilitated usability of these tools that do not require programming skills.

Based on the results of the analysis conducted to map the AI tools that could be used in the social research, it was indeed possible to identify 57 AI software and 4 macro-categories of functions useful in the different research phases: Citation Assistance, Communication Assistance, Data Analysis Assistance and Data Extraction Assistance.

4.1. Citation Assistance

This macro-category includes functions that have in common the possibility of helping the researcher in identifying citations to be included, both because some software tools provide libraries of open-source papers, and because others suggest papers to read based on what is being written, allowing an integration of the literature starting from the researcher's intuitions relating to the research problem instead of relying only on the preliminary study on the topic of interest. In addition, the functions of this macro-category include the visualization of the rankings of published contributions and the connections between different papers, as well as verifying the context of a citation. In this way, it is possible to improve the quality of one's scientific contributions because one can achieve a more accurate epistemic genealogy of the investigation problem and verify the correctness of one's own and others' citations, thus avoiding incurring an erroneous and overgeneralized dissemination of supposed research findings (Horbach et al*.*, 2021). Of course, these functions can be particularly useful in the literature review and research dissemination phases, but also as an aid in conducting analyses such as a systematic literature review or network analysis.

4.2. Communication Assistance

This macro-category encompasses functions that have in common the possibility of helping the researcher to overcome problems related to communication barriers, whether linguistic, temporal or cultural, as they allow to generate personalized messages (Shalom, 2024). These are therefore both tools that allow researchers to correct their own or others' texts from a grammatical or formal point of view (also through autocomplete suggestions), and to translate them into written or oral form. In addition, with some tools it is also possible to generate avatars or short videos in different languages. These functions can be useful both in the data collection and dissemination phases, as they allow the researcher to reach a wider audience more easily, regardless of the languages spoken by the researcher. Similarly, the use of avatars instead of real people used within video stimuli or as interviewers can avoid some reactions in the interviewees due to the imbalance of status between them and the interviewer (Pitrone, 2009). Finally, the possibility of relying on language tutors also makes it possible to check how comprehensible a question is in a questionnaire or interview outline, a function that is ideal in the construction phase of survey tools since it allows them to be pre-tested by simulating the participants' answers (Grossmann et al*.,* 2023); moreover, this can also be useful to refine the difficult identification of the items for the evaluation rubrics (Capozza, 2024; Tremblay and Fraser, Bertrand, 2017).

4.3. Data Analysis Assistance

The functions that fall into this macro-category help the researcher in the analysis of both numerical and textual data: the software that can be used for this purpose can support in the analysis of voice conversations, in categorizing text files and in the generation of Excel formulas. Although these tools are specialized in supporting data analysis, they can also be useful for other phases of the research. For example, the filter options can help a literature review starting from a matrix containing a list of papers. Moreover, some tools help in data cleaning, while others can provide a guide to perform more complex analyses on software such as Python, R or SPSS.

4.4. Data Extraction Assistance

This macro-category includes functions such as automated transcription (from audio or visual content) and synthesis (textual or graphic) of document content. These features are often accessible thanks to AI-powered tools that allow researchers to interact with files.

Data extraction assistance can be useful at different stages of research. For example, the possibility of obtaining detailed summaries can facilitate the work of the researcher when reviewing the literature. Similarly, by interacting with documents it is possible to request specific information within scientific papers and this can be particularly useful for research such as systematic literature review, or to identify key points within interviews in order to understand which items to include in a content analysis sheet. In general, the extraction of data from audio, visual or textual sources can be of great support for content analysis, whether one intends to carry out a more hermeneutic or a more standardized type of analysis (Losito, 1993). In fact, in addition to the aforementioned search for specific information, software that synthesizes content is often also able to transcribe what is said during an audio or video recording and even to do so at the very moment of data collection. The union of these functions can therefore, for example, immediately return the transcription of an interview; this allows on the one hand to request a summary of the same at its end, in order to have material to support the drafting of an ethnographic note (Gobo, 1999); on the other hand, it can help researchers to double-check the answers obtained during the interview, so as to verify the presence of interesting content for the purposes of the investigation objectives and on which to ask in-depth questions. Graphical summaries can be particularly helpful in linking theory to observation and research practices (Kane and Trochim, 2009). The production of graphs and tables can also be useful in the dissemination phase, for the inclusion of these images in scientific papers or within slides. In addition, some tools can generate PowerPoint presentations for conferences, seminars or academic lectures from the upload of a pdf file. For the same purpose, functions such as transforming a pdf file into key questions or extrapolating textual content from images and videos could be used. Finally, data extrapolation can also take place within excel matrices, which facilitates cleaning operations and the choice of specific graphical representations.

There are also some tools (such as Monica.ai) which not specialized in these macro-functions, but which a basic level can still provide assistance with respect to these macro-categories, embracing even more than one if not even all. In general, transversality is a typical feature of AI software; For this reason, as can be seen in the synoptic table below, each software can fall into several macro-categories, as well as provide assistance in the different phases of social research, which have been grouped as follows:

I. Literature review: it refers to all the preliminary phases of social research related to the reading of contributions on the topic of investigation, useful for delimiting the research problem, identifying the questions and hypotheses from which to start, as well as the operational definition of the concepts of interest.

II. Construction and testing of survey tools: the tools that can give support in this phase are those that provide practical help to the researcher, who thanks to the possibility of helping him in the construction of an ad hoc platform for data collection or in verifying the correctness and comprehensibility of the items to be proposed to the interviewees.

III. Data collection: in this case, the focus is not on the tool that allows the collection of data of interest, but on the functions that allow the researcher to concretely obtain the data to be analyzed and interpreted.

IV. Data analysis: includes not only quantitative and qualitative numerical or textual analysis, but also the cleaning of matrices or corpora and the interpretation of results.

V. Support for dissemination: finally, what emerged and interpreted is disseminated through papers, conferences, lessons, etc. All this is part of this last phase.

Table 2. AI-powered tools classification and uses[3]

AI Tools	***Macro-category***	***Phase 1***	***Phase 2***	***Phase 3***	***Phase 4***	***Phase 5***
Kipper.ai	DE			✓		✓
Coconote.ai	DE	✓		✓		
unstuckstudy.com	DE	✓		✓		✓
Paraphrase Online	CO					✓
Quillbot	CO		✓	✓		✓
Grammarly	CO	✓				✓
Heygen	CO			✓		✓
Fireflies.ai	DA, DE		✓	✓		
ChatPDF	DE	✓			✓	✓
Monica.im	MIX		✓			✓
Mindgrasp	DE			✓		✓
Scribe	DE			✓		✓
Formulabot	DA				✓	
mymap.ai	DE	✓			✓	
PopAi	DE	✓				✓
Rapid Journal quality check	CI	✓				
ASKyourPDF	DE	✓		✓		
Dende.ai	DE	✓				
Bigguru	CI					✓
Perplexity.Ai	CO	✓		✓		✓

[3] CI = Citation Assistance, CO = Communication Assistance, DA = Data Analysis Assistance, DE = Data Extraction Assistance, MIX = Multiple Assistance

AI Tools	*Macro-category*	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*	*Phase 5*
Vidnoz Flex	CO			✓		✓
Compose AI	CO					✓
SelectText	DE			✓		
Scholarcy.com	DE	✓				
Otter.ai	DE					✓
Chatdoc.com	CO, DE	✓				
Jenni.ai	CI, CO	✓				✓
WPS Office AI	MIX			✓	✓	✓
GPTEXCEL	DA	✓			✓	
Consensus	DE	✓				
Paperpal	CO					✓
Julius	DA				✓	
research rabbit	CI	✓		✓	✓	
SciSpace	CI, CO	✓				✓
Audemic	CO	✓	✓	✓		✓
mapthis ai	DE	✓				✓
Pdf.ai	DE	✓	✓	✓		✓
numerous.ai	DA, DE		✓	✓	✓	✓
ossa.ai	CO		✓			✓
afterword.tech	DE	✓	✓	✓	✓	
sharly.ai	DE	✓	✓	✓		✓
llamacoder ai	MIX		✓	✓	✓	✓
lens.org	CI	✓				✓
anna's archive	CI	✓				
Rayyan	DA	✓			✓	
Scite	CI	✓				
Connected Papers	CI	✓	✓	✓	✓	✓
Litmaps	CI	✓				
Semantic Scholar	CI	✓				
Humanize	CO		✓			✓
Copy.ai	CO					✓
Praktika	CO		✓			✓
UnRiddle	CI, DE	✓		✓		✓

AI Tools	*Macro-category*	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*	*Phase 5*
Power Drill	DA				✓	✓
Sourcely	CI	✓				
Heuristi.ca	DE			✓	✓	✓
SciSpace	MIX	✓		✓		

Starting with the content analysis sheet used to analyze these 57 tools, it was decided to also calculate the average prices (in euros) divided by macro-category of functions and research phase. In fact, 45 tools have a free trial version. However, only 10 are unpaid and 31 have free features exclusively.

Table 3. AI-powered tools average price by macro-category and research phase

	€/month	**€/year**
Citation Assistance	15	97
Communication Assistance	20	165
Data Analysis Assistance	22	227
Data Extraction Assistance	14	124
Multiple Assistance	18	150
Phase 1	15	122
Phase 2	16	147
Phase 3	15	129
Phase 4	16	166
Phase 5	17	149

What is evident is the economic commitment required of the researcher, which however can imply a gain in terms of time saved and quality of research. The use of AI software makes it possible to speed up and standardize many operations, essential aspects in a world of research that always requires an increasing number of contributions to be published and projects to be carried out simultaneously due to the *publish or perish logic* (Colarusso and Giancola, 2020). In addition, the fact that the various steps and prompts are tracked facilitates both teamwork - as operational definitions and tasks become clearer - and the transparency of the work carried out and the technical reproducibility of the research process. However, some less specialized software (e.g. ChatGPT) does not allow the reproducibility of the output. Finally, the use of this software opens the door to new epistemological reflections, as they act as mediators in the researcher-interviewee and researcher-tool relationship. In particular, the resulting human-computer interaction leads to two main problems: the gulf of execution and the gulf of evaluation. The first one represents the gap between the users' intentions and the output provided by the computer: if it occurs, it means that the user has not been able to give clear instructions to the software. Similarly, the gulf of evaluation is the gap between users' expectations and computer's presentation (Sharples, 1996). From this point of view, it is important that researchers are able to provide AI-powered tools with well-defined prompts, to the point that it would be correct to talk not only about prompt engineering as a new digital competence (Korzynski et al., 2023), but also about prompt providing. Moreover, it is indispensable to remember that AI software could produce some errors, thus their outputs have to be checked by the researcher.

5. CONCLUSIONS

The adoption of AI in social research has been limited by doubts about its ethical and quality implications (Crawford, 2021; Prem, 2023; Bankins and Formosa, 2023). Nevertheless, remembering the active role of the researcher and the supportive role of this software, the perplexity surrounding AI could give way to familiarity and utility, ultimately enriching researchers' lives as already happened for other new technologies (Smiley and Fisher, 2022), even though there could be not only positive but also negative implications of the widespread use of AI on the academic and research fields (e.g. an even higher number of publications required to advance in one's career or a decreasing of the quality of the scientific production due to a superficial and careless use of AI-powered tools). In this journey from confusion to integration, it is essential to embrace the learning curve and remain open to the possibilities that these advancements bring. Just as the technologies of yesterday have been adopted in everyday life, AI will probably find its place in the world shaped by the innovations of tomorrow.

Nevertheless, as already highlighted in the text, nowadays there is still a strong distrust of the use of AI due to three main reasons:

- ethical and safety issues (Ma and Jiang, 2023): the debate on the ethics of the use of AI in the social sciences is crucial in the current context of rapid technological evolution. Concerns about privacy, fairness, transparency, and data control have generated in-depth

discussions about protecting individuals involved in AI-powered social research (Boyd, Crawford, 2012);
- the use of AI-powered tools could be risky due to the now well-known hallucinations produced by LLMs (Ferrara, 2023);
- some AI-powered tools, especially the less specialized ones, when faced with insufficiently structured data and prompts could raise some problems related to the reproducibility of the exact same result.

However, as has happened in the past with other technologies considered innovative initially debated for their ethical implications, industry and academia have demonstrated the ability to address these issues. Furthermore, the use of AI-powered tools does not cancel the role of the researcher, but they reshape it as a bias hunter or AI-data validator (Grossman et al*.,* 2023), reducing the problem of hallucinations.

On the contrary, as shown in this paper, AI can strongly help researchers for three main reasons:
1. To enhance the robustness and objectivity of scientific product evaluations: AI-powered analysis tools can provide assessments of research outputs not affected by the researcher's subjectivity, as proposed for the educational setting (Owan et al., 2023). For example, in this context, AI-powered tools can be used to enhance check for plagiarism or to check whether an empirical basis has also been used in other papers.
2. To expedite the production of scientific outputs: thanks to AI, it is possible to process large amounts of information in a much shorter time than traditional methods, thus offering greater predictive capabilities and a better understanding of complex social models (Mittelstadt et al*.,* 2016).
3. To facilitate the reconciliation of researchers' work-life balance by automating administrative tasks, streamlining workflow, and providing personalized time management support: the quality of life of university researchers suffers from work rhythms and, above all, from the difficult reconciliation of the work domain with other life domains such as leisure and the domestic-family domain (Matrella, 2024). AI could help researchers save resources, thus making their daily routine less tiring and stressful (Loureiro, Bilro, Neto, 2022; Samtharam and Baskaran, 2023).

These reflections suggest that the perplexities that lead to a limited use of AI in social research can be abandoned by remembering that human-computer interaction can be used to empower people, if used with ease (Sharples, 1996): a wrong usage could lead researchers to reduce the attention paid to the research process; on the contrary, AI-powered tools should help researchers in increasing research quality, offering them the possibility to not waste time and energy and to allocate the saved resources in the most important aspects of their work. However, the analysis conducted highlighted a major obstacle in the implementation of these tools by researchers, namely their cost, especially considering the cuts to the world of research that have affected the scientific community and in particular Early Career Researchers (Wöhrer, 2014), who are often those with a higher digital literacy. Moreover, it is important to remember that only people with higher social background can make the most of the opportunities and resources offered by new technologies (Parziale, Cavagnuolo, Matrella, 2024). As a result, rather than worrying about how ethical or reliable it can be to do research with AI, the problem of accessibility may soon arise, both in terms of money, expertise and capital enhancement.

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RESEARCH ON AND THROUGH GENERATIVE AI?
An inevitable entanglement

by *Riccardo Pronzato, Elisabetta Risi*[*]

Abstract

Since the release of ChatGPT to the public, generative artificial intelligence (GenAI) has become a primary concern for social researchers. Specifically, GenAI has been considered both an object of study and a potential tool for conducting social research, just as the Internet and digital platforms had been in past decades. Within this framework, this contribution focuses on these two interrelated realms, i.e., "research on GenAI" and "research through GenAI". Specifically, this paper discusses four areas of interest for the research on GenAI: a. Users' relationships with GenAI; b. Social narratives around GenAI; c. GenAI production; d. GenAI outputs. Then, how research through GenAI tools can be conducted at the qualitative and quantitative level is critically examined. In this regard, it emerges that GenAI systems are frequently framed as "assistants" and, therefore, research through GenAI emerges more as research "aided" by GenAI than "through" it. Given this scenario, we contend that research through GenAI is inevitably intertwined with research on GenAI and an understanding of GenAI itself.

Keywords

GenAI, social research, methodology, artificial intelligence

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1. INTRODUCTION

Over the past two decades, Internet research scholars have considered the Internet – and thereafter social media, streaming services and other types of algorithmic media/digital platforms – both as an object of research (research "on the Internet") and as a source of methodological tools for collecting data regarding users' behaviours (research "through the Internet", see Risi, 2021). Thus, on the one hand, scholars have considered networked technologies as an object of research and investigated how they are produced within corporate environments (Seaver, 2018; Pronzato, 2023), how individuals relate with them (Lomborg and Kapsch, 2020; Markham, 2021), as well as the social narratives around their implementation and functioning (Beer, 2018; Natale, 2021); on the other hand, methods "embedded" in online devices have been repurposed for the analysis of social and cultural change (Caliandro and Gandini, 2016; Venturini et al., 2018).

Similar scenarios emerged in relation to AI systems. While AI systems (machine and deep learning techniques) were analysed both as an object of research and also as methodological tools (e.g., Gefen et al., 2021), the diffusion of generative artificial intelligence (GenAI) models newly raises questions about how to investigate these human-machine interactions (Esposito, 2022), as well as whether and how the features and affordances of these technologies can be repurposed within sociological methodologies. GenAI tools (e.g., ChatGPT, Gemini, Midjourney, DALL-E, Gen-2, etc.) entails several opportunities and challenges for social research (Salah et al., 2023), such as the possibility to streamline data collection and analysis (Haluza and Jungwirth, 2023). Unlike algorithmic media, GenAI platform such as ChatGPT or Midjourney, based on large language models (LLMs) or deep learning techniques, offer not only content recommendation or distribution, but also real-time, interactive content generation, with the ability to adapt responses based on user inputs, i.e., prompts. This shift from the interfaces of digital platforms to dialogic interfaces with anthropomorphic qualities allows new forms of dynamic content creation and introduces various complexities in terms of the role of human input in shaping AI outputs and the relationships users develop with these systems.

Therefore, these technologies raise several epistemological, ethical and authorial concerns (Luccioni et al., 2023; Vincent, 2023). Indeed, beneath the superficial layer of the GenAI platforms' dialogic interface lie intricate socio-technical processes, such as the use of vast datasets, extensive algorithmic models, human labour and monopolised cloud infrastructures (Crawford, 2021). In this scenario, it is vital to resist the temptation to give in to a celebratory of yet another 'Promethean moment' frequently associated with the initial hype for the diffusion of a certain technology, and consider the related media and remediation processes. Indeed, as argued by Bucher (2025: 1), what must be avoided is "jumping to the next umbrella term and technology hype cycle," not considering decades of social and technical analysis "that could help put the current AI craze into much- needed perspective".

Given this scenario, our contribution aims to critically analyse the relationship between social research and GenAI platforms, concentrating mainly on computational systems based on LLMs. Specifically, we focus on two interrelated realms, i.e., "research on generative AI" and "research through generative AI", and argue that the latter is inevitably intertwined with the former.

On the one hand, our paper examines four areas of interest for what it concerns the research on GenAI: a. Users' relationships with GenAI; b. Social narratives around GenAI; c. GenAI production; d. GenAI outputs. On the other hand, we analyse how research through GenAI tools can be conducted at the qualitative and quantitative level. Drawing on empirical examples, we show that GenAI systems based on LLMs are frequently framed as "assistants", resulting in a research more "aided" by GenAI than "through" it. Thus, each research endeavour through these technologies also emerges as an examination of GenAI itself. Indeed, the generative, socio-technical features of these systems, as well as their discursive-material characteristics, make the content generated inseparable from the artefact.

2. RESEARCH ON GENAI

On November 30, 2022, OpenAI launched ChatGPT, a chatbot, based on LLMs, designed for conversational interactions via *prompts* (a set of instructions or inputs fed to an AI tool to produce outputs). Its intuitive Graphical User Interface (GUI), enabled a collective dialogic engagement with the socio-technological advancements of AI in the linguistic field. What differentiates digital platforms based on natural language processing (NLP) or recommendation algorithms is that while social media or streaming services suggest paths and choices among existing digital content, GenAI platforms not only use powerful large language models (LLMs) or deep learning techniques, but also produce and propose new contents by synthesising and remixing existing material from the web through an input-output interface.

The release of ChatGPT fostered a renewed scholarly interest in AI systems, given the specific features of interactive, conversational engagement, real-time content generation, and the chatbot's ability to provide context-aware responses designed to feel personalized. In this scenario, Baidoo-Anu and Ansah (2023) have highlighted the need for responsible integration of ChatGPT in education, while Bodria et al. (2023) emphasised research on explainability and effective benchmarking for complex GenAI models. Similarly, Beaudouin et al. (2020) advocated for flexible and context-specific approaches to explainability across different AI systems.

In general, critical algorithms studies emphasised the role of ranking algorithms and automated decision-making, while research on GenAI is primarily focusing on automated content creation. However, both fields share concerns about bias, transparency, copyright, culture shaping and social control (e.g., Noble, 2018; Ferrara, 2023; Fang et al, 2024). A crucial difference lies in their focus: algorithms do more than just "recommend" content, they shape how content is ranked, prioritized, and presented to users, influencing how knowledge is organised and users' creative activities and decision-making processes. On the other hand, GenAI platforms directly generate new content. In this sense, these systems impact such fields as art, education, research, marketing and communication, thereby influencing the production and reproduction of knowledge (Islam and Islam, 2024; Peres et al, 2023).

In this scenario, focusing on GenAI as an object of research at the sociological level implies identifying the different angles from which researchers can observe, describe and analyse it. GenAI platforms, based on LLMs, are networked objects, i.e., the result of a set of culturally-situated practices and relationships between different elements that contribute to the production of a complex socio-technical assemblage (Seaver, 2017; Wajcman, 2019). GenAI systems are not technological discoveries, but rather the culmination of a longstanding social process, marking the apex of work automation and societal quantification (Pasquinelli, 2023).

There are different disciplinary lenses that can be adopted to scrutinise these networked artefacts. How we [researchers] can look at them is related to what we are looking at. Thus, we identified four areas of interest for what it concerns the research on GenAI - *a.* Users' relationships with GenAI; *b.* Social narratives around GenAI; *c.* GenAI production; *d.* GenAI outputs, which will be discussed in the following section.

2.1 Users' relationships with GenAI

The ways in which users' relate with media products and technologies has been explored as a topic by different academic traditions. Several research areas, ranging from digital sociology (Lupton, 2015), audience research (Livingstone, 2019), communication studies (Senft, 2008; Markham, 2021) and human-machine interaction studies (Turkle, 2011) have investigated how individuals make sense of media content and the functioning of digital technologies, as well as how technological artefacts are employed in everyday life and professional activities. Specifically, it is now well-established that how technologies emerge within social life is not only the result of their design, but of the situated practices through which individuals *agentially* relate with them for their own purposes (Bonini and Trerè, 2024). In this context, it is interesting to examine how users interact with the "artificial sociality" (Natale and Depounti, 2024) and "banal deception" embedded and enabled by GenAI systems.

To comprehend the perception, employment and appropriation of GenAI platforms in mundane and professional practices, different approaches can be adopted. A media reception analysis lens may investigate how individuals "decode" GenAI. In the 1970s, as a reaction to mass communication research, Stuart Hall's (1973) conceptualised the Encoding/Decoding model to scrutinise how audiences interpreted broadcast media messages and if their interpretations aligned with the "preferred meaning" proposed by the dominant cultural order (see also Pronzato, 2024). Lomborg and Kapsch (2020: 746) extended this model to how individuals mobilise their "semiotic and socio-cultural knowledge" to interpret algorithms. Most users may not know how such GenAI systems as ChatGPT function, as in the case of the affordances of recommendation systems of algorithmic media. However, users construct sensemaking processes regarding the conversational interface of conversational agents, the words to use in prompts, the content they expect, and so forth. These sensemaking processes can be investigated to understand whether people adopt a dominant, negotiated or oppositional decoding of a certain GenAI system, i.e., whether they completely adhere to, negotiate or oppose the values underlying the functioning and type of outputs produced by these systems.

A related sociological perspective comes from Bonini and Trerè (2024), who adopt Scott's (1985) appropriation of the concept of "moral economy" to examine the constant struggle between users' values and the operations of digital platforms, such as social media or food delivery apps. Within this framework, Bonini and Trerè (2024) introduced the terms “platform moral economies” and “user moral economies”, as potentially competing entities, with users exercising “tactical” or “strategic” forms of agency that are not aligned with platforms’ values. Specifically, “strategies” are implemented by more powerful actors , while “tactical” forms of agency “come from subaltern agents” (Ivi: 46). Regarding GenAI, researchers can explore how users’ agential activities align with the moral economy embedded in a specific GenAI model. These tensions can be explored through the lens of agency (e.g., prompting and content generation), interface design (e.g., anthropomorphic qualities and interactive elements), and ethical concerns (e.g., bias), showing how users interact with and challenge the underlying values of these complex, multimodal systems.

To understand the diffusion and adoption of specific technological devices, ‘folk theories’ can be another valuable epistemological framework. Folk theories are implicit and practical beliefs that guide users’ media activities and sensemaking processes. Recently, a folk theories framework was adopted by Ytre-Arne and colleagues to investigate beliefs about algorithms (Ytre Arne and Moe, 2021) and online services (Sakariassen and Ytre Arne, 2024) in Norway, as well as by Ignacio Siles and colleagues who, within the research area of human-machine interaction, analysed folk theories regarding Netflix (Siles et al., 2019) and Spotify (Siles et al., 2020) in Costa Rica. Examples of the application of this framework in relation to AI (not necessarily GenAI) are some initial studies situated in the US (Shelby et al., 2024), China (Xu et al., 2024) and Chile (López et al., 2024). Researchers could focus on the emerging folk theories in relation to GenAI platforms, such as the ones based on LLMs, considering how users understand and engage with the anthropomorphic qualities and interactive nature of these technologies. As users interact with chatbots like ChatGPT, they often form implicit beliefs about the systems’ capacity, authorship and intentionality. Studies in this regard can inform researchers about how theories on GenAI platforms may shape users’ prompting activities.

The concept of “folk theories” has also been related to Bucher’s “algorithmic imaginary” (2017). This concept, grounded in a phenomenological approach, indicates “the way in which people imagine, perceive and experience algorithms and what these imaginations make possible” (Ivi: 31). For Bucher, imaginaries have thus a productive function, shaping users’ behaviour and emotional states. Some early studies on users’ imaginaries in relation to ChatGPT were conducted by Ciofalo et al. (2023) and Sūna and Hoffmann (2024), among others, showing the potential of this heuristic lens in analysing the implications of GenAI.

In view of all that has been mentioned thus far, different heuristic lenses can be used to explore the culturally-situated practices and sensemaking activities through which individuals engage with GenAI technologies. Furthermore, studies are needed to scrutinise how social, cultural, ethnic, and gender inequalities potentially shape users' interactions with these systems.

2.2 Social narratives around GenAI

Not only the uses of AI-based systems are important in defining their implications, but also the broader social narratives around AI (Cave and Dihal, 2019; Natale, 2021), as they play a key role in framing expectations and fears surrounding technologies, as well as how people adopt them in their mundane practices. More specifically, social narratives have been linked to "socio-technical imaginaries" (Rahm and Rahm-Skågeby, 2023) that should not be understood in Bucher's phenomenological sense, but rather as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures" (Jasanoff 2015: 4) that informs and shapes choices of people and institutions.

As discussed by Flichy (2007) regarding the emergence of the Internet, collective visions reflect societal hopes, fears, and expectations about the role of certain technologies. More recently, adopting a Foucaldian perspective, Beer (2017: 9) focused on algorithmic systems and claimed that the social power of the algorithm "may then not just be in the code, but in that way that it becomes part of a discursive understanding of desirability and efficiency". Indeed, algorithms are "a notional presence in discourse" and the narratives around them may show how they contribute to "the production and maintenance of certain truths" (Ivi: 3) and some of the broader dynamics of which they are part at the cultural and political level. An example of this approach is Beer's (2018) analysis of public documents from data analytics companies, in which he shows how these actors envision the role of data and metrics and their seamless integration into social and organisational structures. Similarly, Sartori and Bocca (2023) argues that all actors involved in AI production contribute to the construction of narratives and their power onto the public debate.

Recently, several studies investigated narratives around AI, broadly intended, in different realms. For example, Bory and Bory (2015) examined the link between AI in science fiction films over five decades and the emerging socio-technical imaginaries of intelligent systems, emphasizing a double dynamic, of wonder and fear. Cave and Dihal (2019) analysed 300 fiction and speculative non-fiction works about intelligent machines to identify the most prevalent fears and hopes regarding AI. Their examination shows that hopes around AI include the potential for longer lives, greater ease, and fulfilment, yet these are accompanied by fears of losing identity, obsolescence, and social isolation. In a study on Chinese and US military policies regarding autonomous weapon systems, Bächle and Bareis (2022) highlight how these countries politicise these technologies to serve their national interests, using ambiguous definitions. Focusing on the narratives about AI in nine newspapers from the UK, China, and India between 2011 and 2022, i.e., before the release of ChatGPT, Wang et al. (2023) revealed both dystopian and utopian themes associated with AI.

By contrast, focusing specifically on GenAI, Spillare and colleagues (2024) analysed how Italian newspapers discuss these systems after ChatGPT's launch, highlighting a strong tendency towards a "utopian-dystopian dichotomy" and, in particular, a positive attitude towards GenAI. Another interesting work is that of D'Alessandro and Ferzetti (2024) who attempt to demystify GenAI's potential for self-emancipation. By examining issues like the prediction paradox, the Inverse Turing Test, and algorithmic hallucinations, they argue that the human-chatbot interactions are characterised by a fundamental asymmetry: humans make sense of social life while GenAI systems are only content assemblers lacking true understanding.

These studies show the importance of investigating the narratives around different GenAI systems, their specific features and their cultural, social, political and economic foundations. Thus, further work is needed to comprehend how these technologies are imagined and discussed at the individual, collective, corporate and media level and to shed light on competing viewpoints regarding what technological change ought to look like (who and what it will be used for, whether it will replace humans in the workplace or will work alongside them, etc.).

2.3 GenAI production

Sociologists, anthropologists and STS scholars have long been interested in the processes underlying media content and technology production. In the 1970s, Gans (1979), Schlesinger (1978) and Tuchman (1978) conducted ethnographic work within journalist communities to investigate how their activities contributed to the social construction of news. This tradition remains prominent in contemporary sociology (Cottle, 2007; Thomsen, 2018), alongside the development of production studies (Banks et al., 2015). Scholars working within this area explore the environments in which media products, such as films and tv series, are actually staged and produced, thus locating personal activities “within larger cultural studies of discrete production communities, their material cultures, and their historical contexts” (Banks et al., 2015: ix).

More recently, scholars have focused on algorithmic production to better understand what Airoldi (2021: 35) defines as “the culture in the code”, that is, “the culturally informed choices and goals of those in charge of developing and programming algorithms”, whose values and biases are then embedded into, and reproduced by technological artefacts. Key contributions in this realm include Seaver’s (e.g., 2017; 2018) studies on music recommendation systems. Considering algorithms “as the manifold consequences of a variety of human practices” (Seaver, 2017: 4), Seaver argues for the merits of investigating through ethnographic methods their production, in order to scrutinise the culturally-situated environments in which algorithms take shape. Indeed, whereas

> discourses about algorithms sometimes describe them as “unsupervised,” working without a human in the loop, in practice there are no unsupervised algorithms. If you cannot see a human in the loop, you just need to look for a bigger loop (Seaver, 2018: 378).

Seaver’s pioneering work on algorithmic design (2017; 2018) has paved the way for further studies on the practices and values around the design of computational systems. For example, Bonini and Gandini (2019) analysed the dynamics surrounding music curation on streaming platforms, Sachs (2020) focused on the working activities of the people fine-tuning an art image classification system, while Aragona and Felaco (2018) examined the production of data infrastructures in European institutions. Other research includes Kotras’ (2020) study on the production of machine-learning (ML) algorithms used in predictive marketing and Pronzato’s (2023) analysis of tech workers’ activities in a media company.

Although access to the corporate environments where platforms are produced has proved to be dramatically challenging for researchers (Bonini and Gandini, 2020), it is crucial to examine the people, contexts, and activities participating in technology design to gain a deeper understanding of the dynamics that shape these systems. This tenet remains particularly relevant for GenAI systems as well. Indeed, researchers can investigate the practices involved in data curation and dataset creation, examining the human labour shaping processes of data collection and labelling. They can also explore the fine-tuning and algorithmic design of GenAI systems, exploring the work the people who adjust and evaluate the model parameters. Moreover, examining the workplace dynamics and organizational structures of companies developing GenAI can provide insights into how power hierarchies and internal tensions shape the design of these technologies. In this regard, it should be considered that, s discussed by several contributions (Gray and Suri, 2019; Crawford, 2021), AI production and maintenance is a process intertwined with a global labour chain that includes the "ghost work" of a myriad of outsourced data workers, frequently located in the Global South, not only in corporation offices in the Global North. In this context, the activities and experiences of these people are a key aspect to explore and are now the focus of studies conducted in Africa, Asia, and Latin America (Wood et al., 2019; Posada, 2022; Le Ludec et al., 2023; Casilli et al., 2024).

Thus, despite the practical limitations regarding access to the field, research focused on the production of GenAI systems is dramatically needed. Exploring these socio-technical assemblages can shed light on how GenAI systems take shape and emerge within corporate and institutional environments, alongside the transnational labour forces that sustain them.

2.4 GenAI outputs

The socio-technical nature of GenAI systems, alongside their discursive-material qualities, makes the content inseparable from the medium that creates it. By analysing GenAI outputs, researchers can uncover societal representations, implicit assumptions rooted in online discourse and understand how these platforms reinforce societal norms. In other words, they can scrutinise "the code in culture", that is, "how socialized machines shape our society by participating in it" (Airoldi, 2021: 70).

The impact of representational harms has grown significantly due to the public's widespread engagement with GenAI. This issue extends beyond the rapid adoption of ChatGPT to include visual generative models, such as Stable Diffusion, Midjourney, and Copilot (powered by DALL·E 3). Models like GPT-4, trained through unsupervised learning, do not require human-labelled data. Instead, they analyse statistical patterns across massive datasets. To enhance model accuracy, developers increase the model's parameters and training data size, with GPT-4 estimated to contain around 1.8 trillion parameters (Howarth, 2024). Although OpenAI does not disclose specific training materials, they state that GPT-4 sources from a broad mix of online content, including news, fiction, images, blogs, and social media (OpenAI, 2023).

DeepMind researchers (Wendinger et al., 2023) have identified six key risk areas related to LLM outputs: discrimination, hate speech and exclusion, information hazards, misinformation, malicious uses, human-computer interaction harms, and environmental and socioeconomic harms. These concerns are often framed under the term “bias,” implying flaws due to incomplete or inaccurate data (Fang et al., 2024; Friedrich et al., 2023), which favour systematic misrepresentations or distortions, reinforcing stereotypes or assumptions (Ferrara, 2023).

Thus, GenAI outputs reflect and construct the social world and - more particularly - potentially reproduce forms of bias and discrimination within this process. While the term “bias” is helpful, a more useful term can be media “re-presentations’’ for several reasons (Risi et al., 2025). First, “re-presentation” questions the notion of media as an immediate, transparent view of society: algorithmic media offer a refracted, situated perspective of social reality. Second, as theorised by Hall (1986), “representation” highlights the constructive power of media images in shaping social categories like age, gender, ethnicity and class. These images do not merely describe social markers but actively participate in their socialisation. Finally, ‘representation’ better reflects the complex and ambiguous politics of media portrayals, where negative effects are not ascribable to biases. If LLMs replicate social disparities, a straightforward ‘unbiased’ depiction would also perpetuate these inequalities. Paradoxically, a progressive approach to media could involve a conscious bias that counterbalances these disparities.

Argyle and colleagues (2023) suggest that ‘algorithmic biases’ in LLMs might be leveraged, not merely corrected, to create outputs that reflect expected representations across different social groups. GenAI algorithms can capture intricate societal details and nuances among various groups. Since their deployment, these AI-generated representations have attracted increasing scrutiny for their potential harm (Fang et al., 2024).

The risks associated with representational outputs in GenAI outputs stem from various factors, including human labour, corporate decisions, training data, labelling practices, model specifications, algorithmic priorities, design choices, and policy regulations aimed at mitigating harmful behaviours. Empirical observations and critical discourse on these outputs reveal their embeddedness in a particular social framework, marked by discrimination and inequality. For example, Gillespie (2024) examined three GenAI systems based on LLMs (ChatGPT, Gemini, Microsoft Bing AI) with prompts designed to uncover their underlying normative assumptions. In their outputs, Gillespie reveals that GenAI systems tend to reproduce normative identities and narratives, rarely reflecting less common perspectives.

Some scholars categorise these representational issues as demographic and cultural (over- or underrepresentation of certain groups), linguistic (preference for English-language data), temporal (time-bound data limitations), and ideological (potential bias from labelling aligned with specific beliefs) (Ferrara, 2023). For researchers and developers involved in prompting, these images are central to the political and ethical challenges in AI. Studies are ongoing to mitigate these biases, although their persistence is likely, given the complexity of deploying these models across various domains.

The field of algorithmic fairness in GenAI continues to grow, seeking methods to reduce unjust portrayals and discrimination (Luccioni et al., 2023). However, a universal standard for fairness remains elusive, as researchers strive to formalise and find strategies to address these challenges in GenAI models (Friedrich et al., 2023).

3. RESEARCH THROUGH GENAI

Gefen et al. (2021: 191) argue that AI can be used "as a research method", "where massive data processing is made possible by techniques of machine and deep learning". Specifically, the authors highlight that such tools as topic modelling or sentiment analysis can be applied to the analysis of texts and language, allowing for the identification of recurrent discursive patterns. These socio-technical advancements have been particularly relevant in computational linguistics, quantitative history of ideas or quantitative formalism and can represent a new frontier in which the "mathematization of the demonstration" (Ivi: 195) can dramatically impact the production and organisation of cultural knowledge. Following a similar logic, AI systems could be employed "to identify visual similarities between images, diffusion of patterns or styles" (Ivi: 198), thus offering new methodological perspectives in art history. Then, focusing on social network analysis, these authors show how AI and network analysis can be combined for social analysis.

However, restricting the field to recent GenAI developments, there are some cases where these systems have been employed for social research purposes (see Pilati et al., 2024). Following a positivistic and apologetic stance, Islam and Islam (2024) explored the opportunities and challenges of ChatGPT in academia, indicating that it can support research activities, providing additional resources, promoting creativity and innovation, and improving data analysis and interpretation. Other scholars have instead focused on how "AI research assistants" can help write scientific papers (Salvagno et al, 2023; Xames and Shefa, 2023; Dönmez et al. 2023), generating an initial draft, suggesting titles, summarizing the conclusions, highlighting areas of uncertainty.

Given this scenario, the following sections critically discuss the potential use of GenAI in empirical social research, at the qualitative and quantitative level.

3.1 The use of GenAI in qualitative research

The potential of GenAI systems based on LLMs in identifying recursive patterns within narrative material has attracted the attention of some researchers. Specifically, GenAI has been proposed as a research assistant "to streamline processes" (Perkins and Roe, 2024a: 391) for what concerns the qualitative analysis of discursive data.

Perkins and Roe (2024a), a management scholar and a digital pedagogy scholar, respectively, employed ChatGPT to conduct an inductive thematic analysis. By merging coding activities performed by human subjects and chatbots, they developed a final set of themes. Within a post-positivist approach to qualitative research, they claimed that ChatGPT allowed to obtain "increased objectivity, efficiency, and additional cognitive support for the researcher" (Ivi: 392), despite the issues encountered, including irreproducibility, biases and possible hallucinations in the GenAI outputs, even when using identical input data were used. Similar issues were experienced by Sinha et al. (2024) with GPT-4. Other researchers, such as Gao et al. (2023) and Gebreegziabher et al. (2023), developed their own applications to support qualitative data analysis. Even in these cases, although the machine has proven efficient in speeding up the coding phases, it was highlighted that there is the risk to reduce the quality and diversity of the coding process. Nonetheless, all these scholars working around the field of human-AI interaction continued arguing that the use of Gen AI will be fruitful in simplifying qualitative data analysis. Similarly, Davidson (2024: 5) argues for the merits of using GenAI models to analyse qualitative data and "to leverage advanced computational techniques to analyze data more efficiently and at a greater volume than previously possible, helping meet the demand for increased rigor, transparency, and scale". The author claims that a key advantage of these systems is that "queries can be tailored to the data at hand" (Ivi: 3), thus the same model may be adapted to different tasks and at different stages of the process.

Overall, some scholars are experimenting with GenAI in qualitative research. Inductive qualitative methods are considered time-intensive, and recent advances in GenAI as promising for generating inductive coding results (Perkins and Roe, 2024b). According to Sinha and colleagues (2024), conducting research with GenAI can be useful (with caution and critical thinking) throughout all phases of grounded theory. This includes transcribing audio and video recordings, conducting the coding phases, analyzing notes and analytical memos, grouping codes and suggesting interpretations.

However, most contributions have also highlighted that GenAI systems "cannot yet replace human expertise" (Perkins and Roe, 2024b: 6) as the contextual understanding and interpretive capacities of researchers are still crucial for in-depth analyses of social phenomena. Furthermore, research revealed discrepancies in GenAI outputs (Chen et al, 2024), with hallucinations and irreproducibility of results that remain key problematic aspects that seem to be at odds with claims of objectivity and efficiency.

Additionally, GenAI models are always framed as "assistants" in the use of traditional techniques rather than native methodologies that can be repurposed for social and cultural analysis. In this sense, qualitative research through GenAI emerges more as research "aided" by the computational capabilities of GenAI than "through" it.

Finally, it should be noted that now AI features are implemented also in computer-assisted data analysis software programs, such as NVivo, TLab, and ATLAS.ti, integrating NLP and ML in these systems. Originally, GenAI platforms were different from these programs as they allowed contextual code generation in a probabilistic and adaptive approach. Moreover, GenAI's decision-making process was completely black-box, unlike in obfuscated but potentially verifiable proprietary software (Ferrara, 2023; Fang et al., 2024). Now LLMs and Generative Pre-trained Transformer technologies (on which GPT is based) are integrated into these software programs as well, to aid coding, data organization, and pattern recognition. In this scenario, the opacity of GenAI has spread, favouring a more complex situation in which proprietary packages and libraries in coding software become less transparent. Epistemologically, the non-transparent characteristics of LLMs contribute to the construction of meaning in qualitative data analysis. This automation of analytical processes can lead to framings and interpretations of social phenomena over which researchers have limited control, or rather, an "illusion of control" (Markham et al, 2019).

3.2 The use of GenAI in quantitative and computational research

Perkins and Roe (2024b: 7) claimed that GenAI systems can have "the potential to revolutionise how researchers approach data analysis, interpretation, and visualisation" in the realm of quantitative methods. The first domain concerns visual analytics and pattern identification. These models can process large datasets, identify recurring similarities, and then, even generate data visualisations that researchers can use to interpret and present their work. Likewise, Davidson (2024) contends that GenAI can be used by computational sociologists to classify texts and images. For example, researchers can train a model so that it can automatically label large datasets such as news articles or social media posts. Such authors as Salah et al. (2023) even argue that GenAI tools can be provided with insights into cognitive processes underlying social behaviour.

The second area of intervention refers to the integration of GenAI with statistical software programs to conduct operations of data cleaning and pre-processing, as well as to "identify potential outliers or missing data patterns, and suggest appropriate statistical models based on the data characteristics" (Perkins and Roe, 2024b: 7).

The third domain addresses natural language interactions, that is, the possibility to give instructions on statistical procedures to be executed to the GenAI model through plain language queries. According to Perkins and Roe (2024b: 8), this adoption of GenAI can favour a "democratisation of advanced statistical techniques" as it may allow researchers with different backgrounds to conduct statistical analysis only by interacting with a GenAI system.

More generally, both Davidson (2024) and Perkins and Roe (2024b) notice that the aforementioned use of these technologies raise critical questions about the potential for misinterpretation also for quantitative research, highlighting the importance of maintaining statistical literacy and sociological expertise to contextualise GenAI outputs. These reflections show again how post-positivist researchers consider GenAI systems as "assistants" that can facilitate or streamline a research endeavour and even suggest or diminish the choices a researcher has to make.

The rise of various commercial and open-source GenAI platforms, based on LLMs, has also introduced new avenues for creating synthetic textual and visual data. These data are generated to "mimic" content that individuals might produce on social media or in survey or interview contexts (Choenni et al., 2023). By lowering the barriers to synthetic data generation, LLMs are believed to hold significant promise for social research, where access to certain data types is limited. Synthetic data can serve various roles, from data augmentation and prototyping to direct analysis, where LLMs are assumed to act as proxies for real human participants.

In this sense, LLMs are also considered systems for data creation. Such authors as Grossman et al. (2023: 1108) suggest that LLMs' ability to "simulate human-like responses and behaviors" may present an opportunity to test theories and hypotheses about human behaviour at scale and with speed. In various contributions, LLMs have been used to generate human simulacra to serve as experimental participants and survey respondents, i.e., to potentially "replace" human responses in the research tools validation phases. An example is the use of GenAI to pre-test questionnaires and interview templates (Olivos and Liu, 2024; Kim et al, 2024) or attitude scales (Salah et al., 2024). However, who, what and how is created by GenAI remains a poignant and critical question (Gillespie, 2024). As noted in the previous paragraph, its potential depends critically on factors such as the fidelity and representativeness of training data, GenAI biases, and the tendency of these models to hallucinate or reproduce social stereotypes, all of which warrant careful consideration. In this regard, we concur with Jacobsen (2023: 10) that "the claims that synthetic data are ushering in a new era of generated inclusion and non-risk for machine learning algorithms is both misguided and dangerous" and that the frictions and issues embedded into ML cannot be neglected (Jacobsen, 2024).

4. CONCLUSIONS

This paper aimed to critically discuss the social research that can be conducted on GenAI and through it. In the first case, different theoretical perspective and heuristic tools were proposed to investigate users' relationships with GenAI systems, the social narratives that inform the socio-technical imaginaries around these technologies, how GenAI systems are produced in corporate environments, as well as the outputs that generate as a result. In this regard, it seems possible and potentially fruitful to adapt and adjust techniques and approaches that have already proved useful in investigating other complex socio-technical assemblages, taking into account the specific characteristics of the models on which different GenAI systems are based, as well as their specific characteristics, such as their ability to engage interactively in conversations, generate content in real-time, integrate multimodal inputs, provide responses that are contextually aware and adaptable through learning.

Regarding the second realm of examination, research through GenAI emerged more as research "aided" by GenAI than "through" it. While digital methods could repurpose platform environments as contextual domains where situating users' activities (Caliandro and Gandini, 2016), GenAI systems emerge as "assistants", i.e., tools that can be used to streamline a research process rather than a context where individuals conduct activities. Within this framework, we noticed that several scholars argue for the merits of conducting research "aided" by the computational capabilities of GenAI systems, mostly based on LLMs. Interestingly, researchers frame GenAI as suggested by tech companies. Indeed, Google's GenAI platform NotebookLM describes itself on its homepage as "Your personalized AI assistant in research" while Microsoft's Copilot defines itself as "Your Everyday AI Companion", thus echoing interpretations also reiterated by social researchers.

Despite the potential usefulness of these systems, we emphasise that social research through GenAI poses different challenges given the opacity of these artefacts. Zhou and colleagues (2024) highlight several ethical concerns surrounding these research 'assistants,' including the automated reproduction of discriminatory narratives (bias) and risks related to the use and potential leakage of sensitive data (privacy and security). The lack of transparency of these systems and risks of plagiarism also emerge as crucial issues. Furthermore, the "culture in the code" of GenAI systems is not a neutral element and informs how these systems become "code in the culture" (Airoldi, 2021), i.e., part of one's research activity, hence, the roots of these systems and their following implications cannot be underestimated by researchers. More specifically, it is necessary to consider how and by whom GenAI systems are produced. As claimed by Tacheva and Ramasubramanian (2023: 1), the production and maintenance of these computational infrastructures is the result of "interlocking systems of oppression" and of social order "rooted in heteropatriarchy, racial capitalism, white supremacy, and coloniality", perpetuating "its influence through the mechanisms of extractivism, automation, essentialism, surveillance, and containment". Thus, the use of GenAI systems must be evaluated taking into account the violent contradictions underlying their perceived benefits.

At an epistemological level, GenAI also raises concerns, such as the generation of "algorithmic hallucinations" (D'Alessandro and Ferzetti, 2024) and the irreproducibility of its results, which challenges the foundational principles of scientific rigor, accountability and reliability.

As argued throughout the paper, GenAI are complex socio-technical assemblages that consist of several activities concerning both human and nonhuman elements. Their functioning is based on recursive patterns, each data point fed to the machine will contribute to craft its output (Airoldi and Rokka, 2022). What lies in between the input and the output — i.e., the strings of code that guide the process by which online algorithms ingest data and then produce an output — is not transparent and neutral, but rather the outcome of value-laden practices that contribute to the socialisation of artefact. In this sense, "machine learning systems encode a peculiar sort of habitus, a *machine habitus*" (Airoldi, 2021: 28). The activities of GenAI systems "result from the dynamic encounter between an adaptive computational model and a specific *data context*" (*ibidem*), therefore, their activities are always the outcome of social and cultural phenomena that sociologists have been studying for decades.

GenAI is different altogether to digital platforms, they are a different object of study, but not a context. Research through GenAI, therefore, is inevitably intertwined with research on GenAI as the results produced by GenAI are also the outcome of the practices and narratives underlying the design and adoption of these systems. In this scenario, the interaction between a GenAI system's functioning and the data researchers provide raises methodological challenges for qualitative and quantitative research.

In the Bourdesian terms used by Airoldi (2021), we may ask ourselves: what is the "habitus" of the assistant? How can social researchers keep track of the recursivity of GenAI systems in their research endeavours? These questions remain open for further investigations, but this article aimed to highlight an essential point: researching with GenAI implies an inevitable entanglement with its underlying principles and necessitates continual reflection on its socio-technical premises.

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FROM DIGITAL TRACES TO ARTIFICIAL INTELLIGENCE
New boundaries from representativeness

by *Beba Molinari**

Abstract

The abstract aims to highlight what contribution Artificial Intelligence can make in the field of social research by setting as a fixed point the tools to date established in research methodology, whether traditional or closely related to e-methods. It is necessary to stop and think about how and what data AI provides us with by asking: are we in the same scope of analysis as e-methods? Instead, can we continue to handle such data through traditional analysis techniques, or should we think of AI as totally new data/information? These are just a few questions that will be attempted to be answered without any claim to exhaustiveness of course, but aimed at discussing representativeness and margin of error not only statistically, but understood in a much broader sense.

Keywords

Artificial Intelligence, Big Data, E-methods, Machine learning

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1. INTRODUCTION

The ever-increasing use of remote work that occurred in 2020 with the spread of the SARS-CoV-2 virus, which was followed by an increasingly high-performance response through ICT solutions with a consequent acceleration of digital that ensued in the following years, has highlighted how much the digital dimension is an integral and pervasive part of our lives through the solving of real problems with an increasing number of practical applications, most of them based on Artificial Intelligence (AI) (Thottoli, 2024).

AI offers a range of thoughts and opportunities unexplored to date. While we may think of it as a very useful tool that will touch much of our lives, consciously and unconsciously, we ignore the procedures and ways in which AI moves with great adaptive capabilities on our devices. We will have the opportunity in the next 7 years to have a considerable amount of information coming from AI, even more than previously assumed, as the European Programming 2021-2027, particularly the Euromed and Alcotrà programs, focus much more than in previous plans on Technological Innovation with an established interest in the inclusion of AI and the direct consequence of a series of increasingly large experiments both nationally and internationally.

It has already been about 15 years since a strong debate was sparked in Italy about the use of new 2.0 research tools in the social sciences (Corposanto and Molinari, 2022).It is not possible to talk about e-methods without discussing Big Data, inevitably the discourse marries on the "construction" of the data, then on the plausibility of the survey instrument adopted thought in relation to the object of study (Marradi, 1989). It is inevitable to understand how quickly we move from an extremely innovative vision to a discourse rooted in "traditional" research methodology.

This is not the first occasion in which the author questions around the plausibility of new online search tools that allow us to analyze large amounts of information collected within databases. The focus of the discussion revolves around the concept of representativeness, the reliability of the data (Molinari and Corposanto, 2023) with a particular focus on e-methods and how they can be subject to bias, not forgetting that most of the classical tools in the researcher's toolbox are not exempt from such risks. It is important, therefore, to ask what is meant by bias, a word that varies greatly in its meaning depending on the survey instrument under consideration. It is certainly not the first time that attention has shifted in the methodological field to the fidelity of the data

in its dimensions related to: the sincerity of the response, the congruence of meaning, the a priori classification of the responses and their respective exhaustiveness (Bethlehem and Biffignandi, 2012). This is not the place to discuss such topics, about which so much has already been written, but it is necessary to make a clarification that sets the stage for this article. While we have a number of assumptions on which the foundations of social research methodology are based, it is necessary to ask how many of these assumptions can still be valid with an immense amount of information and data provided and analyzed by the network, shifting the focus to data used by artificial intelligence (AI).
It is necessary to stop and think about how and what data AI provides us with, so some questions are necessary: are we in the same scope of analysis as e-methods? Can we continue to handle such data through traditional analysis techniques, or should we think of AI as totally new data/information? Does the data that is "released" to us by AI totally fall under the well-established definition of Big Data? Or are they "other" data because they pose us a number of more purely technical questions (format, size, etc.)?

Before going into the specifics and new methodological frontiers that AI poses to us, let us make a small clarification. We often discuss data quality, but in Web 2.0 contexts, let alone Web 4.0, does the locution "data" still make sense? Or does the connotation change depending on the context, the type of information and the provenance, i.e., the data warehouse[1] from which it was extracted?

In this case, according to the author, given that the level of information changes depending on the type of analysis to be carried out (context analysis, sentiment analysis) and even more so depending on the Application Programming Interfaces (API) used to carry out the analyses, the quality of the data is constantly changing. In light of these considerations, it would be more appropriate to think about the potential of data warehouses and the possible mash-ups of data, that is, the many combinations that can be achieved with data of different nature and origin[2] (Corposanto and Molinari, 2022).

[1] The data warehouse is a kind of second level of a 'database' within which is contained a series of information oriented towards individual subjects, be they users and/or consumers, integrated with several databases from which it 'imports' specific information previously identified and thus of interest to the programmer/researcher.

[2] By way of example alone, it is now possible to use an API to extract data from YouTube, to make topographical maps of real or presumed risks, to build an ego network from facebook pages, to carry out a contest analysis via Twitter, etc.

2. OLD TOOLS, NEW RESOURCES

Before going into what are the survey tools of today's researcher, it is necessary to understand what was the path that led us to an increasingly diverse range of data born with the web.[3]

We have always imagined the moment of data collection as at that stage when the researcher with his or her toolbox goes into the field to begin the administration of the research instruments (Palumbo and Garbarino, 2006). Therefore, the first question we might ask is whether with the tools made available by Web 2.0 the survey phase changes: it is clear that the first difference is clearly visible, the researcher no longer moves in the field, but rather navigates the web and through it moves the everyday real-world to Web 2.0 contexts from blogs, to social networks, to the use of search engines, etc.. It is important to point out, however, that the intromission of the Web does not become apparent exclusively in the phase of navigation on the part of the user, but emerges even earlier, for the researcher in particular it is already configured in the preliminary phase of study, in which the boundaries of the object of research, the declination of hypotheses and the understanding of the population under study are delineated. The use that can be made of it then is manifold, from bibliographic collection, to statistical data, to the identification of the most suitable indicators to understand the phenomenon (Grimaldi, 2005).

It is not our goal here to discuss the more purely epistemological aspect of detection tools in Web 2.0 contexts, but rather to understand the possible developments of such tools by turning our gaze toward AI, taking a first step toward a bumpy and complex path that will seek to understand, whether e-methods can be considered a continuation, or a new Web 2.0 toolbox, and especially whether AI falls within the Web 2.0 toolbox or is something totally different.

Before going into the specifics of the use of AI in social research, it is necessary to set some milestones.

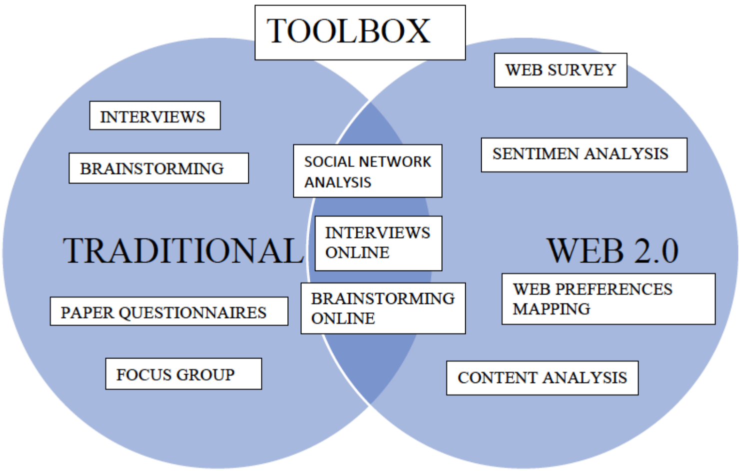
The first major difference, which determines the choice of in-depth analysis adopted in the articulation of the next paragraphs, is the inescapable link between tools and data analysis, an aspect that also arises for the traditional toolbox, but not as strongly constraining as it is for web techniques.

It is the author's (Molinari and Corposanto, 2022) belief that there are

[3] First and foremost, a substantive premise is necessary, namely that the tools determine the researcher's choice to conduct a particular analysis rather than another (Bucchi, 2019). The very nature of the data, whether etic or emic, affects the subsequent choice regarding the type of analysis to be adopted (Corposanto and Molinari, 2017).

as many different toolboxes as there are interpretive lenses that the researcher intends to use. To decide that a tool is within one cassette rather than another would be to claim to contain within a categorization an ever-changing reality. Having made that clarification let us try to define to date a first reorganization of research tools by distinguishing between the traditional and the web 2.0 cassette.

Figure 1. The researcher's toolbox in modern times



Thanks to the use of a Venn we have separated the two toolboxes into two sets, between the two is clearly visible a common area within which are represented the web tools that we consider to be the direct continuation of the traditional tools, on the right instead are enclosed the tools that in our opinion can be considered innovative compared to their predecessors, thus bringing that “something different” compared to the traditional tools.

The choice to include one tool rather than another within an area was dictated by considerations made in different application contexts, with different objects of study.[4] In this regard, the following aspects were considered:

[4] The following has been extensively discussed in an article, here is the bibliographical reference: ---, Analizzare dati di microblogging con la Sentiment Analysis. Quale rappresentatività?.Sociologia Italiana. 11: 123-132.

- survey procedure,
- ype of data to be analyzed,
- quality of the data as a whole,
- type of analysis that allows us to carry out the data obtained.

The first difficulty was that of being able to distinguish between the type of instrument and its analysis.It thus seems clear from the definition of the areas common to the two sets that interviews, brainstorming and focus groups can also be declined in web contexts with the proper adjustments, they are something different from the classical tools, but at the same time they can be analyzed with traditional analysis techniques. However, there are a number of entirely different tools such as data mining, search engine preference mapping, web surveys themselves, sentiment analysis, and content analysis that use totally different data where the application of so-called traditional analysis would certainly be a stretch for some, while for others virtually impossible.
The striking example of the latter case is the mapping of websites, where there is no other way of knowing the preferences of Internet users than through network analysis, the data that emerged can in fact be used only in this sense, an analysis that falls squarely within the scope of web crawlers' programs.[5]

In this context then, how does AI position itself? Let's get into it by trying to shed light on the uses of AI in social research contexts and the respective analyses and, of course, the algorithms on which AI itself is based.

3. WHAT ARTIFICIAL INTELLIGENCE IS

In addition to all these aspects related to the more classical conception from search tools to the arrival of methods related to online contexts, we must say that we live in a context of algorithms that we find in our everyday life without even realizing it. The algorithm conceived in the Big Data context was born to solve complex problems that result in our everyday life, in finding the shortest way to get to the nearest restaurant that at the same time satisfies our food preferences, what are the people you might know and add them on social networks, but they were thought mostly out of a pressing need to adequately manage amount of information seen before.

[5] In this regard, it is also worth mentioning the semantic web, which allows us to monitor the content and semantic context of a web page by means of tags (Trobia, 2014:67-104).

In a note dated April 8, 2019, the European Parliament drafted a document to provide clarity with respect to what is the prerogative of the AI. The Commission Communication on AI clarifies certain aspects of AI as a scientific discipline and as a technology, with the aim to avoid misunderstanding, to achieve a shared common knowledge of AI that can be fruitfully used also by non - AI experts, and to provide useful details that can be used in the discussion on both the AI ethics guidelines and the AI policies recommendations.

In other words, AI is the ability of a machine to exhibit human capabilities such as reasoning, learning, planning and creativity. AI enables systems to understand its environment, relate to what it perceives, and solve problems and act toward a specific goal. The computer receives data (either already prepared or collected through sensors, such as a camera), processes it and responds. AI systems are able to adapt their behavior by analyzing the effects of previous actions and working autonomously.

In more detail (European Parliament, 2021) AI is divided into two major macro areas, software and embedded intelligence. The former include virtual assistants, image analysis software, search engines, facial and voice recognition systems, while the latter include robots, autonomous vehicles, drones, and the Internet of Things. If the former are what we most commonly use in everyday life, the latter are what we at first glance refer to as AI.

From a recent study conducted by the author there is a lot of confusion regarding AI from which there is clear evidence of not only the now widely debated aspect referring to the generation gap of Digital Devide, but across the board a rather marked confusion referring to AI itself. In more detail, out of a sample of 7,900 people only 14 percent chose the correct answer that involves both macro areas of AI, software and robotics, while for 37 percent of the participants AI is related only to robotics, 23 percent think of AI as software, and the remaining 26 percent have no idea what it is.

This is not the place to go into the details of the above study, but it certainly allows us to confirm, what is already partly said in everyday life, namely that the topic is rather thorny and complex. If most people do not have a correct idea of what AI is certainly it is surrounded by it in everyday life and provides useful data for processing a range of information that changes our lifestyles: dietary, relational, educational, etc. We are discussing a volume of information that is difficult to even imagine, from a total of 33 zettabytes in 2018 it is assumed to increase to 175 zettabytes at the end of 2025 where a zettabyte is equivalent to a trillion gigabytes, with this amount of data it is difficult to think of a repository that can hold it all.

Let's get into how AI actually works, albeit in broad strokes. What we usually see and relate to when dealing as users with AI is the chatbot (Xu, 2019). The latter is a software that simulates and processes human conversations, whether written or spoken, in order to make users interact with digital devices having the impression of communicating with a real person. Chatbots are of different types depending on how you program them, there are some extremely simple ones that answer a single question, while others are much more complex such as digital assistants that learn from their own mistakes and the data the web provides them with in order to provide increasingly personalized levels that reflect the user's interests.

So our first approach with AI usually is through a chatbot with devices integrated to smartphones, PCs, or home automation devices. As anticipated usually one formulates a question, either vocal or written, on a device and waits for the answer, we could say more or less correct. What are the broad steps of the mechanism that triggers the response and how this may, or may not, be related to big data and social research methodology?

The chatbot before it is able to respond must be trained, and it is at this stage that AI, or machine learning, comes into play (Liu, Wang, Whang, 2012) through which the model underlying the chatbot learns through a huge amount of data of different kinds (text, images, videos) that are provided to it for free from the web. The learning phases are divided into three successive steps: a first one in which language skills and general notions are learned, and by learning from the mistakes made, the chatbot becomes autonomous in its ability to give correct answers, but only with respect to language proficiency. In this step the role of the programmer comes into play he "adjusts" the errors made through the randomization of correct words and a predictive process formulated as a "learning model." In the second step, the chatbot learns specialized skills through a series of multiple-choice questions against which the model formulates a task. In the third and final step, on the other hand, a team of computer scientists verifies the effectiveness of the responses and defines the "style" and genre with which the chatbot responds. Educated the software behind the chatbot actually could be used even without a network connection, it would evaluate the most reliable answer in relation to the information (big data) it had previously incamerated, but it would lack the continuous data updates that would allow it to properly "train" its skills on specific questions.

Can what we have just described fit into the now widely accepted

definition in the methodological field of Big Data? In this regard, a decade has already passed since Burrow-Savage and Kitchin (20214) defined Big Data as all those data that are distinguished from the more common data with respect to: volume breadth, high speed, variety, exhaustiveness, high resolution, relationality, flexibility (Burrow and Savage 2014, p.1; Kitchin 2014 p. 262).
It is such a broad definition that it encompasses several categories of data because it adopts an exclusionary interpretative philosophy, translated one could say that Big Data is everything that is not commonly known as 'classical' data in research contexts, in fact it is assumed that they are distinguished by 'a norm'.

Thus, the 175 zettabytes of supposed information our days - supposed because it is practically impossible to definitively number the data that travels the net - is in fact Big Data, obviously of different nature and origin. Within this mass of information, we have data derived from the traces we leave behind from shopping on the net, from the most banal online searches, from cyber security, from the ever more present personal digital assistants, from automatic translations, whether carried out within the more classic search engines such as google translator, or made and inserted within the social network, from sensors for home automation, from intelligent infrastructures, from robotically guided vehicles, etc. etc. It should be emphasised that AI and Machine Learning are not synonymous, they are two closely related, yet completely different technologies. The former has designed and will design an intelligent architecture, the latter, on the other hand, allows us to develop a learning system with ease.

4. WHAT REPRESENTATIVENESS FOR ARTIFICIAL INTELLIGENCE

The possibility of mining Big Data and being able to analyze such a vast amount of data that we can identify, a lot of information from different online sources on multiple objects of study is a wealth of information that we often forget. Especially as social researchers, we underestimate the fact that all the software that allows us this kind of analysis, from data mining to its subsequent analysis, is done through algorithms. Different algorithms that mutate at an impressive rate (Quarteroni, 2020, 2013).

This is a reason that the social researcher today must simultaneously have strong computer and mathematical skills. However, it is crucial to consider that while Machine Learning, i.e., the ability of machines to solve problems by giving them the tools to autonomously learn the correct methodology to operate, allows us analysis of online contexts opening new frontiers of interest without any kind of error, it is equally true that we are talking about mathematical calculations only, thus lacking the reasoning that lies upstream on detection techniques and the identification of the different forms of analysis most appropriate for that particular object of research. With the use of online Big Data analytics and related algorithms, error is around the corner and is increasingly evident with the use of AI. In these AI contexts, such as Recommendation Engines that are responsible for choosing and directing the user to targeted ads and information, or Gbl virtual assistants that interact with the customer via chat, the relationships between social actors are completely lost and give way to the algorithm as a substitute form of knowledge and capable of reasoning.

Let us take a step back, in the most classic social research contexts, there is a tendency, when carrying out quantitative analyses, to regard the very concept of statistical representativeness as indispensable, which on the other hand the social sciences borrow from the experimental type of research. In itself, carrying out an experiment in the field of social phenomena is extremely complex, the 'noise' is too deafening, i.e. the environment within which the experiment is to be carried out is impossible to control, the 'intervening' variables are too many and difficult to identify, and there is also the aspect linked to the effect of the experimenter, i.e. the interference of the researcher himself in the 'choice' of experimental subjects (Rosenthal and Jacobson, 1968).[6] There is also the age-old problem of non-representativeness, i.e. in the sense that the results of an experiment are often not generalisable to the entire population, or to segments of the population other than those being studied. The basis of the experimental method is defined by the possibility of varying the independent variable and keeping all the other variables under control, on large numbers this is practically impossible, or at least, in the very few cases in which it is possible to succeed in controlling the dependent variables, we are in any case in the realm of understanding the cause-effect relationship of a phenomenon.

It should be remembered that the inferential representativeness of the sample is also lost in all those cases in which the researcher interferes in the sampling procedures and somehow forces the predetermined procedure, thus passing from a probabilistic sample to a non-probabilistic

[6] They have been purposely named experimental subjects and not social actors, because it makes clear the idea with which the experimental research context considers subjects to be part of the research, where the distance between being part of the research in the most 'aseptic' way possible lays the foundations of the method itself.

one (Kruskal and Mosteller, 1980). It should be noted that the concept of inferentiality relies on two basic requirements, the representativeness and randomness, both decisively challenged by Marradi (1997, p. 23-87) who claims that randomness makes it impossible to assume the representativeness of a sample and vice versa, and that the tendency is to continue to invalidate the concept of inferentiality. However, of equal importance is the Central Limit Theorem[7] and

> the extent of the sample is directly proportional to the desired level of confidence in the estimation and the variability of the studied phenomenon, and inversely proportional to the error that the researcher is willing to accept. This means that the size of the population is of no major importance in determining the sample size, in fact, for example, a sample of 1,000 cases may be sufficient to arrive at the same levels of precision for estimates for populations of 10,000 and 100,000 elements. At the most, if precise estimates to two percentage points are desired, 2,500 cases are sufficient for any population size, including global. (Corbetta, 1999: 320).

There have been authors in the past, among them Kish and Frankel (1974), who have challenged this view of the plausibility of the experimental method in the field of social research, but today with Big Data and machine learning the situation becomes even more complicated.

Starting from these assumptions, it is worth emphasising that there is not just one type of error, there is the systematic error more commonly known as bias, the accidental error, the selection error, errors made at the indication, operationalisation, selection and observation stages. Let us try to clarify, in the more purely theoretical phase there are errors of indication, i.e. a type of error that encompasses a series of aspects linked to the coverage of the sample (mentioned in the previous paragraph), of the universe being surveyed and the relative non-responses. In the more purely empirical phase, on the other hand, there are errors of operationalisation, i.e. those linked to the intrusion of the interviewer, the respondent and the way in which the survey itself was carried out.

We have thus highlighted how error in its different meanings is an overrated aspect, especially when discussing sampling. If we think at error from a mathematical, statistical and/or probabilistic point of view and if we thought we could get around it by using e-methods, we will again make a mistake. They are completely different realities; they are two completely, different epistemological points of view. At the same

[7] By increasing the sample size n, the average distribution of a sample from any population with a finite variance approximates the normal distribution (mean and standard deviation) regardless of how the variable used to calculate the average is distributed in the population.

time, it would be a mistake to think of e-methods as a panacea for all the weaknesses of traditional probabilistic approaches. Certainly, they can help us to analyze data that we once did not have at our disposal, they can provide a different, new point of view and help us understand a complex and different reality. Having made these considerations, social relations in themselves are already extremely fluid, social media and the algorithms with which we analyze most of the data available to us are equally fluid, as is the complexity on the cognitive plane in which we move is extremely changeable.

Those considerations done, when we talk about bias we use to attribute a purely negative connotation to it, but this is not always true; in fact, unexpected influences should not always be perceived as "mistakes", i.e. "errors" that contaminate the quality of the recorded information and thus make the information itself to be considered as unusable. We could, instead, think of biases as a space-time continuum, in which possible distortions can actually modify the Data Quality to varying degrees and, in some cases, allow us to discover new aspects to which not much weight had been given, becoming non-negligible areas of research for the study of the phenomenon.

In this regard, it is easy for data from the web to be affected to varying degrees by distortions that we could distinguish into two macro categories: on the one hand, we have the possibility of incurring errors due to the tool preparation, as it happens in traditional research contexts, in other cases, instead, the biases derive from big data and from the data warehouses themselves, which can alter any information through different digital formats; therefore, it will be up to the researcher to understand these differences and "transform" the format of the data in its useful form, aimed at the analysis that is intended to be carried out.

So far we have considered all the different forms of error possible from the point of view of the 'classical' methodology of social research, superimposing them, when possible, on e-methods, but with AI the situation becomes even more complicated. If, on the one hand, when we discuss e-methods, albeit from a point of view more strictly linked to the operational aspects of data analysis, we have been able to distinguish and find a sort of compromise between the classical techniques and those in use today thanks to web contexts, it is much more complex to examine the concept of representativeness and the margin of error in contexts linked to AI, to Big Data understood in its broadest sense, i.e. linked to machine learning. We start from the assumption that AI and machine learning are strongly connected, and this has been reiterated several times within this article, but how are they connected?

AI can be described according to Burstein, W. Holsapple, & Power (2008) as a decision-support system consisting of: a set of data (observations), the input of an analysis process from which indications can be obtained to define decisions and corresponding actions that, evaluated with measurable results, can have an effect on the achievement of an overall goal (value growth). The basis of this theory is data distinguished in terms of volume, velocity, veracity and variety, fully echoing the definition of Big Data as already mentioned several times. AI can thus be used to provide us with a range of information aimed at telling us what has happened (TRON, 2020), or what is happening (Randazzo et al., 2018) and why it is happening (Benanti and Maffettone, 2024). We are thus linked to a field of research that carries out results related to reporting, or to the description or diagnostics of the event that is being investigated, but AI also answers predictive questions such as what is best to do in order to achieve a set goal (Warren, Lipkowitz, Sokolov, 2019). Precisely in the latter case, the link between AI and machine learning is extremely obvious; it is predictive analysis that makes the automation process the most appropriate one to provide us with such results. As discussed in the first paragraph, chatbots are the interface with which we relate within this human- machine relationship. The machine learning algorithm is used to simulate intuitive capabilities, designed in a data-driven manner thanks to previously learned information, i.e. in the code-writing phase there is a phase during which - according to the scientist interpretation - the algorithm would learn 'reality' in an 'objective' manner from the data set defined a priori by the programmer. The choice regarding which data set to use for the algorithm to learn information is dictated by an exclusively 'human' choice, certainly defined by cultural norms and rules of belonging, which can influence through systemic distortions the model itself (Airoldi, 2022). This type of problem certainly falls within the biases we have previously discussed. It is a type of error which in its declination is difficult to ascertain and define aprioristically and which in some ways comes close to the error as we know it in social research concerning the intrusion of the researcher.

5. Conclusive considerations

Even before AI entered our everyday lives as pervasively as it is perceived to be today, in the pre-pandemic period (Kyriakidis, 2019), there was already international discussion of the black box that characterises the use of systems based on algorithms and computational methods. In particular, the opacity with which the mechanisms of operation are characterised was already being discussed, aspects that among other things still arouse a certain reflexive scepticism, not only for those who use them as end-users, but also for researchers, who often do not possess such specific computer skills as to understand the mathematical and informatics mechanisms. Some of these therefore opt for a scientistic view, while others distance themselves from it by questioning the reliability of many AI solutions, which turn out to be poorly understood and scarcely usable, and for this reason, even less safe and efficient, especially when it comes to automated systems, think for instance of the use of robotics in the workplace.

The article highlighted some basic questions of the concept of representativeness, understood in a broad sense, looking not only at statistical representativeness, but especially at all those aspects with a broader scope. Obviously, an attempt has been made to provide answers starting from a classical view of social research methodology, passing through e-methods up to AI, which gives us a new point of view with respect to the concept of data reliability (Neresini, 2015).

According to the author, it is therefore a question of drawing new boundaries of investigation, because not only are the tools not conceived as human-centred (Amershi et al., 2014) and thus designed not so much to improve human capabilities, but rather to replace them, but they are also obscure for the majority of researchers, who have to deal with new research horizons, understand their potential, versatility, but above all their limits (Xu, 2019). AI is thus not inclusive, certainly it is increasingly easy for end-users to make use of chatbots even for those who have a significant digital divide, but understanding the mechanisms and using AI research fields moves us onto a completely different epistemological plane. According to Shapin's (1982) argument following the Science Studies Unit (SST) strand in Edinburgh, people produce knowledge on the basis of the knowledge they inherit within their own culture, their own collectively situated purposes and the information they receive from natural reality, and not least the role of the 'social', i.e. the importance of pre-structuring, not precluding (the scientist's) choice (Shapin 1982: 196-198). This view of the SST school of thought can also relate well to AI, and it is of the utmost importance to make conscious and culturally defined choices with respect to the choice of the data base on which to base the roots of machine learning, the process underlying AI, thus greatly limiting the 'noise' that can result. Not a few mistakes have been made in this regard in the past, with extremely evident consequences on the use of AI with blatant racial and gender discrimination, etc. etc. On the other hand, AI certainly responds to the need for collectively situated purposes through predictive information, reporting, etc.

When discussing new research frontiers, it is necessary to understand where we are, how we got there and where we are going. This is why the first paragraph presented the author's view of the borderline areas between the classical researcher's toolbox and that within which e-methods fall. From this initial point of departure, a series of arguments concerning representativeness, error and the purpose of understanding the plausibility of AI in social research were discussed.

To recapitulate, therefore, speaking of error, of representativeness in the field of AI in social research is, in my opinion, obsolete, because only the phases of construction of a model at the basis of machine learning can in some way be the object of attention on the part of the researcher and limit any errors linked to the choice of the data base, data set, ect. On the other hand, it is becoming increasingly difficult to enter into research activities that outline an algorithm from scratch, rather than the choice of a specific dataset. We are now in a field where we are mainly users of a wider blockchain, branching out across different datasets, with machine learning algorithms now defined and possibly modified in real time according to specific problems and/or interests already defined ex-ante. In the rare cases in which, the researcher can intervene within the process of building an algorithm and/or a chatbot, the social researcher must have a broad mathematical and statistical knowledge in order to be able to really contribute effectively within a research team dealing with the creation of new AI models and to be able to possibly benefit, at a later stage, from some of the Big Data processed, created, collected, etc.

In my opinion, too many steps are currently missing for the social researcher to be able to answer the questions concerning the margin of error of the research, the concept of replicability, and the plausibility of the tool. Certainly, AI is not a fire that burns out and goes out quickly, it will be the future and in the field of research there are certainly several ways in which it can be used.

The examples are countless, I will list a few without any claim to exhaustiveness. You can summarise a text, a manual, an article and be able to interact in real time with a chatbot to discuss it together. Being able to summarise a paper, a book, a longer or shorter text and turn it directly into a podcast to listen to it in audio format. Asking the AI to carry out a bibliographic reconnaissance from a lemma. There are also some chatbots that transform an analysis of quantitative data into a research report, not only with the most appropriate graphs to describe the phenomenon under study, but with a commentary below it (Mayr and

Schreder, 2014).[8]

I have listed just a few examples to reflect on the fact that there are merits and demerits to each one. Certainly it is useful to be able to summarise some of the texts, provided that we go into them in greater detail later on when the need arises. As the dissemination of scientific information increases, one extremely important aspect is missing, however, and that is to consider that it is fundamental to design AI without forgetting that social, environmental, economic, legal, etc. aspects must coexist in order to respect all the ethical values for each part that makes up the blockchain. The focus then shifts from the concept of representativeness, which as already mentioned is not applicable as we know it in the field of social research, to the ethical aspects, where the ethical design and development of AI systems requires a continuous synergy between a research team that constantly re-addresses the values.

AI's abilities to display human capabilities such as reasoning, learning, planning and creativity will become increasingly powerful (Kissinger, Huttenlocher, Schmidt, 2023). We are already at the stage where AI is able to disentangle itself within complex systems and understand its environment, relate to what it perceives and solve problems accordingly. That is why it is no longer so much a question of representativeness, the boundaries are already extremely blurred, because they are extremely fast, changeable with a level of continuous implementation that one can hardly even imagine. It is therefore crucial that AI is trained on a social-ethical level, with strong values that lay the foundations so that the transcription of the algorithms underlying machine learning is not self-reproduced by the machine itself in continuous evolution, but is driven by people, for a process that is no longer machine-centric, but human-centric.

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[8] Among the most famous is the International System Of Typographic Picture Education, a data analysis and visualisation system that uses a visual language created and reshaped from previous data visualisation experiences to create new hybrid forms of communication between statistics, information, graphic design and data visualisation. It deals with demographic trends, the environment and the economy.

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ON THE ETHICS OF SOCIAL RESEARCH IN NETNOGRAPHY

by *Angela Delli Paoli*[*]

Abstract

The paper aims to discuss the ethical challenges in netnography by highlighting the main dilemmas which develop around what counts as public versus private, whether treating digital data as texts or people's representations, if referring to the authentic embodied self or its digital representation, when sacrificing accuracy to privilege ethics. Such dilemmas refocus our attention on regulatory concepts like privacy, informed consent, anonymity and confidentiality challenging basic regulation terms. The ethical principles emerging from this discussion call for context sensitivity and reflexivity.

Keywords

Netnography, ethics, digital social research

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1. INTRODUCTION

Although the ethical dimension is a fundamental component of any social research, Digital Social Research opens novel and unexpected ethical challenges in the whole research process: from data collection to analysis. Netnography, a qualitative approach for exploring digital cultural context, is not an exception, and it poses particular and innovative ethical controversies which need to be identified and addressed.

Ethical challenges in netnography are difficult to standardize and discipline. Thus, the paper does not aim to provide formulas, but it aims to highlight controversies and detect ethical principles to follow. Providing regulatory guidelines may, indeed, be counterproductive, only reinforcing the practice of writing research proposals in ways that allow them to be approved. This would limit ethical questions to those included in a checkbox and ethics to a process of avoiding errors (Markham, 2018).

Moreover, ethics are not universal, but people, context and discipline dependent. They differ according to people and what they think to be ethical, to culture and their norms, their understanding of morality and social conduct, to disciplines and methods which show different standards for how to navigate ethics.

The paper focuses on the ethics of netnography. Ethical issues are not very considered in the netnographic practice. Quite surprisingly, a recent scoping review of netnography shows that a high proportion of papers do not even tackle the ethical issues (Delli Paoli e D'Auria 2025). Although, some ethical issues of netnography have been separately discussed in some contributions (Markham, 2003; 2006; 2017), a comprehensive overview of the specific netnographic challenges is still lacking.

Thus, the paper aims to highlight what constitutes the core of ethics in netnography: dilemmas with their benefits and costs. Dilemmas are not univocally solvable, are difficult, peculiar and case-based challenges without clear choices and outcomes.

Such dilemmas develop around dichotomic options:

- *Text versus people*: is netnography a text-based or a people-based research? Are digital information and narratives documents or people's worlds?
- *Public versus Private*: Are digital information and narrative public or private? How to distinguish the public/private nature of digital information? Is it an ethic or an emic choice?
- *Covert versus overt*: which is the border between accuracy (e.g. to preserve the non-intrusiveness of information) and ethics

(e.g., to uncover the presence of researchers) in observation? When does the benefit of research overcome its ethical costs?

- *Physical versus digital*: is ethically appropriate to follow the traditional scientific impulse to uncover the real and physical culture or its digital representation (which may not have any correspondence to their physical counterparts)?

Such dilemmas refocus our attention on regulatory concepts like privacy, informed consent, anonymity and confidentiality challenging basic regulation terms.

These are the main questions at the heart of this paper. Answers to these questions are not simple and the choices we make have significant practical and ethical consequences.

The paper is organized as follows. The next section provides an overview of netnography. The other sections face different dilemmas in netnographic research. Then questions about informed consent, anonymity and confidentiality in digital contexts are raised. In the last section some concluding remarks are provided.

2. NETNOGRAPHY

Netnography is the last response to the progressive extension of the ethnographic object and field. Just in a very simplistic way, it can be defined as a non-standard and qualitative approach transposing and adapting ethnographic research to the digital contexts. However, due to extreme differences between the physical and the digital, the digital transposition of ethnography cannot be considered a mere adaptation.

It involves the long term, engaged and more or less participatory observation of digital phenomena through discussions and interactions developing in digital contexts in order to provide deep descriptions of perspectives of particular populations, to interpret phenomena, practices, cultures (*thick description*).

Like ethnography also netnography requires immersion in a relevant social phenomenon. Immersion in netnography does not equal participation as in ethnography where a researcher cannot hide his/her physical presence. In netnography immersion is engagement and it means the personal, intellectual, cultural, historical, emotional, social involvement of the researcher in the social phenomenon (Kozinets, Gretzel 2023).

The cognitive goal of digital ethnography remains related to the reconstruction of cultures with their horizons of meanings and practices. Thus, netnographic research is not aimed at understanding media uses or technological practices for their own sake but at interpreting cultures that find digital expression, their related identity, relational, symbolic, normative, and value experiences.

Cultures or subcultures that emerge from the convergence of media and the mediation and remediation of identities represent the main object of netnography. Thus, it is not limited to new cultural formations that emerge online and through the digital, but it extends to cultural or subcultural groups and practices that, due to the supposed and perceived anonymity of digital communication or the stigmatization that some cultures experience in physical contexts, find distinctive spaces for discussion in digital contexts (underground, stigmatized, minority populations) (Delli Paoli, 2022).

If the object of digital ethnography remains culture, its scope is hermeneutic: culture is understood as a text that must be interpreted and not just decoded by the ethnographer, in an endless process of production of thick descriptions (Geertz, 1973). Interpreting a culture is like interpreting a vast text or collection of texts to piece together the story of stratified meanings. Since cultures are traced back to easily accessible postings, comments, and discussions, as well as cultural artifacts that can be read and reread, dismantled, archived, mixed, assembled, articulated and disarticulated ad infinitum, the text in netnography is literal rather than metaphorical (as in ethnography).

Thus, netnography can be defined as a long-term and thick observation of culture carried out on narratives and discourse developed in digital fields. In netnography the digital field is the discursive terrain where the social phenomenon under study is discursively built.

3. ETHICAL DILEMMAS

3.1 Text-based vs people-based research

Positions on the ethical issues in digital research may be articulated around a dichotomy between text and people.

Being web-based objects such as SNSs, bulletin boards, comments, posts, blogs, in principle, electronic documents (Ess and Committee, 2002), research involving such documents is by some considered not human-subject research (Enyon et al., 2009) but text-based research. Within this perspective, Internet texts can be viewed as cultural products and artifacts and this removes human subjects from the frame of reference (Bassett and O'Riordan, 2002; Hookway, 2008; White, 2002). Those who believe that digital data are texts and not people,, by leveraging on the textual nature of digital data believe they can gloss over the ethical issue. According to this perspective, people would need to be protected, the documents they produce would not: if, therefore, people are removed in the digital research process, ethical protocols such as informed consent become superfluous.

The texts which represent the empirical basis of netnography are user-generated, non-provoked information, routinely generated on the web in the daily use of the Internet (e.g. posts, comments published on social media or communities, blogs; photos of our private life; video diaries; profiles of our social accounts, etc.). They differ substantially from the traditional empirical basis of social research. They are supposed to have a naturalistic and non-intrusive character (Cardano, 2011: 28) since individuals, by producing this information in their daily use of the internet, are barely aware of data collection and they do not modify their behaviors, opinions, thoughts in response to their awareness of being observed or part of a study (artificial situation).

In netnography texts are the building blocks of culture because they are presentations and representations of identity, norms and practices through narratives. Narrative is an existential, identity and social practice. Storytelling is a constitutive feature of man as such: the meaning of existence is constructed in storytelling through the narration of our history. Narrative is a mediation between man and the external world, between man and other men, and between man and himself (Ricoeur, 1994). Narrative is thus a privileged context for the exploration of identity and culture and the building of communities.

The scope of netnography is to detect and recognize the layer of humanity behind texts, technologies and affordances, to understand through texts the lived experience of particular human beings (Kozinets and Gretzel, 2024).

Digital data challenges the ontological distinction between data produced by people and people themselves by fragmenting people into incoherent and decontextualized data traces (Markham, Tiinderberg, Herman, 2018). This accentuates the distance between the people and the data they produce. Moreover, the fact that data are "found" and not provoked by researcher, allow to obtain private data without even intervening in the life of people to gather them. This further strengthens the sense of distance between researcher and the subject. Such double distance – between data and subjects and between researcher and subjects – may obscure ethical issues.

Although it is not always immediately detectable and intuitable how, at what point, and at what level people are involved in digital information, they all involve people: we need not forget that texts are under the agency of real people with feelings and rights. Therefore, netnography needs to consider principles of research on human subjects and ethical and normative accountability related to the consequences of research.

To indicate the presence of people in digital data and consequent harms which may derive from their primary and secondary use, Metcalf and Crawford (2016) use the term *data subjectivity.* Also Zook et al. (2017) recognize as the first (out of 10) rule of responsible digital research the acknowledge that data are people and can do harm.

3.2 Public VS Private

Those who opt for considering digital narratives as texts and not people, although admitting the distinction between a published book and personal information and narratives released online, believe that the use of such information raises privacy issues more than ethical ones (Wilkinson and Thelwall, 2011).

In this regard, it might be useful to distinguish between different types of privacy (Moor, 2004; Tavani, 2005) and in particular between natural and normative privacy: the former matures on the level of expectations, the latter is protected by law.

A person in a remote place configures a naturally private situation: on a remote and hard-to-reach island or mountain, people can expect protection and privacy, they expect to be hidden from others, that whatever they did would not be observed.

In contrast, the release of personal information to a bank configures a normatively private situation: this information is protected legislatively, people expect the bank to protect that information from malicious use and require the bank to keep that information confidential and not disclose it. Public digital information would fall into the first type, and this would justify the use of such information for research purposes.

However, this calls into question the *public-private dichotomy*: even in naturally private situations, while there are no legislatively defined boundaries, people might have expectations of privacy even though they are not formally entitled to it and regardless of the supposed public context where they are.

Some spaces, although being public, may be perceived as private. It is the case of some blogs or online communities where people publish diaries which are perceived as their private diaries, irrespective of their public nature. This implies that divulgation of such information by research is considered inappropriate, breaches and violates the expectations of privacy. Markham (2018) reports the case of Greta, a component of a community of women interested in home styling and interior design, who openly publish posts and photos about her home on the community, but she wanted her blog to remain private and not known in her physical surrounding.

In contrast, some spaces or topics although being private, sensitive and intimate, may be considered public. For example, in his study of a blog of friends of a sick woman (Susan) with heart disease and waiting for an organ transplant, Koufaris (2001) demonstrated that although being on an intimate theme, the blog was perceived as a public space. The website, daily followed by hundreds of people seeking constant updates on her health, anecdotes, testimonies, videos, and pictures of her battle, becomes a way to publicly disseminate an extremely intimate and private event such as the battle for life of Susan. Although the sensitive topic, participants had no expectations of privacy, were very open about their identity and made no effort to conceal it. Markham (2018) reports also the case of Kersten's blog about the suicide of her daughter, built as a retrospective journey of the year before suicide, rich of detailed descriptions of experiences, emotions and pieces of life. Kersten expressed the need to keep the blog public and to make her voice heard in order to raise awareness about the pain that suicide causes to those who survive.

The distinction between public and private becomes very blurred in digital contexts, and the boundaries between the two spheres are neither comparable to those traceable in physical contexts, nor they can be conceptualized according to the pre-digital assumptions. Just to make an example think of the distinction between social arena typical of offline contexts where we are able to reveal or conceal aspects of ourselves according to varying audience. In digital context we are not able to maintain separate faces in distinct social arena anymore. Digital messages are directed to an indistinct mass including family, colleagues, friends, acquaintances, and strangers blurring the boundaries between formal and informal spheres (*context collapse*) (Davis and Jurgenson, 2014). To matter seems to be both the nature of the message but also its context. They both affect, shape and limit our roles, behaviors and expectations.

From this point of view, Goffman's exploration of identity offers an interesting approach, through his fundamental ordering category for identity performance: the dichotomy between frontstage (public/openness) and backstage (private/ secrecy). The identity performance of individuals through recounting of personal narratives occurs increasingly more online, in digital arenas. As in the classical dramaturgical model, individuals still present themselves in front of each other, but the prerequisites for social interaction and the boundaries between intimate and public sphere are different. Frontstage is the social and public arena where performance is held in front of an intended audience which excludes outsiders. Backstage is the private and intimate sphere, an informal area where individuals step out of character (Goffman, 1959: 144). The digital upsets boundaries between the two regions, turning this model upside down and sometimes reversing dramaturgical performance. In digital spaces, by accurately selecting strategies and visual elements of their presence, individuals engage in online impression management, which is important for online identity performances. The audience does not appear anymore only in the front region and the outsiders are not excluded (there is no way to exclude unwelcome individuals apart from the liked audience). The performance is even more theatrical and dramaturgical, but the intimacy is ritualized, and intimate is sublimated so that frontstage is sometimes staged as backstage.

Think for example of traditional intimate and private phenomena such as suicide which in the practice of publishing the last notes on social media is transformed into a public-facing genre (Marres, 2017). Or the practice of maintaining the relationships with death people after death through the dead person's social media profiles. Davide Sisto (2018) observes that such elaboration of grief passes through social profiles when social actors make use of them to leave direct messages to their deceased: the interaction is similar to that which takes place during a dialogue/soliloquy at the cemetery, but in the digital sphere such intimate and personal dialogue takes on the characteristics of intersubjectivity and the generalized other becomes, in some way, a participant in pain. The social profile of the deceased, often "memorialized" through specific procedures provided in the context of social networks, becomes the point of contact between the living and the deceased, between life and death, allows for the creation of community around loss. There are even "griefbots," digital clones, digital ghosts of the dead.

Some digital spaces resemble backstage performances and are those that need to be considered private, regardless of the public nature of the content. They may be conceptualized under the notion of "parochiality": although being public they engender intimate forms of communication. It is the case experienced in a netnography on asexuality. Asexuality is a lack of sexual attraction toward other people. For asexuals the online communities represent a dedicate space, far from a sexual affirmative social context (a society where sexuality and sex are central and omnipresent), to legitimize and build sexual selfhood projects. By entering one of the main online communities on asexuality we soon realized that it was perceived as a socializing agency to build a communal identity through a negotiated process of identification and interaction with significant others. Stories, biographies and experiences can be shared only with those who have similar attitudes. Like a family, the community were perceived as a safe, informal and self-regulating space of self-definition of asexuality that, although being public, oppose to society (which pathologize asexuality) and outsiders (who impose sexuality as an imperative). A form of backstage performance (Delli Paoli and Masullo, 2022).

In the same way, in a study of online coming out by lesbians, the authors decided to apply strict ethical protocol although the online community and its content was public. They soon realized that participants conceived the community as a semi-private and protected space. They use confessional and biographical posting, identity presentations which resembled backstage performances. Thus, they decided to obscure the name of the community and to change also pseudonyms (Munt, Bassett and O'Riordan, 2002).

Both these communities are conceived as socializing spaces containing personal stories not to shore outside that specific context.

For this reason, we claim that ethics goes beyond the regulatory dimension of digital data protection and what appears to be normatively public or private and that digital research is in need of new ethical consciousnesses (Markham, 2017; Varis, 2014) that are difficult to predefine but are inspired by the principle of care, a principle that goes beyond the simple claim of not causing harm (Boellstoorff, Nardi, Taylor, 2012).

Considering the sensitivity of the topic is not enough as the example of Kersten and Greta demonstrate: also in the case of non-sensitive topic people may have expectations of privacy and also in the case of sensitive topics people may express the desire to make their voice heard. Sensitivity does not imply directly privacy or vulnerability and viceversa non sensitivity does not imply necessarily public or non-vulnerability.

Defining something as private or public, as sensitive or not and someone as vulnerable or not has implication for how we assume it should be treated in a research context.

The concept of harm needs to be reconsidered overcoming the equivalence private as harmful and public as unharmful. Considering digital data, the assumption that publicly available information cannot cause any further harm to an individual cannot be considered true. Identity disclosure of people in public communities perceived as private may cause involuntary outings, the revelation of sexual orientations outside the community without the person's will.

Moreover, in digital research it is critical to consider also potentially risk-laden correlations deriving for example from combining seemingly innocuous and anonymized public datasets to other data sets. Think for example to netnography carried out on public social media profiles of a specific geographical community. Financial institutions, by linking this information with their dataset, may infer credit worthiness and orient their decisions to provide credit. Public information may cause economic harm (by affecting their ability to get a loan) to particular individuals and communities (Metcalf and Crawford 2016). Obviously the higher the depth of information, the higher the ethical implications: a single Instagram photo is less problematic than the history of all social media posts of an individual (which is frequent in netnography).

The approach taken here rejects the idea that a simple dichotomy — usually between public and private (sensitive, intimate) information — is sufficient for adjudicating ethical claims. It is therefore important to distinguish between what is ethically public or private but also between what is emically perceived as public and private. Such fences vary between context and context, culture and culture, person and person, and need to be ethnographically defined. It is crucial to focus on people's expectations, on the sensitivity of topics and data and vulnerability of populations and on the impetus to anticipate privacy breaches and minimize harm.

3.3 Physical VS Digital

Within digital spaces the self exists as a textual body. This textual body exists as a separate "entity" from the physical body, an entity which may also be false in "real" terms.

Digital traces have been considered the empirical basis of non-intrusive techniques being not disturbed by the presence of researcher and not influenced by it. For some the non-intrusiveness of digital traces plays in favor of data quality and trustworthiness in particular. Not being disturbed by the presence of a researcher asking direct questions, this information is supposed to be more authentic, sincere, and so more reliable.

However, digital information is still affected by some forms of bias common also in traditional survey research and mainly related to identity and self-presentation strategies. First, the social desirability bias. Social desiderability is a well-known tendency for social researchers first identified by the methodologist Allen Edwards (1957) more than 60 years ago by analyzing responses to the well-known Minnesota Multiphasic Personality Inventory psychological test.

Social desirability can be defined as the tendency to provide normative and non-sincere responses to questions of a survey. This risk is higher, the lower is the interest in the topic of the question and the presence of strong opinions about it and the more sensitive and reactive is the topic (Marradi, 2007). This is an unconscious tendency, only rarely resulting from a conscious decision to lie. Such tendency seems to be present also in digital fields and user-produced information. We can hardly consider digital traces as authentic, true and transparent point of access to the individual identity. Most of time, digital content (being it texts, comments, posts or photos, images, video, links, etc.) is carefully selected to adhere to one's idealized self. Like in the answers to a questionnaire, also in the publication of digital information people move as a maker of impressions in the human task of staging a performance able to provide to others a coherent self-image adherent to social norms (Goffman, 1959). Social media and digital platforms are the new frames where identity is performed through models that resemble the principles of social desirability.

However, digital social desirability may take also forms different from those we are used to in survey and mainstream research. While in some cases it may tend as in traditional social research to reinforce conformism, emphasizing adherence to social normativity and culturally accepted standards and expectations of behavior, in other it can reinforce anti-conformism. Also, thanks to anonymity, on the internet people may have the need to appear more anti-normative than they are. They can emphasize their otherness, opposition, dissent from normative and social-orientated discourse, also by offensive, deliberately anti-political language that defies the codes of political correctness and sometimes takes on the connotations of hate speech. We call this form of bias *social undesirability*.

This may also be due to the difference between private and public opinions and the tendency of individuals to have various opinions and attitudes towards the same object/topic. Such differences may be incompatible if expressed in the same context but compatible if expressed in different online or offline contexts.

Moreover, the presence of non-human entities such as bots or autonomous internet-based computer programs designed to imitate human behavior and automatically interact with humans put into question trustworthiness of digital traces. The same for fake accounts who may be created for marketing reasons, social media consumption motivations or diffusion of hate speech, armful or fake content, propaganda, etc.

Being false or not, in real world digital selves produce real consequences: "real becomes a double negative; simply put, when experiences are experienced, they cannot be 'not real'" (Markham, 1998: 120). The example of the married couple formed by David and Amy Taylor, unemployed and obese in the real life and slim and professionally realized in their Second Life, who had their marriage destroyed by Amy's discovery of the virtual affair of David with a sex worker in Second Life, make the point clear (Ashford, 2009).

The trustworthiness of digital traces may become secondary. Indeed, when interested in exploring identity, it is not the truth of information to be important but their truth for participants: "When people perceive things to be real, they will be real in their consequences" (Thomas, 1928). Digital identities sometimes may offer a means to escape the boundaries of embodied bodies and contexts. In such cases, texts and not bodies or contexts offer a better representation of their beings. It is ethically correct (and not exclusively for anonymity reasons) to resist the tendency of seeking authenticity or validity by for example comparing the digital and physical representations to see if they match. As Markham (2003: 60) highlights:

> We naturally trust our traditional senses of sight, smell, and touch, taste and hearing to provide verification of concrete reality. In essentially disembodied relationships and cultures, however, this desire bleeds integrity from the project of knowing the other in context.

3.4 Covert versus overt

Two basic strategies of access to the field can be identified in netnography:

- *Covert access*: the researcher does not inform the research subjects, of his or her presence and role as a researcher;
- *Overt access*: the researcher overtly makes his presence known, informs participants about the research objectives, and requests some form of consent to participate.

Both strategies have pros and cons, and the choice cannot be made

regardless of the research question, the peculiarities of the digital context being investigated, the level of sensitivity/reactivity of the topic being investigated, and the balance between observational choices and ethical risks or consequences on the subjects being observed (Cardano, 2011).
Covert access may have advantages in terms of minimizing the intrusiveness of the research but has ethical implications (Beneito-Montagut, 2011; Hine, 2005; Bell, 2001; Heath et al., 1999; Garcia et al., 2009; Kozinets, 2010):

- it violates the imperative for researchers to always reveal his or her presence and research intentions to the subjects studied;
- it violates the participatory nature of research, making it a unidirectional process of appropriation;
- it violates the dialogic nature of research, making it a superficial practice. This has consequences for the knowledge process, not allowing for a deep understanding of phenomena (a prerequisite of traditional ethnography).

Avoiding participation can also have consequences for the texts collected by the ethnographer, many of which are invisible in the public sections of digital platforms (Mason, 1996; Leaning, 1998; Heath et al., 1999; Hine, 2000).

In contrast, overt access is ethically sound but intrusive. Proponents of the covert approach (Hewer and Brownlie, 2007; Beaven and Laws, 2007; Langer and Beckman, 2005) believe, indeed, that informing community members of the researcher's identity would undermine the main advantage of the approach, i.e., its non-intrusiveness. The richness of this information would lie in its being derived from socially constructed interactions among like-minded individuals rather than from interaction with researchers that would limit it to only provoked information. In addition, a covert approach would overcome the power asymmetry between researchers and participants and the risk that the researcher may put his or her self first in the meaning-making process (Atkinson and DePalma, 2008; Kavanaugh and Maratea, 2020).

This may be particularly important for sensitive topics, invisible, hard-to-reach and stigmatized, purely digital populations which would not welcome the presence of a researcher, or anyone perceived as an *outsider*, deviant or illegal phenomena, extreme activism, communities in the deep or dark web. Covert observation may be ethically acceptable only in those cases that otherwise may not be studied on the condition it fully preserves the privacy and anonymity of participants.

In all other cases overt observation is necessary and participants need to be informed. However, as we will see in the next paragraph, traditional informed consent may be not enough.

In the case of overt access, compliance with community rules, behavioral expectations, and norms specific to the digital contexts involved, is also ethically critical. It is ethically correct to respect behaviors or practices that have meaning and value within the context under investigation. It is what Cardano (2011) calls *pragmatic participation*, the understanding and application of the rules of conduct and behavioral practices of a given community, of the syntax of a given culture: ways of greeting, calling each other, rituals of farewell, strategies of communication and interaction, etc. We usually realize we have not understood a community norm after we have unknowingly violated it, from the reactions of natives to our unintentional "gaffe". In digital, more than perhaps in physical relationships, these mistakes can undermine the possibility of being well-accepted and staying in that context.

It is therefore necessary to know netiquette, community norms, rules, and group syntax before entering the field. Many studies report cases of researchers not being accepted due to violation of community norms (LeBesco, 2004). Learning these norms, specific to different digital contexts, can also take place through a brief phase of covert observation preparatory to unveiling one's role as a researcher and useful to familiarize oneself with the field, the practices, languages and symbolic resources of the participants, to identify the most active members, possible gatekeepers, discussion topics, technical strategies of the context and affordances used. In case of overt access, we need also to consider the inclusiveness of the field. In exclusive fields (such as many of those which although public are perceived as private) also personal attributes of researcher may matter. In these fields personal attributes such as gender, age, ethnicity, education, occupation, etc. may impact on access and participation. A case of an exclusive netnographic field is the communities of incels (involuntary celibates). The difficulty of accessing this field by a female researcher who wants to explore a community of self-described misogynistic males appears evident in Sugiura's (2022) research. In digital contexts, it is not so much the actual identity of the researchers that matters, given both the possibility of hiding socio-demographic information online and the potential to explore multiple identities. In contrast to face-to-face interactions, in digital contexts identity clues are less overt. In this research, the researcher embarked on a path of careful management of her digital identity, of meticulous attention to digital communications, the posts she made, the "likes" she entered, and the materials she shared, in order not to be provocative. She also avoided appearing provocative through strategies of including/excluding aspects of her identity in the biographies of the various social media accounts associated with her account. However, she decided to maintain her feminist identity despite knowing that this would make her an enemy in the eyes of the incels, for ethical reasons and also because she did not want to sacrifice such relevant aspects of her identity for research purposes.

4. BEYOND STATIC INFORMED CONSENT

In general terms, informed consent implies that researchers commit to providing detailed information about the purpose, duration, risks, and benefits of the research for participants and that participants are granted the absolute right to withdraw from the research at any time.

The concept has a long history in biomedical research, where it is conceived as the fundamental mechanism for ensuring that research prioritizes the well-being of participants. Most ethics committees require that all human-subjects research include informed consent; exceptions must be carefully justified.

However, we cannot merely translate the notion of informed consent derived from biomedicine to social science research: being informed about a medical experiment is different from being informed about ethnographic research. Compared to a medical experiment with its certainly more immediate aims, in social research participants, even the most educated, often know little about ethnography and social research and understand even less about its goals.

Signing an informed consent could therefore in ethnographic research turn into a mere ritualized practice that prescinds from the participants' real understanding of the goals and consequences of the research.

The type of procedures required depends on the presumed severity of the risks: the greater the risk the more formalized the procedure must be. However, regardless of the risks it is always important to reveal the nature and objectives of the research and the role of researchers. Informing strategies are highly contextual and dependent on the cognitive goals, the type of digital field, and the affordances.

Crucially, it is essential to create a digital context for presenting the research. In some cases, a short textual presentation that links to multimedia content (video clips presenting the research) and provides in-depth references may be necessary.

For example, in gaming contexts the researcher identity could be included in one's character description, on social media in the profile description, etc. Ideally, a research blog or website should provide the objectives, the teams, the institutional affiliations, and contacts. This channel should also be gradually updated with research results and used as a tool for returning results and collecting feedback from participants (member checking).

Risks are considered higher in the case of research involving sensitive data or vulnerable participants, while they are considered lower when data aggregation makes it difficult to identify individuals.

However, the principle of aggregation that would protect anonymity by (thus not requiring informed consent), has been shown to be unfounded in digital contexts.

In 2008, a group of researchers made public a dataset that contained profile data from several Facebook accounts of an entire cohort of students at a U.S. university. Although procedures were applied to anonymize the personal data with related removal of the students' names and IDs, of the university of origin and cultural interests, the data were easily re-identified revealing the fragility of the alleged privacy of the subjects under study (Zimmer, 2010).

Some consider informed consent to be unnecessary due to the digital consent given by those who share information in public digital spaces. However, problems arise in relation first to the awareness of users who often automatically consent to the release of their personal information and only rarely change their privacy settings. The informed consent model is based on participants' autonomy, competence, and ability to understand risks, all assumptions challenged by digital information. Acceptance of the platforms' terms of use may not meet the criteria for informed consent, as the often vague language alluding to “use for research” does not involve disclosure of the specific elements relevant to a particular research program.

Consent given in platforms is also contextual in nature. Information that is disclosed for example on social media is expected to remain within those spaces. Think, for example, of a borderline case or an emergency or crisis situation (environmental disasters for example) where some people might share personal information to ask for help or help other people. The disclosure of this information should be protected, it needs to remain within the original context and not exploited for research purposes (Crawford and Finn, 2014).

To complicate the process, there is the difficulty for the researcher himself or herself to anticipate future risks and potential negative consequences of the research for participants.

Informed consent becomes somewhat problematic and obsolete in digital contexts where it is anachronistic to require people to sign a form as a sine-qua-non condition for participating in research. In addition to the unfeasibility of this when there are many participants, signing a form also becomes potentially risky.

In addition, the time aspect must be considered. First, signing on a form cannot cover a person's consent for the entire period of his or her engagement in a group. Digital groups, communities and contexts are very dynamic and continually subject to member changing (the access of new members for example who may not have signed the distributed informed consent prior to their joining the group). Second, keeping participants informed about the research is an ongoing imperative which does not end with a signed consent form.

The concept of consent should be readapted to digital contexts and conceived more as dynamic rather than static, as a process of continuous exchange and negotiation, a process that needs to be modulated in relation to the evolution of the situation, contingencies in the field, changes in memberships, attendances and absences, and expectations of participants. Even when feasible, informed consent is not enough because it needs to be considered both the direct and the indirect violation of anonymity. Written permission by one participant does not resolve the issue of indirectly violating anonymity for those in the participant's social network. In netnography the identification of a participant often implies the identification of his/her friends, relatives, groups, colleagues, etc. This is an unethical practice. Thus, even when informed consent is possible and participants consent to be identified, it may be appropriate to maintain anonymity to preserve participant's social network from unforeseen consequences (Boellstoorff, Nardi, Taylor, 2012).

5. ANONYMITY AND CONFIDENTIALITY

Anonymity and confidentiality are often contemplated together, although they refer to different concepts. Both are basic requirements of social research.

Confidentiality refers to access to personal information by the researcher alone and the assurance that it will not be accessible by anyone but the researcher while anonymity is about ensuring the non-identification of the person from the research data through removing sensitive and personal identifiable information such as names or personal codes.

In digital contexts where data mining technologies can easily link participants to the information they produce through different devices and in different contexts, anonymity and confidentiality are continuously challenged.

Although the use of pseudonyms is considered to be enough to ensure confidentiality, the publication of pseudonyms or nicknames could put anonymity at risk. A pseudonym could also coincide with the person's real name without the researcher's knowledge. Even if it does not coincide with the real name, it could contain part of the name and members of a group or community could still identify the person through it. As Bruckman (2004) points out, participants might use the same pseudonym over a very long-time span, in different contexts and platforms in which they alternatively might reveal personal information that, when combined and reassembled (when, for example, stored in databases), might end up identifying the person.

It might therefore be useful to also change the nicknames of participants in research reports using invented pseudonyms but still semantically close to the original ones.

Such a process may be more or less time-consuming. It is somewhat time-consuming, for example, in virtual worlds where participants often have extraordinarily creative pseudonyms for which finding equivalents that maintain the creative dimension without violating identity is difficult.

While anonymizing data and changing people's names, narratives could still be searchable and linkable to people through relational databases. Someone calls this traceability, instead of anonymity (Beaulieu and Estalella, 2012). The searchable and relational nature of digital environments poses problems perhaps particularly for ethnographers whose goal is to give voice to participants often "in their own words". Recognizing such risks might require difficult compromises such as the need to sacrifice ethnographic details and accuracy of accounts to preserve participants.

Obviously, the more sensible is the topic (such as when the research concerns vulnerable, invisible or stigmatized populations who might be endangered by the disclosure of their identities), the more important is to guarantee anonymity.

Think, for example, of political activists who might face legal repercussions or nonregulatory sexualities whose identity disclosure might involve unintentional outing, the revelation of orientations without the person's knowledge or will.

Therefore, digital information cannot, under any circumstances, be considered as information that is publicly available and readily usable by anyone and for any purpose.

Ethical decisions must be adjusted on a case-by-case basis depending on the type of platform, the sensitivity of the topic being investigated, and the potential risks to participants (Garcia, Standlee, Bechkoff, Cui, 2009; Varis, 2014).

The greatest risks are obviously related to the violation of the privacy of those involved. This is not only an issue related to the protection of sensitive data per se but also to the consequences that could result from such disclosure such as stalking, discrimination, black-mailing, or identity theft (Gross and Acquisti, 2005).

The example of netnography in dangerous contexts may help to clarify the point. Research on authoritarian regimes and/or during violent conflicts may have severe consequences for participants, should them be identified as members of armed forces, opposition movements, dissidents and therefore persecuted by the police, become targets for paramilitary groups or accused of revealing secret information, being traitors or spies. Consequently, protecting the identity of participants must be given top priority (Malthaner, 2014).

Direct risks are compounded by indirect risks when research findings are used for other purposes such as, for example, targeted advertising campaigns, mass manipulation, or political propaganda, as the Cambridge Analytica case (a data mining analysis firm able to access personal details of 50 million of Facebook users without their direct permission) has shown.

6. ETHICAL CHOICES

Some ethical strategies can minimize the risks highlighted in the previous paragraphs.

For example, in a netnographic research on a community of sexy selfie enthusiasts on Tumblr.com (Tiidenberg, 2018), a public space with publicly accessible content, the researcher by discussing with participants noted that they perceived that context as private and intimate. This combined with the sensitive content (sexuality and nudity) prompted the author to request informed consent. However, she did not limit herself to a general request for consent at the beginning of the study, but activated a dynamic path to consent by requesting it at each new stage of the research and each new “use” of the images (e.g., for presentations and publications). It was also beneficial the creation of a blog by the researcher in which to communicate the results and interpretations of the research and collect feedback from participants (*member checking*). In addition, in order to protect participants' privacy, which is all the more necessary in contexts where the public and private are difficult to distinguish, the authors proposed composite narratives, fictional narratives, and remix techniques to avoid identification and re-identification of participants. For example, they changed all images into pencil sketches that retained visual details while reducing recognizability. They reassembled the narratives by avoiding direct quotes from the web and making sure (through Google cross-searching) that the altered texts could no longer be traced back to the blog from which they came.

Being interested in digital activism and the ways in which it is able to connect the public square with the digital sphere, Barbosa (Milan and Barbosa, 2020) conducted a digital ethnography on a leftist activist group on WhattsApp - #UnidosContraOGolpe (UCG) created during the controversial impeachment of President Rousseff in Brazil. It was a closed group with invitation-only access created at the initiative of a citizen and soon became a space for discussion, expression of outrage, proposals for alternative scenarios, and mobilization. The researcher managed to gain access to the group through direct knowledge of some of the participants, and as soon as he entered, he posted a message informing members of the research and announcing that some of them would be invited for an interview at a later stage. Recording no opposition, he considered this a "green light". Through his active participation in group discussions, he began to build a trusting relationship that, like the admission, was facilitated by previous knowledge of some group members and was thus quickly considered a full member. However, the researcher was aware of the dynamic nature of group accesses on WhattsApp and the fact that continuously new users may join, some may drop out, not everyone participates assiduously, etc. He therefore occasionally chose to send a reminder about the research. He also made an informal commitment to the group as a spokesperson at public meetings to present the research results. Such public meetings were co-constructed so that over time the group members legitimized him as their "voice" in academia.

In a netnographic research on intimate relationships with robots and dolls, the researcher decides not to disclose the exact name of the forum that represents the major context of observation and for which he uses as the fictional name Prominent Doll website. He openly discloses his role of researcher to the administrators, also sending them the whole research design. After receiving administrators' consent, he actively participated in content production by publishing posts and sending private messages to various members, but always reiterating his role as an outsider researcher (outsider to the community and not a sex doll owner). Also contributing to overt his role was his institutional bio with real name and institutional contacts. As an additional ethical consideration and given the sensitivity of the topic and the stigmatization of the community under study, the author also decided to change the nicknames of both people and their dolls (Hanson, 2021).

7. DISCUSSION AND CONCLUSIONS

At the end of this paper, we can say that the ethical controversies to which netnography exposes are significant and certainly not exhaustively contained in this paper. For while it is difficult to exhaustively list the challenges that different netnographic research may face, it is equally so to standardize and discipline solutions for these dilemmas.

With reference to the first dilemma (text versus people) we opt for a balanced position by considering digital data as texts under the agency of people which can do harm.

The difficulty in distinguishing between public and private settings leads to overcoming the legal public/private dichotomy to concentrate on the emic perception of participants and their definition of the content as public or private.

The decision between covert or overt access to the field needs to be ethically grounded by considering the inclusiveness of the field and being prepared to sacrifice accuracy if required.

What matter for netnograhy is the digital representation and not its physical or real correspondence.

The paper highlighted challenges to the traditional nature of consent and anonymization, the need for respecting expectations of privacy, the contextual nature of ethics. Concerns over consent, privacy, anonymity do not disappear simply because participants interact and discuss in public space. Instead, they became even more important and complex.

Neither the delineation of something as public or private, as true or false, as legitimate or not, nor informed consent, anonymity and confidentiality are obvious in digital context.

I have certainly not succeeded with this paper in providing an unambiguous ethical procedure that can be considered correct because I believe there is no formula other than reflexivity that requires the researcher to continually question not only the process of observation but also its consequences.

Ethical challenges require researchers to develop reflexivity about choices and how they will impact the outcome, whether they will affect and in which way the people we seek to represent and to reflexively and flexibly adapt to the context.

It is our responsibility as researchers to raise questions but also to ensure that our methods and procedures remain rooted in long-standing ethical practices.

No regulations or codes of conduct imposed from the outside may help to carry out ethical research. Instead, it is important to shift from a top down to a bottom-up logic, interrogating our methods from the inside in: "reflexively interrogating one's methods of inquiry shifts attention away from codes of conduct imposed from the outside and reveals hidden ethical practices from the inside" (Markham, 2006: 39).

The ethical focus must shift from mere consideration of the data collected to the entire process: all decisions in netnographic research - from the questions asked, methods of defining field boundaries, accessing participants, collecting, organizing, interpreting the information - are ethical decisions. Moreover, how the ethnographer analyzes, categorizes, represents and interprets (sub)cultural identities or cultural practices influences how they will be perceived, understood in the academy and outside it by readers, students, policy-makers and others. This expands the ethical dimension to the entire netnographic process.

Dynamic informed consent (where possible), altered quotations so that they cannot be backward traces in search engines, anonymizing and pseudonymizing people assumes a huge importance for vulnerable populations and sensitive topics, as the examples demonstrate.

The ethical principles emerging from this discussion call for ethical consideration of vulnerable populations or topics, for balancing people's rights and expectations with the social benefits of research, for considering ethics in the entire research process and not only in the dissemination of results. In one word, by highlighting dilemmas, the paper attempts to establish the moral authority for self-regulation.

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OLDER PEOPLE AND DIGITAL DISCRIMINATION
Promoting digital literacy to reduce biases in oline social research

by *Danilo Boriati**

Abstract

In the digital age, older people are often marginalized and discriminated against in online social research due to their perceived lack of digital literacy. This bias can have significant implications for research validity and the representation of older adults in various fields. This essay aims to explore the challenges faced by older people in online social research, the importance of promoting digital literacy among older adults, and strategies to reduce bias in research methodologies. By enhancing digital literacy among older adults, in fact, researchers can ensure a more accurate and inclusive representation of this demographic group in online social research.

Keywords

Older adults, Digital discrimination, Biases, Digital literacy

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1. INTRODUCTION

In post-modern society, information and communication technologies (ICTs) have brought about changes that have tangible effects on people's daily lives; these technologies have also assumed such a central role that they are now considered essential for people to be truly included within social systems (D'Ambrosio and Boriati, 2023).

However, not all people have the same chance to be integrated within digital social systems, due to the low digital literacy, the digital divide and the consequent limited accessibility of digital platforms by older people.

This condition causes an increased digital discrimination (Delli Paoli and Masullo, 2022) in globalised social contexts, i.e. that kind of injustice or inequality in the treatment of people based on their ability to access or use digital technologies (Köttl and Mannheim, 2021). For older people, in particular, this means remaining excluded from the possibilities offered by virtual reality (Castells, 1996; Bauman, 1998; Norris, 2001), as well as from possible online social research paths[1].

This contribution aims to reflecting on the need to address the digital divide and digital discrimination among the older adults, in order to reduce the possible methodological biases that often occur with social digital research, such as the low representativeness of the older component in online surveys conducted on the entire population.

Specifically, the contribution emphasises possible strategies to be implemented in order to include older people in social research conducted online: offering, for instance, through life-long learning (Drew, 1997; Diggs, 2008 Quadagno, 1999) and digital literacy (Rivoltella, 2017) strategies, free training courses to teach older people how to use digital technologies and to develop technologies and interfaces that are easily usable by older people, taking into account their physical and cognitive needs.

In this way, it will be possible to increase the share of the older component that – when not specifically targeted by researchers – is currently excluded from participating in social research that are conducted with the purpose of digital tools. For example, in research conducted on non-probability samples, very often the share of the older population is underrepresented due to their low participation, which is due to a lack of sufficient digital literacy.

[1] In this paper, "older adults" are considered to be those who are over 65 years old, based on what has been suggested by major national research institutes.

2. DIGITAL DISCRIMINATION OF OLDER ADULTS: IMPLICATIONS FOR SOCIAL RESEARCH

Many studies have discussed the issues of access to information and communication technologies by older adults and typical challenges they encounter in the digital arena[2].

Older people, in fact, face numerous challenges in online context, including limited access to technology (Millward, 2003), lack of digital skills (Van Deursen and Van Dijk, 2011), and stereotypes about their abilities. The digital divide (Hargittai, 2002; Van Deursen and Helsper, 2015a) – which refers to the gap between those who have access to technology and the internet and those who do not – is also a significant barrier for older adults in participating in online social research.

So, older adults face digital discrimination[3] in various aspects of their lives: many researchers established and focused on digital discrimination (Dabo et al., 2022), which can be highlighted and explained including access to technology, online services, and social interactions. As technology continues to advance rapidly, older people often struggle to keep up with the latest trends and developments, leading to their exclusion from digital platforms (Bentivegna, 2009). This exclusion can be attributed to ageist stereotypes that portray older adults as technologically incompetent or disinterested inusing digital tools (Anderson, 2008; Van Deursen and Helsper, 2015b).

Many older adults, in addition, may not have the financial means (Choi, Dinitto, 2013) to purchase devices or internet service, or they may lack the technical know-how to navigate online platforms effectively. In fact, according to ISTAT data (2023), in households composed only of the older people (65 years and older) there is a lower prevalence of the Internet, such that just over half of senior citizens (53,4%) have a web access.

Moreover, older adults are often stereotyped as being technologically inept, which can lead researchers to overlook them as participants in online studies. These stereotypes can perpetuate ageist attitudes and further marginalize older adults in research contexts.

Furthermore, older people may encounter age-related barriers (Raihan et al., 2024) such as reduced dexterity, vision impairment, or cognitive decline, making it challenging for them to navigate the digital

[2] For a preliminary theoretical reconstruction, see Manor and Herscovici (2021) and the essay by Schroeder et al. (2023).

[3] Digital discrimination is defined as discriminatory treatment or disparate impact acts based on automatic decisions made by algorithms (Wihbey, 2015).

landscape effectively. As a result, older adults are often overlooked in online research studies, leading to a lack of representation and diverse perspectives in social research and a low representativeness of the older component in online surveys conducted on the entire population.

3. THE IMPORTANCE OF PROMOTING DIGITAL LITERACY AMONG OLDER ADULTS

The term literacy can be defined

> as the mastery of simple and practical skills which bring a profound enrichment and transformation of human thinking capabilities […]. Technological innovations have transformed how learning is taking place and digital literacy has become one of the main competences in this era (Reddy et al., 2020: 81).

In this perspective, digital literacy can be defined as the set of skills, knowledge and abilities needed to use digital technologies effectively, safely and critically (Tinmaz et al., 2022). Competence which is not limited to the ability to use digital tools, but also includes the ability to understand, evaluate and create digital content (Heitin, 2016), manage one's online identity and actively participate in the digital society.

Digital literacy, therefore, is crucial for older adults to navigate the digital landscape effectively and, also, to participate in online social research. In fact, by promoting digital literacy among older people, researchers can ensure equitable representation and reduce bias in their studies.

This becomes possible because digital literacy encompasses a range of skills, including the ability to use digital devices, access online information, communicate effectively, and participate in those sociological researches that are conducted with internet-based techniques.

To promote digital literacy among older adults and encourage their participation in online surveys, researchers can provide training programs, workshops, and resources tailored to needs and preferences of older people. By empowering them with the necessary skills and knowledge to engage with digital platforms, researchers can, in this way, enhance the quality and diversity of their online social research. Promoting digital literacy among older adults (Xu et al., 2021), hence, is essential for reducing bias in online social research and ensuring the inclusion of this demographic group in research studies, analysing also their perspectives to studies in various fields.

Additionally, promoting digital literacy among older adults can help combat ageism and stereotypes about older people's abilities in using technology. By equipping older adults with the skills and knowledge to navigate online platforms, researchers can, ultimately, create a more inclusive research environment that values the contributions of older adults and reflects the diversity of the population sample.

4. STRATEGIES TO REDUCE BIAS IN ONLINE SOCIAL RESEARCH WITH ELDERLY

For many years, the methodological literature has been concerned with the comprehensive ananlysis of bias in social research[4]. In general terms, bias «means that the samples of a stochastic variable that are collected to determine its distribution are selected incorrectly and do not represent the true distribution because of non-random reasons» (Panzeri et al., 2008: 4258).

The biases referred to in this paper, concern, specifically, the non-participation of the older population share in social research conducted online on entire populations. In this case, the reference is to those non-probabilistic samples used, very frequently, in surveys conducted online, in which there is a self-exclusion of the older portion of the population. It must be emphasised, however, that the sample size depends on the size of the population to be sampled (Bailey, 1982).

To reduce this type of bias in online social research and promote inclusivity, researchers must take proactive measures to include older adults in their studies. This can be achieved, for example, by designing research protocols that accommodate the needs and preferences of older participants, such as providing clear instructions, accessible formats, and technical support.

Researchers should also ensure that online surveys and questionnaires are user-friendly and age-appropriate (Regmi et al., 2016), taking into account the cognitive and physical limitations of older adults. Additionally, researchers can collaborate with community organizations, senior centers, and advocacy groups to recruit older participants and foster partnerships that promote digital literacy and engagement. By implementing these strategies, researchers can create a more inclusive and diverse online research environment that values the perspectives and

[4] For a brief literature review, see, among others, the essays by Suchman, 1962; Berk, 1983; Winship and Mare, 1992; Hammersley and Gomm, 1997.

experiences of older adults.

There are, however, several strategies that researchers can implement to reduce bias in online social research and promote the inclusion of older adults. One approach is to provide training and support for older adults to enhance their digital literacy skills and confidence in using technology. This can involve offering workshops, tutorials, or one-on-one assistance to help older adults navigate online platforms and participate in research studies. Additionally, researchers can design studies that are accessible and user-friendly for older adults, taking into account their unique needs and preferences. This can include using plain language, providing clear instructions, and offering accommodations for those with sensory or cognitive impairments. By creating research studies that are inclusive and welcoming to older adults, researchers can ensure a more diverse and representative sample of participants.

From a specifically methodological point of view, reducing bias in online social research with older populations involves a combination of methodological strategies and ethical considerations dealing with sampling and selection bias, technology barriers, question design bias, digital divide considerations, monitoring and adjusting during research program.

Regarding sampling and selection bias, in the writer's opinion, the focus should be, as anticipated, on: a) diverse recruitment: use multiple channels for participant recruitment, such as social media, community organizations, healthcare providers, and senior centers, to reach a broad demographic; b) inclusive criteria: ensure inclusion of participants with varied socio-economic, cultural, educational, and geographical backgrounds; c) digital access consideration: provide devices and internet access if necessary, to avoid excluding those people with limited technological access; d) random sampling: use random or stratified sampling techniques to ensure representation across subgroups of the older population; e) screening participants: clearly define inclusion and exclusion criteria that align with the research objectives to prevent overrepresentation of certain demographics.

With regard to technological barriers, attention must be paid to: a) user-friendly interfaces: design research tools (e.g., surveys, platforms) with clear, large fonts, simple navigation, and low cognitive load (Melani Christian, Dillman, 2004); b) tech support: offer technical support and provide detailed instructions to participants on how to engage with the study materials; c) alternative modes: combine online methods with offline options, such as telephone interviews or paper surveys, for those less familiar with technology.

With regard, on the other hand, to the question design bias, it would be appropriate to make: a) pilot testing (Gangemi, 2007): test the survey with a small group of older participants to identify unclear or biased questions; b) avoid jargon: use straight forward language, avoiding technical terms or overly complex wording (Melani Christian et al., 2007); c) neutral wording: ensure questions are neutrally phrased to avoid leading responses.

The digital divide considerations, relate specifically to provide tutorials or coaching on how to use digital tools for research, if needed.

A further strategy could be to monitoring and adjusting during research program by collecting feedback from participants about the process to identify and address any emerging biases and by checking data for signs of bias or missing representation, and adjust recruitment strategies accordingly.

Last, but not least, is the choice to use a Mixed-Methods approach: using both methods to validate the results and ensure their robustness, while addressing the biases inherent in the individual approaches, makes it possible to avoid "coverage errors" (Corbetta, 1999), while also intercepting more heterogeneous portions of individuals. The combination of both quantitative and qualitative techniques (Frudà, 2007; Amaturo and Punziano, 2016) can make it possible to satisfy the requirements that a sample must have: heterogeneity (i.e. the ability to include the internal differences specific to the universe of reference), representativeness (i.e. the ability to represent the known qualities and characteristics of the entire universe) and sufficiency (i.e. the ability to guarantee a sufficient level of statistical reliability of the representation of the characteristics specific to the universe under analysis) (Guala, 2000), especially in Internet-mediated researches (Hesse-Biber and Griffin, 2013).

By employing these strategies thoughtfully, researchers can achieve more accurate and ethical outcomes in online social research involving older populations.

5. CONCLUSIONS

Older people face digital discrimination in the digital age, which can lead to bias and exclusion in online social research. By promoting digital literacy among older adults and their digital engagement (Kebede et al., 2022), researchers can reduce bias and ensure equitable representation in their studies.

Digital literacy is an essential skill for navigating today's complex technological ecosystem. The spread, use and improvement of information and communication technologies, in fact, impose new challenges and critical issues but also significant opportunities for those who are able to understand and use them with awareness. This is why, to best address these changes, it is crucial to promote digital literacy that goes beyond basic technical skills, moving towards a critical understanding of technologies and the power dynamics behind them. Indeed, when technologies are used by competent people, they are able to effectively improve the quality of life, promoting the active and responsible inclusion (D'Ambrosio and Boriati, 2023: 26) of social actors.

Digital literacy is essential for empowering older people to navigate the digital landscape effectively and participate in online research. By implementing strategies to promote digital literacy (Ahmad et al., 2022) and inclusion (Hill et al., 2015), researchers can create a more diverse and inclusive online research environment that values the perspectives and experiences of older adults. It should not be forgotten, in fact, that the development of web 2.0 and mobile devices are turning obsolete ways of doing research (Punziano, 2016).

Ultimately, promoting digital literacy among older people is critical for combating bias and promoting inclusivity in social research. In fact, by promoting digital literacy among older adults and providing them with the necessary support, researchers can empower older adults to engage in online social research effectively and contribute their perspectives to studies in various fields of so-colled "Digital Sociology" (Lupton, 2015). By implementing the above mentioned strategies to reduce bias and create a more inclusive research environment, in conclusions, researchers can ensure a more accurate and representative representation of older adults in online social research and lead to more representative samples that can improve researchers' ability to generalise results (Hewson, 2003).

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HOW ARE SCIENCE MUSEUMS PERCEIVED IN ITALY?
Tripadvisor as proxy of visitor studies on public engagement

by *Noemi Crescentini and Andrea Rubin*[*]

Abstract

Science museums, science centres and discovery centres (SMCs) are key spaces for dialogue between science and society. Their evolution has integrated scientific and social perspectives, significantly influenced by the digital revolution, as demonstrated by the increase in online visitor reviews. This exploratory study investigates TripAdvisor users' narratives about science museums in Italy and assesses how these reviews reflect the effectiveness of audience engagement. Using Topic Modelling and Qualitative Content Analysis to analyse the reviews, the research identified key themes influencing visitor satisfaction, such as the educational value and interactivity of the exhibition, with the ultimate goal of improving museum practices and audience engagement strategies.

Keywords

Science Museums, Science Communication, TripAdvisor reviews

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1. INTRODUCTION

In the past decade, there has been a significant rise in public engagement activities in science communication. Events such as conferences, festivals, interviews, films, and publications are primary channels for disseminating scientific knowledge to the public.

Museums and science exhibitions occupy a central position in science communication landscape, serving as key intermediaries between the scientific community and the public. In line with the theoretical approaches of Public Communication of Science and Technology (PCST), such institutions are conceived as informal learning environments and dynamic and participatory spaces facilitating dialogue between science and society (Schiele et al., 2021). Their function extends beyond the mere transmission of knowledge, taking shape as platforms for critical reflection and public debate on socially relevant scientific issues (Mortensen, 2011; Bucchi & Trench, 2021). Recent data indicates that over 45% of Italians have visited a science museum or exhibition at least once, and 25% have attended a public event focused on science and technology topics (Bucchi et al., 2024), marking unprecedented levels of engagement. Such trends offer valuable insights for stakeholders, especially given the limited—possibly insufficient—audience development research in Italian museums. This surge in public interest represents both an opportunity to foster new initiatives and an affirmation of museums' role as highly trusted sources of information on science and technology for citizens. The Toronto Declaration, for example, emphasizes that museums should serve as forums for open and informed discussion on the ethical, social, and economic impacts of scientific research and new technologies (Toronto Declaration, Fifth Science Centre World Congress, 2008).

A challenge taken up by SMCs which, although reflecting different cultural approaches to science and public communication of science (Schiele et al., 2021), have progressively represented forums for debate (Einsiedel and Einsiedel, 2004; Lehr et al., 2007) between science and society. Originally created as places devoted to conservation, museums have reshaped their structures and functions by reproducing the changes that have taken place in the conception of relations between citizens and experts and are well summarised by the different models of public communication of science. From a first phase, dedicated to conservation and exhibition, there has been a gradual shift to a phase dedicated to the transmission of scientific and technological knowledge (reproducing the assumptions of the deficit model).

Science and technology museums have gradually changed their communicative paradigm, moving from a deficit model to a dialogue approach. Currently, in the so-called "fourth generation" of science museums, these institutions play a central role in promoting the active involvement of the public (Schiele et al., 2021). However, attempts to overcome the deficit model predate the conceptual shift from Public Understanding of Science (PUS) to Public Engagement with Science and Technology (PEST). As a result, the role of museums has expanded to include promoting debates on controversial science and technology issues such as stem cell research, GMOs, AI, nuclear energy and science policy. However, several studies (Delicado, 2009) highlight the many difficulties that institutions face in putting these participatory objectives into practice. The ability of museums and science centres to engage with the public is therefore closely linked to their continuous ability to adapt to new curatorial practices, internal institutional cultures and changing visitor expectations (Merzagora and Rodari, 2007). In this regard, it is interesting to note that the number of SMCs has grown considerably both nationally and globally, especially thanks to Asian countries such as China. The demand is also coming loud and clear from the public: in Europe, for example, 33% of citizens visit science and technology museums (European Commission, 2021). Italy has EU-average visit rates to science museums, although differences remain related to socio-demographic variables, especially age and education levels.

The evolving sociocultural landscape over recent decades has also driven museums to adopt new roles and address continually emerging challenges. Today's science museums and science centers are increasingly responsible for catering to a diverse public, meeting demands for accessibility and fulfilling an educational mission through a range of projects and activities. In the nineteenth century, museums primarily focused on preserving and curating collections, like zoos or art and history museums. However, traditional practices in curation, communication, and research alone are now insufficient to meet the demands of contemporary society.

Many museums and interactive science centres have moved away from traditional collections, instead prioritizing experiential learning and engaging audiences with cutting-edge scientific and technological developments (Schiele, 2014). However, museums have increasingly assumed the role of an "agora", where the concept of "science in action" (Latour, 1987) can be visible yield to the public, rather than functioning solely as a space for the presentation of science as certain, objective, and free of doubt (Butler, 1992; Durant, 1999). In major science museums, the "public understanding of science" has given way to "public engagement with science" (Elam and Bertilsson, 2003; Lehr et al., 2007; Hagendijk and Irwin, 2006), an adjustment of strategy largely due to the perceived failure of the "deficit model" and an increased intervention of social studies in science. Museums play an important role in promoting cultural heritage also through web channels, social media and interactive platforms, thus offering additional access points and opportunities for participation to a wider and more diverse audience (Cameron & Kenderdine, 2007). In this regard, ministerial guidelines on digitisation and museum communication (for example, the "Guidelines for the digitisation of cultural heritage" issued by the MiC, 2022[1]) underscore the imperative to integrate the physical experience with multimedia resources and interactive content to enhance the enjoyment of heritage.

The promotion of open debates and the adoption of digital communication tools have been identified as key factors in enhancing the museum as a space for inclusion, learning and critical debate[2].

The advent of user-generated data on digital review platforms such as TripAdvisor has profoundly impacted the realm of social research, offering invaluable insights into the public's perceptions and experiences. Initially developed for the tourism sector, these platforms have undergone a remarkable evolution, transforming into dynamic archives that document a diverse array of experiences. These experiences encompass a wide spectrum, ranging from urban visits and excursions to nature parks to explorations of museums and science centres. The ability to collect and aggregate feedback in real time provides researchers with a unique perspective on visitor engagement, as well as insights into the perception and valuation of cultural and scientific institutions.

In this context, digital platforms emerge as significant arenas for promoting dialogue about science, facilitating interaction between different communities, and stimulating public participation. By sharing reviews and ratings, users not only contribute to the dissemination of knowledge but also actively participate in the construction of a collective discourse reflecting the intersection of science, culture, and society. This process of co-creation, based on digital interaction, reinforces the role of online platforms in fostering greater scientific

[1] https://docs.italia.it/italia/icdp/icdp-pnd-digitalizzazione-docs/it/v1.0-giugno-2022/index.html
[2] http://musei.beniculturali.it/

awareness and strengthening the link between scientific institutions and the public.

Our study, which lies transversally between the fields of public communication of science and visitor studies, presents a qualitative and quantitative analysis of reviews of Italian science museums and science centres on TripAdvisor. The findings aim to address the following research questions:

RQ1: What elements are most valued by the public in online reviews?
RQ2: Do these elements pertain to public engagement factors or organizational aspects?
RQ3: What elements (if any) influence the positive or negative rating?

2. TRIPADVISOR AND THE MUSEUM EXPERIENCE IN THE DIGITAL CONTEXT

Digital platforms represent another arena for fostering these science-related dialogues (Van Dijck et al., 2018). Museum experiences extend beyond the physical visit, remaining in visitors' memories and continuing through post-visit online discussions on social media or platforms like TripAdvisor. These platforms influence potential visitors' decisions (O'Connor, 2008) and they also serve as important data sources for real-time analysis of user narratives (Burtch and Hong, 2014). Tourism experiences have been described as inherently personal and subjective responses to organised contexts, activities or events (Packer and Ballantyne, 2016; Packer et al., 2019). These experiences are difficult to measure in objective terms, and emerge from the interaction between individual expectations, environmental characteristics and perceived service quality (ibidem). Despite their intangible and variable nature, tourism experiences exert a significant influence on the decisions and behaviour of other travellers, particularly when shared through digital and social media platforms. The online sharing of such experiences contributes to the construction of collective and participatory knowledge, strengthening trust and reducing uncertainty in tourism-related decision-making processes. This phenomenon highlights the crucial role of reviews and personal narratives in shaping perceptions and promoting destinations, outlining a tourism ecosystem increasingly driven by co-creation dynamics and virtual social networks.

TripAdvisor has also emerged as a key resource for analysing visitor perceptions, not only about restaurants and hotels, but also in relation to cultural and natural heritage sites, including science museums and centers, as demonstrated in studies on locations like the Danube Delta UNESCO World Heritage site (Stoleriu et al., 2019).

TripAdvisor represents a significant platform for travel reviews and advice, situated within the broader context of *user-generated content* (UGC) platforms. TripAdvisor have been shown to exert a growing influence on the construction of collective meanings and narratives related to tourist and cultural attractions (Green and Jenkins, 2011; Castells, 2010), thereby helping to redefine the way the public experiences and interprets travel (Wakkary et al., 2008). The platform was established in 2000 by Stephen Kaufer, integrating social networking features with booking tools for tourist services. It enables users to contribute reviews, comments and ratings, as well as organise and book accommodation, restaurants and activities. This multifunctional platform plays a pivotal role in the tourism industry by facilitating the sharing of personal experiences and the establishment of a vast network of opinions that significantly influence the travel choices of an increasing number of people (Alaimo et al., 2020).

The constant production of content by users reflects the shift from traditionally monodirectional communication to forms of interactive participation, an expression of the "participatory culture" theorised by the sociology of media and digital public communication (Carpentier, 2011; Couldry, 2012). In this context, TripAdvisor exemplifies a platform where the conventional boundaries between consumer and producer become increasingly indistinct, thereby disintermediating access to information and concomitantly redefining the logic behind the establishment of reputation and authoritativeness (Dedeoğlu et al., 2019).With a substantial volume of over 600,000 reviews published[3], the platform has made a substantial contribution to the transformation of tourism-related decision-making processes, thereby expanding the information ecosystem available to travellers.

The ability to access detailed reviews and ratings of other visitors has redefined consumers' decision-making processes, influencing their expectations, the quality of tourism experiences and, consequently, the selection of attractions, including museums.

In particular, the impact of TripAdvisor on the museum experience is manifold (Su, 2023). Users share experiences and rate museums

[3] https://www.tripadvisor.com/TripAdvisorInsights/abouttripadvisorreviews

based on their visits, potentially influencing other users' decisions to visit museums (Budge, 2017; de Mendívil, 2018). Furthermore, TripAdvisor, as a platform based on user-generated content, acts as a vehicle for the dissemination of collective narratives and sentiments, potentially influencing the general public's perception, expectations and appreciation towards museum efforts in communicating science to a diverse audience (Dedeoğlu et al., 2019).

The integration of interactive technology, both passive and active, is identified as a key element to increase visitors' social engagement and facilitate their understanding of exhibition content (Ibrahim et al., 2021). Consequently, science museums need to consider the implications of TripAdvisor and other similar user-generated content platforms in the strategic planning and implementation of science communication initiatives. In fact, by understanding the factors influencing social media use and information sharing, museum institutions can develop more effective strategies for using such platforms to enhance public engagement.

Furthermore, Vásquez (2012) describes reviews on TripAdvisor as narratives, specifically as "little stories" about visitors' experiences. Similarly, Carter (2016, p. 235) states that 'reviews, published on TripAdvisor [...] constitute narrative evaluations of tourist sites, i.e. stories of places written by visitors. The process of sharing a review typically commences with the allocation of a title to the review, followed by the reviewer's assessment of their experience on a scale ranging from 1 (terrible) to 5 (excellent). These ratings are accompanied by additional information pertaining to the timing of the visit, the group (e.g. professionals, singles, couples or friends), and, if desired, the submission of personal photographs captured during the visit.

3. METHODOLOGY

In the present work we have chosen to explore reviews of science museums in Italy, with the aim of analysing visitors' perceptions and experiences of these institutions. In particular, the selection of the museums to be analysed was made on the basis of the "Science Museums 2024" list provided by the TripAdvisor platform. The reference population for the analysis includes the first 50 Italian science museums on the list[4], in order to guarantee a representative coverage of

[4] 1. Museo Leonardo Da Vinci, 2. Museo della Scienza e della Tecnologia Leonardo Da Vinci, 3. MUSE, 4. Museo Galileo, 5. Città Della Scienza Di Napoli, 6. Leonardo Interactive

the main attractions of the sector.

The research strategy adopted explores the potential and limitations of digital methods (Rogers, 2013; Marres, 2017). These methods are based on automated categorisation processes and algorithmic logics. From a methodological perspective, the adoption of these approaches is driven by two factors: firstly, there is the extensive availability of textual and paratextual data generated by users; secondly, there is the capacity to observe phenomena in an "ecological" manner, that is, as they emerge spontaneously in online interactions (Boyd and Crawford, 2012). This enables access to disintermediated information, providing a picture of museum experiences and perceptions that authentically reflects visitors' perspectives.

This research consists of a first quantitative explorative part using the *topic modelling* technique implemented through the T-Lab software, followed by a more in-depth qualitative analysis. The latter phase allowed us to examine in detail the experience of science museum visitors using the Nvivo 15 software.

The reviews were collected in all the languages available on the TripAdvisor platform, with a subsequent translation process into Italian to ensure the linguistic uniformity of the dataset.

The decision to utilise TripAdvisor as the exclusive data source stems from its dominance in the tourism review domain, a position reinforced by its vast user base and its systematic arrangement of public reviews. Furthermore, the diversity of user-generated content,

Museum, 7. Tecnoparco Museo di Archimede,8. MUSA - Museo Universitario delle Scienze e delle Arti, 9. Museum of Optical Illusions, 10. Museo di Palazzo Poggi, 11. Museo Leonardo Da Vinci Experience,12. MUSME - Museo di Storia della Medicina in Padova, 13. Museo Della Luce, 14. Museo Delle Illusioni Firenze, 15. Creazioni Artistiche Il Faro, 16. Museo delle Arti Sanitarie, 17. Museo Leonardiano di Vinci, 18. La Fabbrica della Scienza, 19. Museo di Storia Naturale - La Specola, 20. "Museo di Scienze Naturali "E. Caffi",21. IllusionVille, 22. Museo Archimede e Leonardo – Siracusa, 23. Orto e Museo Botanico di Pisa, 24. All About Apple Museum, 25. Museo Nazionale del Cinema, 26. Museo del Balì, 27. Space Dreamers, 28. Parco Astronomico San Lorenzo, 29. Museo Guglielmo Marconi, 30. Museo di Scienze Naturali dell'Alto Adige, 31. Museo Geologico delle Dolomiti, 32. Collezione delle Cere Anatomiche Luigi Cattaneo, 33. Museo Sulphur, 34. Planetario Di Torino, 35. Museo Delle Illusioni Roma, 36. Centro Espositivo Leo Lev, 37. Museo per la Storia dell'Università di Pavia, 38. Laboratorio-Museo Tecnologicamente, 39. Museo Paleontologico e parco dei Dinosauri, 40. Museo Della Specola, 41. Museo delle Palafitte del Lago di Ledro, 42. Museo della Natura e dell'Uomo, 43. Museo Geologico e Paleontologico G.G. Gemmellaro, 44. Museo di Zoologia Adriatica Giuseppe Olivi, 45. Centrale Idrodinamica, 46. Museo Paleontologico Territoriale dell'Astigiano, 47. Museo Geologico e delle Frane, 48. MuMa Museo del Mare Milazzo, 49. Collezione di Geologia "Museo Giovanni Capellini", 50. Museo Universitario.

encompassing extended reviews and numerical ratings, furnishes a complete picture of the visitor experience. Other platforms, such as Google Reviews or Yelp, were excluded on the grounds of limitations in data access and structuring, or due to their inferior level of detail. A singular data source has allowed us to ensure methodological consistency and circumventing issues of heterogeneity in data format and quality.

Data collection was carried out through the use of a Python script, which allowed the automation of the extraction process and ensured a systematic and complete collection of reviews. Overall, the resulting dataset comprises a total of 31,673 reviews, covering a time span from March 2010 to the beginning of September 2024. The use of reviews published on TripAdvisor as a data source provides access to a variety of perspectives from both occasional visitors and regular museum-goers from different cultural backgrounds. In the context of the present study, a demographic analysis of reviewers reveals that 58% of users are of Italian nationality, while 13% represent an international clientele. With regard to the reasons for visits, 34% of respondents indicated that their experience was with family, 27% as a couple, 18% with friends, 8% alone and 2% for work reasons.

The data were collected in accordance with the structure of a standard collection grid (Losito, 2003; Amaturo and Punziano, 2013), which was divided into two main domains (General Information and Contextual Information). These were then organised into a matrix of cases per variable, consisting of 27,785 observations for eleven variables, which were defined as follows:

- General information: *Id; name of the museum; reviewer nickname; date of the post; title of the review; length of the post;*
- Context information: *type of trip (family, couple, etc.); geographical origin of the reviewer; classification of the geographical context of the reviewer (local if Italian and non-local if international);, text of the post; score (numerical rating assigned by the reviewer from 1 to 5); score sentiment classification (category assigned to the score divided into high, medium and low based on the rating expressed).*

4. ANALYSIS AND DISCUSSION

4.1 Topic modelling

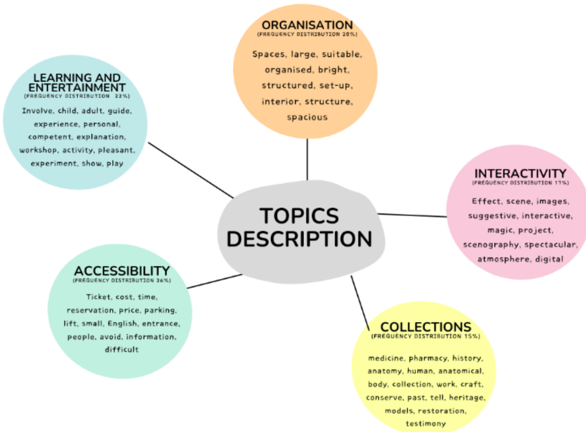
The considerable quantity of information presented in TripAdvisor reviews presents a significant challenge in discerning a semantic structure. In light of these considerations, we propose a straightforward yet statistically sound approach: Topic Modelling.

As a first step, we imported the database into T-Lab, a specific content analysis software capable of developing appropriate models based on the textual context. We subjected the textual variable consisting of the corpus of reviews extracted from TripAdvisor to T-Lab's topic analysis procedure, preceded first of all by the following automatic processes. The lemmatisation consists of 1) the standardisation of all verb forms in the same way; 2) the transformation of nouns and adjectives placed in singular number; and 3) the removal of definite-indefinite articles. The frequency threshold was set at 20 occurrences, which led us to exclude all words below this frequency value, eventually reducing the database to 2616 total words in the analysis. Finally, we proceeded to exclude empty segments deemed insignificant or irrelevant to our analysis. Next, we implemented a topic extraction modelling based on Latent Dirichlet Allocation (LDA) and the Gibbs Sampling, a probabilistic generative model proposed by Blei, Ng and Jordan (2003) for identifying latent topics in document collections. The probabilistic LDA (Latent Dirichlet Allocation) model, used by the software employed for our analysis, considers that each individual text within a corpus contains one or more "topics". To identify the different topics present in the corpus, the software identifies groups of recurring words. The set of words would identify a single topic. Each "topic" is imagined as a probability distribution of certain words within the corpus.

Applying this procedure, we extracted five topics, appropriately renamed, respecting statistical criteria such as the consideration of the occurrences of specific words that characterise each topic, as well as the occurrences of words shared between topics. Furthermore, we used semantic tagging (Bolasco, 2013, p. 126) on the selected content in order to identify the right meaning of the document by resolving disambiguation and identifying concepts from a set of words.

Finally, we classified the five topics considering the 32,900 emerging elementary contexts, understood as analysed document fragments in which the topic itself is most relevant. The most significant parts of documents are evaluated according to the informative weight of their fragments, characterised by their discursive formulas, their position in the document, the specific weight of each word in relation to its dispersion in the text, and other similar factors.

The topics that emerged were appropriately defined as shown in Figure 1. Topics Description



The analysis of themes emerging from the application of Topic Modelling to science museum visitor reviews revealed five thematic areas:

- *Accessibility:* Accessibility is an essential element of the visitor experience in science museums, particularly in terms of inclusivity and usability of spaces. This topic emerges as the topic with the highest frequency distribution, standing at 26%. The reviews analysed highlight relevant aspects such as the absence of architectural barriers, the adequacy of space size, effective crowd management and the comprehensibility of exhibits. Particular attention is paid to the availability of multilingual information in the descriptions of works and scientific content. The most common words are: “ticket,” “cost,” “time,” “reservation,” “price,” “parking,” “lift,” “small,” “English,” “entrance,” “people,” “avoid,” “information”, “difficult”. These findings resonate with the growing scholarly recognition of accessibility as a core tenet in the development of public cultural institutions (Pekarik et al., 1999; Falk & Dierking, 2016). In fact, as the words of a visitor show, references to architectural barriers and space management emerge:

> [...] I understand that to go up in the lift the places are few, so the queue is almost taken for granted, but for access to the museum I don't understand it!!! Only two cashiers to pay, no cloakroom, you enter with backpacks, bags, etc. When asked if the museum entrance could be supplemented with a lift, the answer is NO! (review at Museo Nazionale del Cinema).

Other reviews highlight the critical issues and dissatisfaction related to the management of the public and show dissatisfaction with the management of queues:

> […] There are already quite a lot of people, you get to the back Then the voice at the microphone reminds everyone to go to the ticket office and here People arrive in the lobby all at once, randomly piling up; the queue is engulfed in chaos, people arriving from all sides: tickets distributed randomly (review at Planetario Di Torino)

> [...] It would be a good idea to change the office manager and to reprimand his staff for underestimating the influx of people on a day when (given the 1 May long weekend and the following weekend) a greater influx of visitors was to be expected, also in view of the (predicted) adverse weather conditions. The museum, however, is a marvel, spread over four floors (review at MUSE).

Furthermore, the importance of providing descriptions of the works and scientific content in a variety of languages is emphasised, as this is recognised as a fundamental element for a diverse audience. The most frequently occurring keywords, such as "English", "information" and "difficult", underscore the necessity to ensure that materials and indications are suitable for non-native speakers as well.

As Falk and Dierking (2016) point out, visitors experiences are shaped by their expectations and by the organisational responses of museum institutions. The critical issues that emerged from the review suggest the need to review the planning of spaces and the use of services (in particular queues and ticket offices), in order to put the principle of inclusivity into practice. This approach is in line with the growing recognition of accessibility as a fundamental value for cultural institutions.

- *Learning and entertainment:* Analysis of the reviews reveals that the museum experience is perceived not only as an educational opportunity, but also as a form of entertainment. This theme stands out with a frequency distribution of 22%. Visitors report on the ability or otherwise to arouse interest in scientific disciplines, expressing appreciation for the effectiveness with which these institutions also transmit knowledge using engaging modes. In particular, they emphasise the didactic value of the exhibitions and activities on offer, such as educational workshops, which enrich the visitor experience by promoting active and participative learning. The most frequent words are "Involve", "child", "adult," "guide," "experience," "personal," "competent," "explanation," "workshop," "activity," "pleasant," "experiment," "show," "play". Some elementary contexts are:

> […] Outdoor exhibition areas and hands-on demonstrations allow visitors to experience Archimedes' inventions first-hand This hands-on approach is particularly popular with children and families, making the visit a fun educational activity for all ages. The guided tours are well organised, and the guides are passionate and knowledgeable, ready to answer any questions and provide interesting insights (review at Tecnoparco Museo di Archimede*)*.

Here the educational value is linked to the possibility of experiencing scientific principles first hand, showing how active participation favours the internalisation of knowledge.

Another visitor underscores the inclusive approach and the consideration given to diverse age groups, illustrating the integration of entertainment with learning within an intergenerational framework. The experience is valued by both children and adults, thereby fostering a sense of shared engagement and social interaction:

> […] The visit to the museum is very interesting for both adults and children and, without a doubt, a lot of fun for everyone. All the staff are very friendly and welcoming; during the visit we were guided all the way around making our visit even more enjoyable and interesting (review at Museum of Optical Illusions).

In a review for the Balì Museum, as in many other cases, the visitor makes it clear how the creation of fun games and experiments helps the involvement towards scientific concepts.

> […] The planetarium was excellent and the staff very competent, plus the museum boys had organised some very fun games such as making chickpea bricks etc. and we almost had more fun than the children! (review at Museo di Balì).

Many reviews stress the value of social interaction in museums. Visitors often comment on how competent and enthusiastic the guides and staff are. They respond to queries, provide engaging explanations and facilitate enjoyable activities. Sociological studies on leisure activities emphasise the importance of intergenerational opportunities for collective learning and social bonding (Stebbins, 2009). Entertainment facilitates deeper engagement with scientific concepts (Mossberg, 2007).

- *Organisation:* The theme of organisation emerges with 20% of the frequency distribution and refers to the overall configuration of the museum experience, including aspects such as the clarity of signage, the management and optimisation of visit times, the design of internal routes, and the appropriateness of room sizes. The most frequent words are "Spaces," "large," "suitable," "organised," "bright," "structured," "set-up," "interior," "structure," "spacious". Some examples of elementary contexts are for example the value of a well-designed layout and an engaging structure for visitors of all ages. The organisation of the spaces allows for the integration of different activities (e.g. experiments, exhibitions), demonstrating how museum design should support the variety of the offer.

> […] The structure alone is worth a visit. Inside it is a paradise of beauty for young and old. Interesting experiments, wonderful animals, exhibitions and all kinds of initiatives. We had 12 children with us. At 4 p.m. we booked a guidebook entitled "But how do you speak?" On the language of animals. At 4 p.m. on time we were met on floor 0 (review at MUSE).

Furthermore, visitors have expressed appreciation for the cleanliness and maintenance of the environment, while simultaneously highlighting a concern regarding the guides' inability to be heard, which can be attributed to an absence of microphones:

> […] The facility is very well maintained and clean, including the toilets in my opinion half a day is enough to visit it and spend some pleasant time in the company of dinosaurs There is also the possibility of doing the dinosaur discovery tour with a guide but I would suggest a microphone so that you can hear better! We couldn't hear anything so we went on our own, breaking away from the group (review at Museo Paleontologico e Parco dei Dinosauri).

This observation reveals two salient points. Firstly, the structure is deemed to be "adequate" for a brief visit. However, the management of guided tours could be enhanced to optimise the utilisation of time and content. The incorporation of elements such as clear signage, well-structured services and itineraries, and adherence to timetables, contributes to a more seamless and enjoyable experience. The ability to complete the museum itinerary within a time frame that meets the expectations of families and groups of visitors is a critical factor in the overall success of the visit.

The topic of organisation encompasses a wide range of elements, including the clarity of signage, the effective management of visiting time (Serrell, 1997; Falk, 1982). The notion that museum spaces are considered “suitable” and “well organised” signifies that visitors not only value the content of the exhibitions, but also the manner in which they are presented and mediated through the design of the environments.

Another important element that emerged from the reviews is the management and optimisation of visiting time. The capacity to conclude a museum experience within a specified timeframe that aligns with visitor expectations is frequently identified as a pivotal factor in determining the success of the visit. By employing effective management strategies for space, time, and activities, museums can meet the evolving expectations of a diverse audience by providing personalised and enriching experiences.

- *Interactivity:* The presence of interactive activities is often cited by visitors as a distinctive element of the experience in science museums and the topic has 17% of the frequency distribution. Reviews suggest that such activities enhance active learning and promote deeper engagement with exhibition content. In particular, interactive exhibits promote the involvement of a larger number of users, avoiding a mere superficial exposition of scientific phenomena and preventing simplified “one-line” explanations (Allen, 2004).The most frequent word are “Effect”, “scene,” “images,” “suggestive,” “interactive,” “magic,” “project,” “scenography,” “spectacular,” “atmosphere,” and “digital”. Elementary contexts example is for example the possibility of personalising the route according to your interests: visitors can opt for a more structured approach or free exploration, interacting with installations and “optical experiments” that make the visit active rather than passive:

> […] The museum can be enjoyed by enthusiasts, non-enthusiasts, families with children, anyone You can logically approach it, but you can also wander around aimlessly, taken to the “scenographic” rooms

> or play with the optical experiments (review at Museo Sulphur).

The presence of immersive and spectacular installations creates an atmosphere that can be described as "magical" and spectacular. In this environment, the experience goes beyond the simple fruition of content, becoming an opportunity for emotional and sensorial involvement. Digital technologies and immersive environments — such as virtual reality (VR) and augmented reality (AR) — can further facilitate this type of interaction (Wojciechowski et al., 2018):

> […]An idea of a museum that goes out of the usual box, but to say that the route is interactive would be reductive in any case I have seen children and adults amazed and excited at the various "stages" of the museum (review at Museo Nazionale del Cinema).

Furthermore, the social and participatory dimension of interactive exhibits, emphasising that they cater to a diverse audience beyond individual visitors, including groups and families. Workshops and "hands-on" sections are designed to promote cooperative learning, curiosity and motivation in participants of all ages, from children to adults (Stebbins, 2009):

> […] The museum is very nice, there are children's workshops, interesting explanations and many interactive parts that make it usable also for children (review at Muse).

Interactivity is recognised as a fundamental component of the science museum experience, enhancing active learning, promoting inclusivity and enhancing the visitor experience. The integration of digital technologies and immersive environments, in conjunction with a participatory exhibition design, serves to further augment the value of this dimension, catering to the requirements of a progressively diverse audience eager to have meaningful museum experiences.

- *Collections*: This theme incorporates all visitor commentary pertaining to the museum's collections and has 15% of the topic frequency distribution. The reviews underline the quality and diversity of the collections, as well as the aesthetic and intellectual appreciation of the exhibits. Users often discuss the importance of maintaining the collections and the quality of the exhibits, as well as evaluating their visual organisation and cultural-historical value. The most frequently occurring words and phrases associated with this theme are "medicine", "pharmacy", "history" "anatomy", "human", "anatomical", "body," "collection," "work," "craft," "conserve," "past," "tell," "heritage," "models," "restoration," "testimony," and "museum". Some reviews emphasize the role of the museum as a connecting space between the past, the present, and the future, with narrative and didactic experiences that enrich understanding and stimulate curiosity. Here the plurality of contents emerges – from historical machinery to sustainability issues – offering a heterogeneous museum experience, favouring the understanding of historical, cultural and scientific phenomena through a multisectoral approach:

> [...] One section presents the many different discoveries and inventions of Leonardo da Vinci. Another section is dedicated to food and sustainability, with talking displays and a table showing meals from various countries. The museum includes sections dedicated to rubbish and waste, with an exhibition on the subject, a video on the space nebula that can be manipulated, a small and charming wooden laboratory, exhibits on copper, metals and chemicals, and much more. Besides a large number of specialised sections, the museum also contains a huge submarine, several trains, a glider, a rocket, old cars, a ship, an aeroplane and more. People of all ages can enjoy this museum (review at Museo della Scienza e della Tecnologia Leonardo Da Vinci);

The narrative approach connects the visitor to the exhibits, transforming the collections into stories that connect different eras. Not just "exhibits", therefore, but tools for emotional and intellectual involvement that increase interest in the discoveries and the personalities behind them:

> [...] Here, every object on display, every didactic card, bears witness to the love and passion for an Italian genius who, with his discoveries, left his mark on the whole of mankind. Certainly, the accurate explanations that accompanied me during the visit played a decisive role and I am grateful to those who, by placing anecdotes, explanations of exhibits and repeating experiments in time, guided me on this adventure in which past, present and future intertwine, making the visitor's imagination soar; (review at Museo Guglielmo Marconi).

The collections in this museum are of particular interest insofar as they illustrate the evolution of knowledge and techniques, with a particular emphasis on the medical and anatomical fields. The exhibits, which include preparations in formalin, mummifications and wax reproductions, are both rare and of a high quality. This makes the museum a unique place where science and art converge, thereby increasing both its fascination and its educational value:

> [...] Immeasurable historical value, from all points of view, both for understanding how modern medicine developed, but also for understanding the greatness of human nature. No museum in the world offers the opportunity like this one to see formalin specimens (with human parts such as brains, hearts, foetuses, eyes, etc.), skeletons, vascular apparatuses, anatomical parts perfectly mummified using techniques that have remained largely a mystery, masterly wax reproductions that are comparable to true works of art (review at MUSA - Museo Universitario delle Scienze e delle Arti).

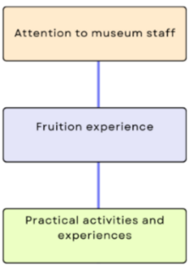
As the reviews analysed here demonstrate, museum collections are perceived as custodians of memory, capable of connecting past, present and future. This assertion is further corroborated by extant research (Hooper-Greenhill, 2013; Falk and Dierking, 2016), which emphasises the educational and experiential potential of such collections. The emotional and intellectual involvement of the public in these settings arises from the narrative and the context in which the objects are presented. Visitors do not merely "look" at the exhibits; rather, they experience them as evidence that stimulates their curiosity and encourages them to reflect. This underscores the significance of effective museum management and interpretation, which are instrumental in enhancing heritage and promoting meaningful learning.

4.2 Qualitative content analysis

At this phase of the research, it was decided to proceed with a qualitative analysis of the reviews. This approach enabled a more profound and contextualised examination of the results derived from topic modelling, thereby facilitating a more precise interpretation of visitor perceptions. This integrated methodology offers a more nuanced comprehension of the topic areas, emphasising aspects and qualitative elements that might not be fully captured by topic modelling approach. One of the main advantages of qualitative content analysis lies in its ability to go beyond the descriptive analysis of the "what" expressed in a text, allowing for a deeper investigation of the "how" and "why" that characterise the underlying meanings (Wiesner, 2022). In the present study, a qualitative content analysis based on a hermeneutic approach was chosen, with the specific aim of exploring the dimensions of public engagement. Indeed, public engagement represents an evolution in the approach of the scientific community, which is moving away from the traditional deficit or unidirectional communication mode focused on filling knowledge "gaps" (Wooden, 2006; Druckman and Bolsen, 2011) and towards two-way approaches based on dialogue and active participation (Sturgis and Allum, 2004). For this purpose, a stratified sampling of the selected reviews was employed, defining stratification criteria based on the sentiment expressed (high, medium and low) and the type of travel experience (e.g. family or group travel). Textual content analysis was conducted with the aid of Nvivo 15 software, widely used in the social sciences for coding qualitative data, which proved particularly effective in supporting the development of thematic codes and conceptualisation of empirical material (Bazeley and Jackson, 2013; Silver and Lewins, 2014).

The analysis identified three main analytical dimensions related to public engagement (as illustrate in Figure 2).

Figure 2. Analytical Dimensions from Nvivo 15 Software



The first one concerns the attention that reviewers devote to museum staff, with particular reference to guides or lecturers, evaluated in positive or negative terms. Indeed, the ability of museum staff to link scientific concepts to visitors' everyday experiences makes exhibition content more relevant and meaningful, facilitating a personal connection with science (Rennie and Johnston, 2007).

Reviews tend to praise the staff's ability to make topics and content clear and stimulating even when there is no satisfaction with the structure or content although language barriers are sometimes reported:

> [...] but above all I was impressed by the guide's passion in explaining the workings of the machines and the whole historical period;
> [...] The young people who accompany you inside the museum do it for free, for the purpose of dissemination, they are volunteers, but they transmit so much passion;
> [...] the guide was really good at getting the children involved, even

> getting the adults to participate in the various activities;
> [. ..] Very bad staff as they were not prepared to welcome an international clientele (lack of language skills).

The second analytical dimension pertains to the experience of utilising the exhibited content and collections, with a particular emphasis on multimedia tools and exhibition spaces that facilitate access to information. The reviews indicate that the provision of digital resources, including apps, monitors, audio guides and multilingual information panels, enhances the visitor experience, facilitating access to information and deepening comprehension of scientific phenomena (Falk and Dierking, 2016). However, the reviews also reveal some critical issues related to the management of the exhibition space and the quality of the information content. Some critical observations report a perception of insufficient scientific accuracy and a poor ability to maintain the interest of younger audiences. This suggests the need for improvements in both content and communication methods to respond more effectively to the expectations of a diverse target audience.

> [...] The tour is guided by numerous multimedia aids, from a smartphone app (to download) to numerous monitors/TVs located in most of the rooms to illustrate the various thematic areas and related scientific instruments;
> [...] full of reproductions and didactic panels dedicated to both adults and children;
> [...] The route is characterised by panels in various languages with explanations and the audio guide that can be downloaded from your smartphone with qr code is also very useful.
> [...] kept in cramped quarters where too many people are let in at once, so that if you don't push your way through, you risk not seeing anything.
> [...] no scientific accuracy, no ability to hold the attention of younger audiences.

The third analytical dimension pertains to the hands-on activities and interactive experiences provided by the museum. In the context of science communication, such initiatives, when effectively designed and managed, have the potential to facilitate the deepening of concepts, active public participation, and cognitive and emotional involvement (Bitgood, 2000; Macdonald, 2007). The reviews indicate a dichotomy of opinions. On the one hand, visitors expressed appreciation for the availability of workshops and hands-on activities, which were subject to booking. However, on the other hand, there was frustration at the poor functionality of the equipment, the limited educational usefulness of some interactive games, and the lack of content capable of stimulating visitors' interest:

> [...] It is possible to participate in various workshops, but remember to book them at least the day before, as the number is limited.
> [...] Very disappointing because the workshops in this museum are unusable;
> [...] The activities that seemed to be most successful were video games which apparently did not have much educational content.
> [...] the lack of interesting hands-on activities and engaging descriptions. It felt more like a boring textbook.
> [...] Some of the monitors for the games (positioning organs and bones) did not work Maybe because being touch they were too dirty and greasy The finger could not carry the objects on the body and so the game ended without having done anything The sphygmomanometer did not work and while we were unsuspectingly trying it out, an assistant came in and told us that she had to put the sign out

These observations serve to reinforce the notion that accessibility, maintenance of equipment and quality of the proposed content represent pivotal elements in the effective engagement of an audience. In this regard, the incorporation of interactive experiences that align with the museum's communicative objectives and foster curiosity, dialogue, and reflection is essential for enhancing the quality of the visitor experience (Black, 2020; Simon, 2010). Thus, enhancing the relevance of such activities, in conjunction with the attention paid to logistical and experiential aspects, represents a strategic lever for augmenting visitor satisfaction, consolidating learning, and fostering public participation in the collective construction of scientific knowledge.

6. CONCLUDING REMARKS

Science museums operate in a space of intersection between science and society, progressively positioning themselves as models of participatory and inclusive communication (Achiam and Sølberg, 2017). This orientation makes them ideal for supporting and facilitating a new form of interface between science and society, in which active involvement and co-production of knowledge are central (European Commission, 2007).

The present study made it possible to examine, through the analysis of TripAdvisor reviews, a) how visitors perceive public engagement within science museums (RQ1), b) which are the factors with greater incidence in the museum experience (RQ2), and c) to know the visitors and the critical factors of Italian science museums (RQ3). The utilisation of online review platforms serves as a pertinent perspective for the analysis of visitor experiences and expectations. Taking into account user feedback on Tripadvisor is of great interest when studying the dynamics of use and visitor evaluation. However, it should be stressed that this source must be contextualised in view of its limitations in terms of representativeness. Nevertheless, the data collated are inherently constrained to individuals who opt to proactively articulate their perceptions on such digital platforms, thereby excluding the experiences of those who are not registered or do not actively utilize these instruments (Filieri et al., 2015; Cox et al., 2009).

To avoid generalising conclusions that may not be representative of the full diversity of museum audiences and uses, it is important to be aware of this partial vision.

Nevertheless, online reviews, such as those available on TripAdvisor, serve as a suitable proxy for examining visitors' perceptions and experiences in science museums, offering direct and spontaneous access to users' opinions. These user-generated contributions provide rich, unstructured qualitative data reflecting visitors' actual interactions with museum exhibits, services and activities. Consequently, such information can be considered a valuable resource for identifying and understanding the critical factors and strengths of museum experiences (Tussyadiah and Zach, 2013; Marine-Roig and Clavé, 2015), thus contributing to the optimization of management and communication strategies adopted by science museums.

This study offers three main findings for museum researchers, practitioners and museum governance. Our study shows that visitors who review their experience online effectively reflect the prevailing composition of the audience in science museums and science centres. The audience is mostly composed of groups and families or couples (Merzagora and Rodari, 2007). Rare, if not completely absent, are solo visitors (8%). The composition of the audience is also reflected in the elements that are emphasised or criticised in the online reviews. From the analysis of the reviews, it emerges that visitors have high expectations with respect to various aspects of the museum experience (RQ1): organisation and accessibility of the museum, enjoyment of the collections, interactivity of the exhibitions, preparation of the staff and presence of hands-on activities In particular, activities with an interactive and workshop character – dimensions that are increasingly regarded as a fundamental prerequisite in museum offerings – are configured as informal educational tools, aimed mainly at younger visitors (Rennie & Johnston, 2007). This approach reflects the transformation occurred in the recent periods' museum landscape, wherein the educational function is not confined to the mere transmission of knowledge. Instead, it encompasses the advancement of cognitive and experiential processes that facilitate active learning, emotional engagement, and the growth of transferable skills (Kelly, 2007; Simon, 2010). These aspects are considered essential to foster meaningful and accessible engagement. However, not all Italian science museums offer structured opportunities for hands-on activities or interactive experiences, a shortcoming that may limit the effectiveness of engagement, especially for younger audiences, who tend to prefer interactive learning modes over passive enjoyment of exhibitions (Lehrer & Schauble, 2002).

The online reviews voluntarily provided by visitors emphasize the predominance of organizational and logistical aspects over engagement or more properly cultural factors (RQ2). This makes it possible to consider the reviews submitted by visitors on the TripAdvisor platform as an expression of the "science tourist" phenomenon (Lundberg et all., 2022).

From a managerial standpoint, the insights yielded by this study are pertinent to museum administrators, as they are able to utilise the analysis of self-generated user data to evaluate and optimise the visitor experience. The examination of online reviews, for instance on platforms such as TripAdvisor, is a valuable tool for identifying and ranking the determinants of the museum experience. The analysis of such feedback also allows the isolation of positively evaluated elements, which can serve as key indicators of public satisfaction.

Positive and negative aspects (RQ3) also emerged from the present study, as summarised in Figure 3.

Figure 1. Summary of the positive and negative elements that emerged from the analysis of TripAdvisor reviews.

ELEMENTS	POSITIVE	NEGATIVE
MUSEUM STAFF	Staff's ability to make topics and content clear and stimulating	Lack of language skills other than Italian
FRUITION EXPERIENCE	Digital resources, including apps, monitors, audio guides and multilingual information	Management of the exhibition space and the quality of the information content; poor ability to maintain the interest of younger audiences.
ACTIVITIES AND INTERACTIVE EXPERIENCES	Availability of workshops and hands-on activities	Inadequate functionality of facilities, limited educational value of some interactive games and lack of content to engage visitors.
ACCESSIBILITY	Dissatisfaction with queuing management;	Dissatisfaction with queuing management; works and scientific content described in few languages.
LEARNING AND ENTERTAINMENT	Educational workshops, inclusive and age-appropriate approach	Lack of practicality, interactivity and laboratories

From a methodological perspective, this strategy is advantageous in terms of efficiency and cost containment, offering a quicker and less expensive alternative to traditional field research. In contrast, considerable deficiencies are identified with regard to logistical organization, the absence of comprehensive information or captions, the poor maintenance of installations (for example, non-functioning interactive stations), the perception of high costs in comparison to the quality of the offering, and the inadequate management of visitor flows, which frequently result in lengthy queues and overcrowding. Furthermore, the absence of accessibility to certain sections and the inadequacy of provided services (such as bars, restaurants, or rest areas) are frequently identified as shortcomings that detract from the overall experience.

Although the present study focused specifically on Italian museums, the results obtained have a broader scope and contribute to the current debate on the managerial and methodological use of data produced on digital platforms such as TripAdvisor. Online reviews facilitate the identification and mapping of visitors' expectations and perceptions, and contribute to the redefinition of cultural mediation processes, the relationship between museums and their public, and the dynamics of inclusion or exclusion of different audience segments (Parry, 2010; Kelly, 2007). The advent of digital and social platforms for sharing the museum experience has had a profound impact on cultural production and consumption practices, giving rise to more active and dialogic forms of participation (Proctor, 2010; Marty & Jones 2008). In this context, visitors assume the dual role of users and co-producers of content, directly influencing the perception and reputation of museum institutions. Furthermore, the extensive availability of data from these platforms allows for the exploration of interpretative processes, aesthetic preferences and fruition strategies adopted by heterogeneous audiences, providing valuable insights for the development of more responsive and participatory museum policies (Camarero and Garrido, 2012; Styliandou-Lambert, 2010).

In light of the considerations presented, it is our contention that future research conducted in other museum contexts, from a perspective that is not directly aligned with customer research, may prove instrumental in advancing the conceptualisation of visitor inclusion within the dimensions of the museum experience. A broader database, incorporating additional review platforms such as Google Reviews, Yelp, and specialised thematic portals, would facilitate more nuanced analysis, integrating cultural, social, and technological dimensions, and advance the development of more robust and generalisable interpretative models (Wong, 2015; Lindqvist, 2012). Further research could examine other museums, transcending national boundaries and considering a range of exhibition specialisations. Moreover, further investigation, conducted through direct surveys of reviewers or visitors to science museums, could facilitate the acquisition of more detailed, diverse, and representative information about different audience experiences and expectations. This would provide a solid basis for the development of museum strategies that specifically address emerging audience needs.

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AWAKEN IN DREAMS
Old and new inequalities in future fasion

by *Michele Varini**

Abstract

This study analyses the interaction between fashion and digital technologies, focusing on virtual environments such as video games. Traditionally, fashion has played a strong role in defining social classes, genders, body ideals and identities. With the advent of the digital, these dynamics have changed, amplified and extended beyond the physical world. Using netnography and visual ethnography, this research aims to examine how four extremely popular multiplayer video games (League of Legends, Apex Legends, Overwatch 2 and Valorant) represent bodies and genders, to explore whether traditional mainstream fashion models are reflected or, conversely, transformed. By examining official content produced by gaming platforms, the research seeks to trace how representations of body and gender are conveyed in a top-down manner, similar to traditional fashion communication. This investigation highlights the hybrid relationship between fashion, gaming and media, in which the boundaries between material and non-material, online and offline, constantly shift. The study also considers how the pandemic has transformed the ways in which consumers engage with digital fashion, making this area of exploration increasingly relevant.

Keywords

Digital Fashion, Digital Methods, Visual Methods, Body representation; Gaming

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1. INTRODUCTION

The phenomenon of fashion has long been a subject of study within the social sciences and has been widely discussed. (Rocamora and Smelik, 2016). Fashion is a cultural industry capable of regulating the relationship between the material and immaterial content of its products and of interacting with its publics, which are also constantly changing, by soliciting their desires and proposing models of behaviour (Mora, 2009). By its very nature, fashion both influences and is influenced by society, which, in contemporary times, is characterized by an accelerated pace of change, increasing fragmentation, and unpredictability (Paltrinieri, 2013).

Fashion has always possessed a communicative dimension: as Crane (2004) asserts, "we dress for others, not for ourselves." These "others" constitute increasingly interconnected audiences (boyd, 2010), as fashion, like many other phenomena, has become mediatised, progressing hand in hand with technical and technological developments (Rocamora, 2013). Indeed, digitalization and fashion have been intrinsically linked since the very beginning, and today, the fashion industry is experiencing unprecedented transformations that impact not only communication but also the dynamics of perception, representation, and self-representation. These changes pertain not only to clothing but also to physicality and the representation of bodies (Sweetman, 2007). The interplay between the body and the fashion industry is a fundamental and inseparable relationship: garments envelop and shape bodies, just as bodies influence clothing, from sizing systems to tailoring and design. This interaction is cyclical, at times synergistic, and at times problematic. Not only do physical bodies play a role in this process (Zauner, 2023), but imagined bodies, beauty standards, and stereotypes are also integral to the production process, both in physical and mediated forms (Yan, Bissell, 2014). Given the longstanding role of fashion communication in shaping Western ideals of beauty (Cheang et al., 2022), it is imperative to consider the influence of certain key players in the industry (Castaldo Lundén, 2020), first and foremost fashion magazines. Historically, print publications - and subsequently, their digital counterparts - have played a pivotal role in constructing and disseminating these aesthetic paradigms (Pedroni and Mora, 2023). Images of bodies and their stereotypes have played a crucial role in the construction of imaginaries, generating a series of potential issues, especially in relation to female bodies.

One of the most significant entities in this domain is *Vogue Italia* (Piccolo, 2019), one of the most relevant titles in the last decades from a graphic and communicative point of view. *Vogue Italia* has historically been one of the most influential fashion publications (Wissink, 2018), shaping models, ideas, and representations within the industry while exerting generational influence on women and young audiences worldwide.

The history of *Vogue* serves as a lens through which to examine social, cultural, and economic transformations over time (Kopnina, 2007). Simultaneously, *Vogue* exemplifies a top-down system of imagery production. *Vogue Italia*, in particular, occupies a unique position within the international fashion scenario, representing the "Made in Italy" approach to fashion while functioning as a key actor in Italy's creative fashion cluster (Pandolfi, 2015). Artistic curation, especially under the editorship of Franca Sozzani, has been the hallmark of the magazine's quality and worldwide reputation for decades (Noia et al., 2023).

The magazine's visual orientation, bolstered by collaborations with internationally renowned photographers and artists, underscores the significance of visual communication in fashion's dissemination (Kalbaska et al., 2018). The direction of communication in this media was one-way, top-down, with no possibility of direct interaction. The authority (in this case *Vogue*) was the broadcaster, who univocally produced input that was then to become standard with the receiving public. However, with the advent of participatory media and the interactive web, the communication landscape has shifted, enabling audiences to actively engage with and influence these dynamics (Kalbaska et al., 2019). The rise of social media, nowadays indispensable especially for the fashion industry, has further complicated this transformation, bringing to a new level a whole series of theories and theorisations that, before, were nothing more than speculations and ideas (Bruning et al., 2020; Nielsen and Ganter, 2022). Within this evolving ecosystem, fashion plays a pivotal role, particularly in the emergence and expansion of online celebrities and influencers - figures intrinsically linked to the fashion industry from its earliest digital engagements (Pedroni, 2023). The advent of new digital technologies and infrastructures has made possible what is often termed Web 3.0 (Choudhury, 2014) and the current media environment, where participatory platforms and social media are now part of the ordinary existence of billions of people. This phenomenon has been studied mainly by considering the dynamics of influence, from celebrity culture to the role of influencers (Muniesa and Giménez, 2020; Nannini, 2020), moving more recently to virtual influencers (Arsenyan and Mirowska, 2021; Mortara and Roberti, 2022). This development signals a fundamental transformation: historically, the fashion industry has relied on physical bodies—bodies that are dressed, photographed, and represented. However, in the digital age, bodies are no longer necessarily tied to physicality; instead, they can become "dematerialized," existing as data-driven, malleable entities unencumbered by the constraints of corporeal materiality (Han, 2022). While this phenomenon is not novel in fields such as digital media, visual arts, and illustration, its implications for the fashion industry are particularly profound, bearing similarities to the role of digital bodies in video games (Cover, 2016). In video games, digital bodies are crucial, they are an indispensable part of the dialectics and logic of many gaming platforms. The video game must necessarily rely on these digital physicalities (Richardson, 2021), which allow one to act and intervene within its reality. The same applies to the visual dimension, which is crucial for the vast majority of video games and their enjoyment. These common elements suggest a growing intersection between fashion and video games, as evidenced by increasing hybridization and cross-collaboration between the two sectors (Boughlala and Smelik, 2024). Video games and the reproduction of bodies in digital format is a phenomenon that, from an auroral phase of the video game industry, has necessarily been fundamental (Barlett and Harris, 2008). Consequently, the relevance of not only performative, but also cosmetic elements to make these bodies unique has always been an element that, within digital game universes, referred back to the phenomenon of fashion, in part laying the foundation for digital fashion itself (Boughlala and Mazzucotelli, 2024). Cosmetic and purely aesthetic elements have always been a widespread feature within various platforms, for example as rewards for player skill or dedication, even before they became purchasable, thanks to the advent of online gaming and micro-transactions (Tomić, 2017). The world of video games has therefore always been a space within which the fashion phenomenon has been able to experiment with forms of hybridisation, along with some of the potential of new digital contexts: many collaborations between brands and fashion industries, software houses and video game producers have flourished and multiplied. Marketing and communication scholars have explored these intersections, focusing on partnerships between major fashion brands and the gaming industry (Noris et al., 2021; Reay and Wanick, 2023). The world of video games, with its distinct aesthetic and semiotic systems, offers an "alternative" physicality—one that challenges traditional fashion paradigms. As fashion enters this domain, it introduces new questions regarding the negotiation of imagery, aesthetics, and representation within this interstitial space between the physical and the de-physical, this new form of materiality.

In mainstream discourse, both fashion and video games have frequently been dismissed as “frivolous” pursuits. As Simmel (1895) has previously pointed out, the charge of frivolity was one of the traits that defined the fashion phenomenon up until a few decades ago, but it may also be applied to video games today. According to Simmel fashion was historically associated with frivolity - a perception intertwined with the marginalization of women, who were largely excluded from male-dominated spheres of economic production and power. Fashion was thus construed as a superficial pastime linked to gender and social identity formation. Similarly, video games were, until recently, largely associated with subcultures (e.g., “geek” or “nerd” communities) and with individuals seeking for a social identity in dynamic virtual communities. (Pedersen et al., 2018). Unlike fashion, however, gaming has traditionally exhibited a male-oriented aesthetic, with industry marketing often favoring hyper-masculine narratives (Smith and Moyer-Gusé, 2006). Nevertheless, the massive expansion of video games - accelerated further by the COVID-19 pandemic (Vargo et al., 2021) - has contributed to a shift in perception, broadening the market interest and diversifying gaming audiences, as well as their gender. From this phenomenon stems a further point of contact between the gaming and fashion worlds, as the audience of female gamers over the years has grown conspicuously, and with it also the availability of proposals and practices dedicated to them (Schott and Horrell, 2000; Witkowski, 2018; Yao et al., 2022). In this regard, too, we are witnessing a rapprochement with the fashion industry: which has always referred to a female audience, it is, however, situated in a context, that of Western society, where and male gaze and dominance are preponderant (Bourdieu, 2001; Lee, 2020). Given these evolving dynamics, this study seeks to explore select gaming platforms to determine whether the representation of bodies within these spaces, their instances and imaginaries (Hansen-Hansen, 2020), aligns with conventional fashion industry practices or whether digital affordances introduce novel, potentially democratizing paradigms that transcend the constraints of physical materiality (Bae, 2022; Varini, 2023).

2. METHODOLOGY

2.1 Research questions

With these premises, this relationship and these similarities between fashion and video games, a number of questions may be raised. With regard to bodies, and in particularly their representations, which - as has been briefly described - represent a crucial element, common to both these fields in question, several issues can be addressed: are the dynamics attributed to fashion in the literature - such as the construction of imaginaries, aesthetic stereotypes, gender norms, and bodily representations - being reproduced in digital contexts like video games? And furthermore, how is the boundary between material and non-material, reality and imagination, being challenged within virtual play environments? Moreover, in compliance with this evolving link between the two universes of reference, fashion and gaming, do digital platforms and gaming environments introduce new modes of body and gender representation, or do they reinforce conventional ones, constructed by the traditional mainstrem fashion system?

2.2 Research design and theoretical framework

In an effort to address these instances, a theoretical approach grounded in interdisciplinary principles has been adopted (Klein, 2007), aiming to reflect as closely as possible the diverse nature of the various objects of study. This approach seeks to integrate concepts and knowledge from academic fields traditionally concerned with fashion—particularly fashion studies (Lusty, 2021; Manlow et al., 2022) and gender studies, with specific reference to the body (Pilcher and Whelehan, 2016)—while also establishing a synergistic and coherent relationship with insights derived from media studies (Ott and Mack, 2020) and game studies (Raessens and Goldstein, 2011). The primary focus of this investigation, as briefly mentioned earlier, is the exploration of fashion's role in shaping imaginaries, bodies, and gender norms within hybrid digital environments. Data sampling was limited to four specific gaming platforms. Given the vastness of the video game landscape, the selection of game titles was carefully considered for both theoretical and methodological reasons, as will be elaborated upon.

2.3 Methods

The methodology adopted in this study employs a digital methodology (Addeo et al., 2024) combined with a grounded approach (Cutcliffe, 2000; Dey, 2004).
Given the visual nature of the data under analysis, it is necessary to implement a structured coding process. The development of the codebook also follows a grounded approach (Belgrave, Seide, 2019),

with the objective of minimizing arbitrariness and bias as much as possible (Verbeiren et al., 2014). The construction of the coding scheme involved multiple iterative cycles of analysis (Eugeni, 2004; Konecki, 2011), ensuring a systematic and reflexive engagement with the data (Gobo, 1993; Bovone, 2010). The resulting codebook is structured according to three levels.

- At the first level, where subjectivity and arbitrariness are minimized, fundamental elements such as the number of characters present in the image are considered. Subsequently, additional highly objective factors - always contextualized within the sampled dataset - were examined, including species, gender, and ethnic origin.
- Following this initial, more objective coding phase - designed to mitigate cultural and perceptual bias (Ostroot and Snyder, 1985) - the analysis proceeded to a second level. At this stage, character bodies were coded based on their alignment or deviation from the beauty standards traditionally endorsed by the fashion industry (Entwistle, 2023; Dwyer, 2004). This classification emerged inductively from the dataset, identifying three recurring categories: muscularity, thinness, and sexualization.
- The third and final level of analysis introduces a stronger interpretative dimension. At this stage, the images are not merely examined and categorized but are instead subjected to a process of 'reading' (Kress and Van Leeuwen, 2020). Here, visual material is approached as:

  > 'visual text, a fabric of signs whose conformations and correlations are functional to a project of interpretation aimed at the viewer'. The image becomes a metatext, creating a multidirectional relationship between the spectator, the object of the gaze and the reflective sum of this dynamic relationship. It becomes a 'device for building relationships between a spectator subject and certain symbolic entities' (Eugeni, 2004: 14-15)[1].

At this point in the analysis it becomes necessary to undertake a process of interpretation and decoding, born in and with the previous levels of observation, in fact

> The interpretative process is therefore cyclical and constructive; it is articulated and rhythmic based on progressive steps that correspond to the completion of a cycle and therefore to the elaboration of relatively autonomous cognitive constructs. […] Each cycle of the interpretative process takes up and elaborates

[1] Tranlsated by the author.

> the constructs of the previous cycle or cycles; the higher cycles therefore imply the lower ones and the succession of cycles has a logical character.' (Eugeni, 2004: 19)[2].

All images embody, contain and concretise messages, characters, stories, narratives, a peculiar 'plot' (Penn, 2000; Aiello, 2006). The result of this third level of coding is the identification of recurring categories within the sample under examination, aimed at the development of codes referring to the recurring imagery and narratives (Castoriadis, 1987; Ivy, 1995; Strauss, 2006).

2.4 Sampling

The video game world, within which we have decided to develop this reflection, is not only continuously expanding (González-Piñero, 2017) but also highly diverse and dynamic (Goh et al., 2023). Consequently, the selection of visual material for analysis consists of official images from specific gaming platforms. These platforms were selected based on several criteria, including the the possibility to create and customize a personal avatar with predefined characteristics and the presence of a multiplayer mode. The objective is to examine the representations of body and gender embedded within these virtual environments and how they are perceived, incorporated and discussed by consumers (Eckersley, Duff, 2020). In both physical and virtual social spaces (Ducheneaut et al., 2007), fashion and the body function also as communicative tools, making this an essential area of inquiry.

To ensure methodological rigor in the selection of gaming platforms, specific criteria were established to maximize the relevance and visibility of body representation and gender dynamics:

- The platform must support online multiplayer mode.
- The platform must be widely popular.
- The platform must feature anthropomorphic and sexually connoted characters.

The first criterion, multiplayer functionality, is fundamental as the social dimension of consumption and engagement plays a crucial role in both fashion and video games (Choufan, 2022). Without an interactive, 'social' component, the consumption and fruition of aesthetic or fashion-related elements and products would become entirely marginal or would

[2] Tranlsated by the author.

in any case undergo different dynamics from those that characterise it in material content. Similarly, the representation of bodies gains significance primarily through social engagement and shared experiences within these platforms.

The second criterion, popularity, is another key factor linking fashion and gaming. The diffusion and widespread appeal of a platform are relevant aspects, both in terms of the extent of the phenomenon and the effects of imitation, emulation and ostentation, which have been the subject of attention since Veblen (2009) and Simmel (Craik, 2024). To operationalize this parameter, the study relied on statistical data from recognized sources, particularly the Active Player website, which is regarded as a reliable reference in gaming analytics[3].

The third criterion, the presence of anthropomorphic characters - or, in cases involving zoomorphic characters, those exhibiting human-like traits (Koikem and Loughnan, 2021) - is necessary to explore the generative dynamics of fashion and body imagery. Thus, anthropomorphic (or human) figures are essential to the purpose of this research.

Furthermore, this study employs a combined data- and theory-driven approach to sampling, ensuring that the selection process is informed not only by empirical evidence but also by established theoretical frameworks. It is important to highlight that this sampling approach follows two distinct directions: one theory-driven and one data-driven.

With regard to the theory-driven dimension, it is essential to reiterate that fashion is understood as a social and cultural form of consumption (Barnard, 2014; 2020). Consequently, it must be examined within contexts of sociality, which - particularly in the post-COVID era - have increasingly hybridized with online and non-material phenomena (Kyrlitsias and Michael-Grigoriou, 2022; Hennig-Thurau et al., 2023). Regarding the decision to investigate representations of bodies in non-traditional, non-material contexts, a data-driven selection was necessary. Specifically, this required identifying platforms in which avatars with bodily characteristics suitable for the study's objectives were present (Bailenson and Beall, 2006).

The exclusion of the top three ranked games - Fortnite, Roblox, and Minecraft - was a necessary step due to their specific graphical styles and the limitations they impose on anthropomorphic and sexually connoted character representation. Roblox and Minecraft (Gupta and Kim, 2018) feature highly stylized, simplified avatars, which do not align with the

[3] https://activeplayer.io/top-15-most-popular-pc-games-of-2022/

study's focus on detailed bodily representation. Although Fortnite does include anthropomorphized and gendered characters, their number is relatively limited, and the game's customization system prioritizes functional and aesthetic modifications over explicit bodily representation. A similar rationale applies to the exclusion of Counter-Strike 2, where character representation is not a central feature of the gaming experience.

By systematically applying these defined criteria, integrating both theoretical perspectives and empirical data sources, this study ensures that the sampling process remains methodologically rigorous and aligned with the research objectives. The selected gaming platforms, which offer significant opportunities to analyse the intersection of body representation, gender and fashion in digital environments, are as follows:

- *League of Legends;*
- *Valorant;*
- *Overwatch 2;*
- *Apex Legends.*

3. SAMPLING

Now that the sample in issue has been briefly clarified, it is necessary to explain the selection process for the photographs. As seen above, the goal of this section of the work is to investigate the dynamics of top-down creation by the media and communication product makers themselves. The decision was made to use only the official websites of the video games in issue as the source of the works being analyzed, in order to maintain scientific rigor. The resulting database has 2,142 entries in total, subdivided as follows:

Table 1. Sampling of the official images of the 4 game platforms under analysis, the total number of characters and their gender

	Number of Characters	**Total images number**	**Female**	**Male**	**ND**
League of Legends	166	1.783	63 (699)	102 (1.064)	2 (20)
Valorant	23	23	11 (11)	12 (12)	
Overwatch 2	39	182	19 (89)	20 (93)	
Apex Legends	25	154	13 (87)	12 (67)	
Total	253	2.142	106 (886)	145 (1.236)	2 (20)

Having outlined the methodological framework and sampling criteria, we now present the analysis of the sampled visual data, following the previously described steps, along with the various coding schemes developed from this material. As can be clearly seen from the information in Table 1, it is evident that *League of Legends* has the most content out of the four video games examined. This is undoubtedly also because there are a lot more characters accessible on the aforementioned gaming platform.

3.1 First level of the coding progess

The first level of coding developed, concerning gender, species (being faced with a database in which not all the characters are human) and ethnic origin, as specified above, presents a reduced level of arbitrariness, not requiring an elaborate interpretative dimension at all, or only to a minimal extent. The relationship between the sexes is fairly equal on all platforms, except for *League of Legends*, where we find a majority of male or male-dominated characters.

Proceeding with the coding, the 'species' dimension was examined. To make the categories created by this first level of coding more understandable, we have included some examples below. We have decided to designate as 'Half-human' any character that presents markedly anthropomorphic traits, even if not completely superimposable to human ones, with uncommon or preponderant elements of animal or technological hybridity. By way of example, we propose below a case among those mentioned above, taken from the *League of Legends* gaming platform[4].

Also included in the 'anthropomorphic' category are those characters who, due to accessories, armour, covers, cannot be unambiguously identified and whose features are partially hidden, but who nonetheless present humanoid forms.

The 'Beast' category includes all those characters whose characteristics are animal-like, or in any case in which anthropomorphisation and elements that may lead back to the human figure are absent or in the minority. A similar discourse can be made for the category 'anthropomorphic beast', which differs from the previous one simply because of a more consistent presence of anthropomorphising elements.

[4] https://ddragon.leagueoflegends.com/cdn/img/champion/splash/Kennen_6.jpg

Table 2. First level of coding of the 4 game platforms under analysis according to category: Species

First level of coding: Species						
	Human	**Half human**	**Antropomorphic**	**Beast**	**Antropomorphic Beast**	**Cyborg**
League of Legends	1.047 (+12)*	147	153	51 (+12)*	280	93
Valorant	21	0	1	0	0	1
Overwatch 2	145	0	0	0	9	28
Apex Legends	138	0	0	0	0	16
Total	1.351 (+12)*	147	154	51 (+12)*	289	138

**Refer to images with two characters in them, one belonging to the category 'Human', one belonging to the category 'Beast'*

Finally, as far as the 'Cyborg' category is concerned, this includes all those characters with robotic characteristics or, in any case, with a prevalence of technological and mechanical elements. An emblematic example can be Kay/o, a character from *Valorant*[5].

As a third element of this introductory codification, the aspect of racialisation was addressed, as mentioned above.

[5] https://playvalorant.com/it-it/agents/kay-o/

Table 3. First level of coding of the 4 game platforms under analysis according to category: Ethnic Origin

First level of coding: Ethnicity				
	Caucasic (F+M)	**Afro (F+M)**	**Asian (F+M)**	**ND (F+M)**
League of Legends	644 + 461 (1.105)	29 + 44 (73)	0 + 44 (44)	20 + 26 + 515 (561)
Valorant	8 + 6 (14)	2 + 3 (5)	1 + 0 (1)	0 + 0 + 3 (3)
Overwatch 2	52 + 36 (88)	21 + 26 (47)	6 + 4 (10)	0 + 10 + 27 (37)
Apex Legends	45 + 25 (70)	23 + 21 (44)	11 + 9 (20)	0 + 8 + 12 (20)
Total	1.277	169	75	621

A significant number of characters, both male and female, fall into the 'Caucasian' group, as can be seen in Table 3. Characters that fall into the 'ND' category do not have adequate characteristics to be attributed to an ethnic group or elements of racialisation; many of them are actually characters that belong to the 'Cyborg' or 'Beast' categories and do not display human or anthropomorphic traits. This category also includes images of characters entirely covered in armour, clothing or accessories that make it impossible to identify their features, either ethnically or, in some cases, in terms of gender connotations. As far as racial representations are concerned, stereotypes are present and preponderant (Abraham and Appiah, 2006), with a number of recurrences rather easy to identify. With regard to characters identifiable as 'Afro', for example, there are numerous references to hip hop culture (not only in bodies but also in clothing) and hairstyles inspired by 'dreadlocks'. This is graphically evident in several cases within our sample, as well as a rather common phenomenon in the media landscape of yesterday and, especially, today (Ash et al., 2021).

We list below, by way of example, two different cases, one referring to a female character, and one to a male character, taken from *League of Legends* and *Overwatch 2* respectively. In the first case, the character in question, Senna, has what we might call street clothes and dreadlocks[6]. The second, Doomfist, in addition to extreme musculature, has features and clothing reminiscent of exoticism and the tribal world[7].

[6] https://ddragon.leagueoflegends.com/cdn/img/champion/splash/Senna_1.jpg
[7] https://overwatch.blizzard.com/it-it/heroes/doomfist/

3.2 Second level of the coding progess

The second level of coding, as specified above, has as its object the dimension of conformity to the models and canons of body beauty traditionally promoted by the fashion system (Frith et al., 2005).

Table 4. Second level of coding of the 4 game platforms under analysis according to category: Conformity

Second level of coding: Conformity		
	Conformity (F+M)	**Non – conforming (F+M)**
League of Legends	607 + 553 (1.160)	91 + 511 (602) + 20*
Valorant	10 + 8 (18)	1 + 4 (5)
Overwatch 2	57 + 55 (112)	32 + 38 (70)
Apex Legends	61 + 50 (111)	26 + 17 (43)
Total	1.401	720 + 20*

**Refer to non-identifiable character images at the level of the 'Genre' category.*

The relationship between bodies defined as 'Conforming' to mainstream fashion stylistic features and those 'Non-conforming' is unbalanced in favour of those aligned to certain pre-existing stylistic features and imagery (Dawney, 2011; Stojanowski and Duncan, 2015). Included within the category 'Non-conforming' are all those bodies that do not fully adhere to the gendered ideals of aesthetic beauty prevalent in Western culture, such as youthfulness, thinness, performativity, muscularity, sexualisation. Among them are several bodies with androgynous elements, some bodies that do not meet the criteria of thinness, some bodies that are not young. In *League of Legends* we find 8 images in total of older bodies, all referring to the same character, male. These are the only images of non-young bodies in the entire database. Another exception are bodies with features that could be described as androgynous (68 in the entire sample). By 'Androgyny' we mean all those bodies that do not or do not fully conform to the binary stereotypes that exist in Western aesthetic imaginaries regarding gender differences (Chattopadhyay, 2020; Cusack et al., 2022).
One possible example of this category is Seer, a character from *Apex Legends*[8].

[8] https://www.ea.com/it-it/games/apex-legends/about/characters/seer

A next level of analysis of the characters coded in the 'Conformity' category consists of three particularly recurring aspects, muscularity, thinness, sexualisation.

With regard to muscularised or muscular bodies (Hargreaves, Tiggemann, 2009), images have been selected that emphasise (with varying levels of intensity) the performative, athletic and, indeed, muscular dimension of bodies. As might be expected, this phenomenon is significantly more prevalent when the analysis focuses on bodies connoted as male. This gender-based disparity emerges as one of the most consistent patterns across the sample.

With regard to the aspect of thinness and skinny bodies (Volonté, 2021; Fixsen et al., 2023) - with varying degrees of intensity - a partial reversal of the muscularity trend is observed. In this case, the majority of such representations within the sample are associated with female characters. Again, there are cases in which thinness is taken to the extreme, in a particularly evident manner. With regard to the female characters present within this coding, we find a certain recurrence, both at the level of physical conformation and at the level of photographic compositions, very much in line with traditional advertising images (Dimitrieska, Efremova, 2020).

As in the two previous elements examined, the gender imbalance is evident. The phenomenon of sexualisation is particularly pronounced in the sample of female characters, again with varying degrees of intensity. The phenomenon of the sexualisation of female bodies in the media is well-known and present in the literature (Herndon, 2020), as is their stereotyping. Bodies that are canonically considered to be conforming, desirable, tend to be thin, lanky, Caucasian (Biefeld et al., 2021), and these aspects are also confirmed in the sample examined here. Although there are some differences, this aspect can be found in all platforms, with differences due to the nature of the aesthetics, the peculiarities of the game dynamics, and the history of each individual title. In several cases, these characteristics are taken to extremes; we propose here an example extracted from *League of Legends*, featuring the character of Janna[9].

[9] https://www.leagueoflegends.com/it-it/champions/janna/

Table 5. Second level of coding of the 4 game platforms under analysis according to the category.

Second level of coding: Conformity, sub-category "Muscularisation", "Slimness", "Sexualisation"						
	Muscolarisation (F)	**Muscolarisation (M)**	**Slimness (F)**	**Slimness (M)**	**Sexualisation (F)**	**Sexualisation (M)**
League of Legends	16 + 1*	329 + 103*	649	449 + 3*	293 + 80*	29
Valorant	2	4 + 1*	10	8	9 + 1*	0
Overwatch 2	10 + 1*	22 + 8*	70	48	15 + 1*	1
Apex Legends	9	17	78	47	15	5
Total	37 + 2*	372 + 112* (484)	807	552 + 3* (555)	332 + 82* (414)	35

**Cases in which the Muscularisation,Thinness and Sexsualisation aspects are taken to the extreme.*

3.3 Third level of the coding progess

The third level of coding, as previously specified, focuses on the imaginary dimension and therefore presents a semiotic interpretation of the images, with a greater presence of arbitrariness and possible bias (Hammersley and Gomm, 1997). The coding of the material using this approach produced some more clearly defined imaginary reference clusters. We will now list and describe the ones most present in the sample:

- Dark fantasy
- Fantasy
- Anime
- Arcade
- Cyberpunk

Certainly, references to 'Dark Fantasy' are evident, characterized by elements typical of fairy tales and fantasy literature, yet infused with dark, ominous, and horror-inspired themes (Brock, 2014; Fabrizi, 2018). Representations associated with this aesthetic are often melancholic, featuring a predominance of dark and twilight hues, set within shadowy or enigmatic environments. sometimes cosmic or surreal[10].

Furthermore, 'Fantasy' elements are widespread, encompassing fairy-tale motifs yet devoid of the same level of darkness and gloom. These references are diverse in nature (Mendlesohn, 2002), often containing medievalism (Matthews, 2015), lighter and more varied color palettes, as well as more defined and less foreboding natural landscapes. Both of these aesthetic categories are prominently featured in *League of Legends.*[11].

References to the 'Anime' world can also be easily found, with more or less explicit references to Asian culture (Sasaki, 2011; Cavallaro, 2013), settings rich in elements traditionally considered oriental (lanterns, hand fans, cherry blossoms), as well as the clothes worn, which often recall kimonos or traditional clothes from the East. Finally, the last two clusters identified are the 'Arcade' and the 'Cyberpunk' clusters, which present certain similarities. The first of these aesthetic categories can be traced back to a retro, pop-inspired visual style, drawing partly from the gaming culture of the 1980s and 1990s (Sharp, 2015) and partly from the Vaporwave movement and online nostalgia, incorporating utopian and

[10] https://ddragon.leagueoflegends.com/cdn/img/champion/splash/Syndra_0.jpg
[11] https://ddragon.leagueoflegends.com/cdn/img/champion/splash/Taric_1.jpg

futuristic motifs (Koc, 2017; Cole, 2020). In contrast, the second aesthetic category is characterized by futuristic, technological, and robotic elements, often manifesting in various nuances and facets that frequently lean towards dystopian themes (Eriksen, 1991). Its references span the broader domain of science fiction (Russ, 1975), shaping both the visual and narrative dimensions of the settings. This latter category is particularly prevalent within the *Valorant*, *Overwatch 2* and *Apex Legends* gaming platforms[12].

4. CONCLUSIONS

This study was intended to explore the dynamics of the representation of bodies in the context of videogames. This specific context was defined during the sampling phase, when the focus laid particularly on multiplayer online videogames, in order to understand the dynamics of 'social' consumption, which are particularly characteristic of the world of fashion and its communication. This choice has allowed us to place the present work within a theoretical framework, that of the sociology (Kawamura, 2018) and the semiotics of images (Aiello, 2006), which we believe has several points of contact with the specific object of the present research. Based on this approach, the analysis does not reveal a revolutionary change in the production of images and imaginaries, nor even in the representations of bodies. On the other hand, many of the established canons of mainstream fashion communication and its supply chain, both past and present, seem to have been reaffirmed (Winterhalter, 2019), and in some cases strengthened. Notably, while fashion has been significantly increasing its attention to inclusion and diversity in recent years (Prasad et al., 2011; Doyle and Moore, 2023), reflecting the growing sensitivity of society and consumers towards these issues, the videogame context examined does not seem to manifest the same phenomenon. Most of the representations of bodies in this context remain linked to a dimension that we could define as performative (Meliakova et al., 2021). The images developed in the sample often appear to be anchored to aesthetics and stereotypes that the fashion industry is, to some extent, questioning or, where possible, trying to overcome (Entwistle, 2023). The female body, for example, continues to be represented in a manner consistent with the 'supermodel' image (Tovée et al., 1997): impeccable, accessible, available and passive. Similarly, the male body is often portrayed as the 'macho' (Mosher, 1991), strong, athletic and

[12] https://www.ea.com/it/games/apex-legends/apex-legends/characters-hub/ballistic

sculpted. Traits such as muscularity, thinness and stereotypical notions of Eurocentric aesthetic beauty (in particular hyper-sexualised representations of the female body) remain dominant (Bordo, 2023). This aspect represents a further link between the world of videogames and that of fashion, which until recently was predominantly a Eurocentric phenomenon, deeply rooted in Western society (Cheang, 2022). The photographic compositions within the sample predominantly feature a single subject, mirroring traditional fashion communication, most notably editorial styles (Smedley, 2013). These characteristics are represented in the medium of video games, with its rules and its peculiar elements, which aim to construct 'heroes' emphasising attributes such as strength, dexterity and extraordinary abilities, but which share with fashion publishing unidirectional, top-down modes of communication (Varini, 2024). With reference to images produced using top-down dynamics, it is essential to highlight the most important and controversial phenomena, once again concerning the female body. Women continue to be objectified in these representations, remaining subjects of the male gaze and the gaze of others (Ponterotto 2016; Oliver 2017). The intersection of digital technologies and fashion has given rise to a new hybrid reality in which digital bodies are supposed to reshape traditional representations and the very structure of the fashion system. Digital avatars, in particular, are now at the centre of the continuous evolution of fashion, presenting both new opportunities and challenges (Noris et al., 2023). These digital bodies offer unprecedented possibilities for creativity, inclusion and interactivity, but they also introduce new threats that need to be critically examined. One of the main advantages of digital bodies lies in their ability to transcend the physical limits not only of traditional fashion, but of the laws that constrain matter (Bench, Elswit, 2022). Unlike physical models, digital avatars can be modified, personalised and manipulated in potentially infinite ways. This freedom would seem to open the door to experimentation and artistic expression that was previously impossible. Designers can create garments and accessories that exist only in virtual spaces, enabling new forms of fashion presentation and allowing the exploration of unconventional materials and shapes (Zhang et al., 2022). Digital bodies could also facilitate the creation of fashion that is not bound by the limits of physical production, allowing the creation of garments that adapt to different body types and identities, reflecting a broader and more inclusive vision of beauty, apparently increasingly embraced by the industry supply chain (Prasad et al., 2011) and changing the supply chain and the professions involved in it (Barnard, 2020). Furthermore, digital bodies could contribute to a democratisation of fashion. Through platforms such as virtual worlds, video games and social media, users are no longer passive consumers of fashion, but increasingly active participants, able to design, customise and showcase their own digital identities. These possibilities encourage greater self-expression, allowing people to experiment with a wide range of aesthetic choices, either by adopting avatars that reflect idealised versions of themselves, or by exploring new and imaginative avatars that break free from the norms and expectations of society (Bailenson, Beall, 2006). But while digital fashion would seem to offer interesting creative possibilities, the sample examined does not seem to support these theories. Moreover, the proliferation of digital bodies in the case examined here seems to exacerbate existing problems regarding imaginaries and body identities. While digital avatars can, by their very nature, offer freedom and flexibility, they can also create new forms of visual hyperreality that impose unrealistic standards of beauty and physical perfection (Kazansky and Milan, 2021). The ease with which avatars can be modified to resemble idealised versions of the body could further reinforce performative, unachievable and unrealisable ideals, particularly among the younger generations (Tovée et al., 1997). Furthermore, the digital world is predominantly characterised by Western beauty standards and the prevalence of typically thin, tall and young avatars in the analysed sample may contribute to the marginalisation of other body types, ethnicities and cultural representations. The design and representation of digital bodies, shaped by technology companies, platforms and dominant cultural norms, risks reinforcing dynamics of stereotyping and exclusion instead of countering them. This aspect also emerges from the analysis conducted here; in fact, there is a rather evident overrepresentation of certain groups to the detriment of others, often from minorities or non-Western contexts, which in addition to being underrepresented are also presented through neo-colonial or exoticism aesthetics and imagery (Kyrlitsias and Michael-Grigoriou, 2022). These dynamics, which reflect status and exclusion dynamics present in society and culture, seem to transfer and translate into new forms in the digital context (Hartl and Hess, 2017) and its aesthetics, as is the case with the dynamics of capitalism, which has adapted to this new terrain, developing an increasing integration with virtual spaces. Digital capitalism (Andrejevic, 2014; Zuboff, 2019) focuses on how data and attention have become key commodities in the digital age, shaping consumer behaviour, identity formation and economic systems. This perspective can be applied to the world of digital fashion and avatars, making virtual representations of bodies not only a simple form of artistic expression, but products created, commercialised and consumed in a capitalist context, once again in a performative logic, synergic with dynamics of consumption and profit (Smelik, Rocamora, 2015). Digital bodies become a tool for the commodification of identity (Wee, Brooks, 2010). Within digital platforms, avatars are continuously curated and customised, often acting as an extension of the user's self-presentation. As these digital bodies are increasingly shaped by consumer demand, brands and platforms have the opportunity to influence the way individuals represent themselves, thus transforming self-expression into a marketable commodity (Fuchs, 2017; Chandler and Fuchs, 2019). Drawing on the concept of hyperreality (Baudrillard, 1981), digital bodies can be seen as a form of simulacrum, virtual representations of bodies that do not merely imitate reality, but overlap with it. In this process, the distinction between virtual and physical bodies becomes increasingly fluid, which would seem, at least in part, to be driven by the capitalist logic of continuous consumption. Unlike fashion and physical bodies, where materiality limits consumption, the digital counterpart is a continuous and constantly evolving process that invites users and consumers to constantly update themselves. In the context of digital capitalism, this encourages a new kind of aesthetic consumerism, which is less about tangible products and more about cultural productions, virtual experiences and representations. Consumers invest their time and resources in work aimed at developing virtual statuses and identities, which are increasingly significant within digital and social spaces. The value, both economic and imaginative, of digital bodies extends beyond the avatars themselves, as these digital representations contribute to the broader virtual ecosystems and economies of gaming platforms, social media and virtual reality spaces, where fashion items often have significant social and economic value (Kozinets, 2015), and even extend to catwalks, fashion shows, physical retail outlets. By connecting theories of digital capitalism to the topic of digital bodies, we can better understand the economic, social and political implications of digital avatars and virtual fashion. This framework helps to situate digital bodies not only as aesthetic objects, but also as part of broader systems of consumption, data extraction and labour within the digital economy. The analysis in question lends itself to potential future developments, which could be profitable, in particular if aimed at exploring the dynamics of cultural hybridisation and the fusion of practices in different social and geographical contexts, crucial for understanding some of the mechanisms at play in this phenomenon also through a reflective observation coming from a non-Western cultural context. Visual analysis by its very nature presents biases (Wall et al., 2018), including socio-cultural ones. In particular, this reflection applies when dealing with a level of interpretive analysis (Bresciani, Eppler, 2015). Another promising avenue for future research could stem from the users of these platforms, in particular from the ways in which gender, the political instances related to it, rights and ideologies manifest themselves within these dematerialised spaces, increasingly the places of choice for identity, political and consumerist expression (Kucuk, 2016).

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MULTI-PLANETARY INFRASTRUCTURES AND HYBRID EXPLORATIONS
An analysis of the structures of epistemic enrolment in online discourses on space missions

by Ilenia Picardi and Marco Serino[*]

Abstract

This paper explores the *sociotechnical imaginaries* involved in the construction of technoscientific knowledge as it is conveyed by space science institutions through websites and social media. The study focuses on the discourses by which Nasa promotes the Artemis programme, aimed at achieving a new human landing on the Moon. The study is based on a mixed-methods perspective that combines the *social world framework* and social network analysis to examine the relational structures at play in the discourses disseminated by Nasa through several online spaces observed between March and November 2024. Using a methodological protocol developed to study epistemic structures, we analyse the discursive assemblage constituted of knowledge claims on space missions and the (heterogeneous) actors discursively enrolled to sustain those claims. Through this analytical framework, we reconstruct the epistemic structures underlying Nasa's discourse on Artemis and the intertwining of technoscientific elements and sociotechnical imaginaries relevant to these structures.

Keywords

Nasa, space missions, online discourse, social network analysis

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1. INTRODUCTION

«Earth is the cradle of humanity, but one cannot live in a cradle forever». With these words, in 1911, the Russian-born scientist and mathematician Konstantin Tsiolkovsky opened what later became the field of study of astronautics and human spaceflight[1]. Two centuries later, after humans have landed on the Moon and robotic machines have reached the surface of Mars, the world's major space agencies and scientific institutions are still hard at work trying to turn Tsiolkovsky's visionary imaginaries of human life beyond the limits of our planetary system into imaginaries of the possible – or, in other words, into reality.

Space missions are an elective field to investigate how imaginaries are embedded in the construction processes of technoscientific knowledge and, more specifically, the relationship between images, imagination and imaginaries in such epistemic processes. Given its nature, research on space missions plans crewed travels to places (almost entirely) unexplored by humans, and therefore, based on the technoscientific knowledge acquired so far, the same research can only *imagine* human life beyond Earth – or can, at least, try to perform a *placemaking* endeavour (Messeri, 2016). Accordingly, *techno-imagination* (Maestrutti, 2011) is a constitutive and determining element of research on space missions, in which diverse skills converge. The boundaries between images and imagination in space mission research dissolve in the creation of imaginaries that elaborate and plan crewed space travels and the occupation of outer space, hence proposing forms of «humanization of the universe» (Dickens and Ormrod, 2007: 2) as well as forms of anticipation of the future and, at the same time, a construction of expectations and visions about the future (Konrad et al., 2016).

Science and Technology Studies (STS) have developed a range of conceptual and methodological frameworks for understanding the performative force of *imaginaries*. In this contribution, we thus adopt the theoretical and methodological tools provided by this field of studies to understand how scientific institutions construct and enrol imaginaries on space missions are aimed not only at communicating the research's objectives but also at legitimising space science.

The analysis focuses on the online spaces run by the National Aeronautics and Space Administration (Nasa) to promote the Artemis campaign, the programme developed by this agency in collaboration with US and international public and private partners, aimed at achieving a new human landing on the Moon (and then on Mars). We explore the *sociotechnical imaginaries*

[1] Indeed, Tsiolkovsky is acknowledged as both «the world's first rocket scientist» and «the first space scientist» (Scharmen, 2021: 14)

(Jasanoff and Kim, 2009; 2015) involved in the processes of technoscientific knowledge construction performed by space science institutions to disseminate their work via their own websites and social media channels. The notion of sociotechnical imaginaries is familiar to scholars working on outer space from an STS perspective (e.g. Tutton, 2021; Cirac-Claveras, 2022; Rementeria, 2023; Klimburg-Witjes, 2024; Young and Docherty, 2024). In fact, the sociotechnical imaginaries of outer space largely relate to the promises of science for the future. Hence, it is worth looking at how these imaginaries are depicted in space science to shape future visions and expectations concerned with space missions (Borup et al., 2006; Konrad et al., 2016; Van Lente; 1993; Tutton, 2018; Rementeria, 2023).

The present study poses the following questions: Which actors are enrolled into the narratives of space scientists implicated in the construction of a performative future? What are the enrolment strategies implemented by scientific institutions in the construction of imaginaries of humans in space embedded in these forms of scientific knowledge? To answer these research questions, we assume the *sociology of associations* (Callon, 1984; Latour, 2005) as the theoretical framework for analysing technoscientific knowledge, and rely on its empirical translation through a methodological protocol developed for the study of the epistemic structures of knowledge refused by science (Picardi et al., 2024)[2], by which we analyse the corpus of knowledge on space missions promoted by Nasa in online environments, understood as a discursive assemblage constituted of both knowledge claims on space missions and the heterogeneous actors enrolled to sustain these knowledge claims.

The concept of *enrolment* is derived from Latour (1987; 2005) and adapted to our context to mean the discursive involvement of a plurality of heterogeneous actors – both human, such as stakeholders, concerned people, Nasa representatives, etc., and non-human, like technological devices, spacecraft, planets, biochemical elements, and so on – in the framing and promotion of the relevant activities. It should be noted that, in line with the perspective of the sociology of associations, attention is paid to all aspects of technoscientific activities and domains of interest, including its political, cultural, and economic implications.

The analysis is framed within a mixed-methods perspective that combines the *social world framework* (Clarke and Star, 2008) and Social Network Analysis (SNA) to examine the relational structures at play in the enrolment of actors in support of the claims disseminated by Nasa's online

[2] More specifically, the protocol has been applied to the study of "refused knowledge communities", i.e. communities promoting «a body of knowledge partially or totally refused by institutional and scientific authorities» (Crabu et al., 2024: 10).

spaces. Through this analytical framework, we reconstruct the epistemic structures underlying Nasa's online discourse and the intertwining of techno-scientific elements and sociotechnical imaginaries in the identified structures.

The findings of this study show that, on the one hand, Nasa sets forth different sociotechnical imaginaries centred on the increasing advancement of technologies (including AI) to emphasise the future undertaking of lunar exploration and the exploitation of lunar resources. On the other hand, the human factor is central to narratives related to the crew modules developed by Nasa, such as the Orion Spacecraft or Gateway. The network analysis permits us to explore the configuration of these narratives and to highlight how they are distinct and yet interrelated through the ties between claims and actors, which keep the whole epistemic structure connected and consistent.

2. INVESTIGATING SOCIOTECHNICAL IMAGINARIES OF OUTER SPACE THROUGH THE SOCIAL WORLD FRAMEWORK

In this section, after a brief review of STS literature on sociotechnical imaginaries, we illustrate the theoretical and methodological framework employed in this study to explore how imaginaries are involved in the construction of the technoscience of space missions and, more specifically, how Nasa embeds visions of human life in space in the technoscientific knowledge disseminated through the online spaces devoted to promoting the Artemis programme.

In recent years, the concept of sociotechnical imaginary has informed a growing STS body of work focused on the analysis of how broad narratives orient pathways to the future, legitimating ones, and foreclosing others (McNeil et al., 2016; Konrad, 2016; Felt, 2015; Jasanoff and Kim, 2009; 2015; Levidow and Papaioannou, 2013; Taylor-Alexander, 2014). Following the theoretical perspective tracked by *Dreamscapes of Modernity* (Jasanoff and Kim, 2015), we borrow the concept of *sociotechnical imaginaries*, defined as «collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of life and social order attainable through, and supportive of, advances in science and technologies» (Jasanoff, 2015: 4).

Some STS scholars have concentrated their reflections on *expectations* and *visions* related to imaginaries. Konrad et al. (2016: 466) define *expectations* «as statements about future conditions or developments that imply assumptions about how likely these are supposed to be and that travel in a community or public space». As Van Lente (1993) suggests, expectations have agency in the representation (and creation) of the future; they advise, show direction, and create obligations (Van Lente, 1993: 191). In this sense, «expectations are performative» (Tutton, 2018: 521) and constitutive in recruiting allies, «in defining roles and in building mutually binding obligations and agendas» (Borup et al., 2006: 289). Such promises and concerns mobilise and legitimise the activities of scientists, innovators, policymakers, companies and other societal actors, with future expectations that can align with or contest each other (Konrad, 2006; Meyer, 2019; Pfotenhauer and Jasanoff, 2017; Rementeria, 2023).

On the other hand, *visions* relay a wider picture of future societies in which new social orders, governance structures, cultures and values are redrafted. While expectations concern future developments in specific technological contexts, visions forward fuller portraits of an alternative world, presenting (coherent) packages of potential future states (Konrad et al., 2016; Berkhout, 2006; Eames et al., 2006).

Consequently, both expectations and visions work well with the notion of sociotechnical imaginaries, as well as with those of «sociotechnical futures» (Konrad and Böhle, 2019; Meyer, 2019), and «sociotechnical future scenarios» (e.g. Neresini et al., 2020). Most importantly, sociotechnical imaginaries and sociotechnical futures have proven to be well suited for the study of outer space activities (Tutton, 2018; 2021; Cirac-Claveras, 2022; Rementeria, 2023; Klimburg-Witjes, 2024; Young and Docherty, 2024).

To investigate expectations and visions embedded in the sociotechnical imaginaries concerned with Nasa's Artemis campaign, we mainly refer to the conceptual framework of the *social world perspective* proposed by Clarke and Star (2008). To this aim, we introduce below a set of definitions for *sensitising concepts* (Blumer, 1969) that we have utilised to develop the analysis, namely those concepts which «merely suggest directions along which to look», instead of providing «prescriptions of what to see», as is the case with «definitive concepts» (Blumer, 1969: 148).

Relying on the definition of social worlds as *universes of discourse* (Strauss, 1978), we focus on the dissemination of knowledge on space missions performed in the online spaces run by Nasa, conceiving of them as «shared discursive spaces» (Clarke and Star, 2008: 113) in which expectations and visions of the future are conveyed and elaborated to engage the larger publics' attention and interest.

According to the social world framework, Nasa scientists and the authors of the contents displayed in the relevant online spaces are considered as the *entrepreneurs* (Clarke and Star, 2008: 118; see Becker, 1963) of the relevant technoscientific knowledge. In using the term *entrepreneurs* we refer to those who are committed to promote the perspective of Nasa towards future missions via these online spaces, although we do not consider them in terms of the active role they play as agents, limiting our attention to the outcome of the entrepreneurs' activity. Nonetheless, as a sensitising concept, that of entrepreneur leads us to look at online spaces as cues to understanding the various ways in which Nasa commits itself to provide Artemis with a sound and captivating discursive framing.

In this respect, drawing on Latour's early work on the making of technoscience (Latour, 1987; see also Callon and Law, 1982; Latour, 2005), by *enrolment* we mean the process through which the promoters of technoscientific knowledge attempt to frame the contents and the ends of such knowledge and its products, in order to make them relevant to others' interests and concerns, including the fabrication of imaginaries apt to foster such relevance. In the context of the present inquiry, this means to construct knowledge that necessitates the involvement of a plurality of human and non-human (i.e. heterogeneous) actors in the discourse to be legitimised, with the objective of reinforcing that knowledge itself.

Hence, in our context, enrolling other actors does not mean to directly involve them in the construction of scientific facts, but to consider them in the discursive framing of the facts as part of that process of construction. Therefore, as for the human actors considered in the discourse analysed in this paper, these are *implicated actor*s, i.e. «actors silenced or only discursively present – constructed by others for their own purposes» (Clarke and Star, 2008: 119). In addition, the focus is only on the second type of implicated actors defined by Clarke and Star as those who are «*not* physically present in a given social world but solely discursively constructed and discursively present» (*ibidem*)[3]. Consequently, these actors are neither actively involved in negotiating self-representations in social worlds nor considered for what they argue, although they can play a determinant role in enrolment processes aimed at conferring legitimation to given forms of knowledge.

Non-human actors enrolled in discourse are, instead, all those objects, imageries, and ideas that can help to give meaning and pertinence to the claims – namely to make the latter *interesting* for other people, such as concerned actors, stakeholders, and the general public (a strategy that can be often recognised in the development of technoscientific ideas and products; see Latour, 1987).

As this process covers many aspects of technoscientific activities, ranging from the design and production of technological devices employed in space missions to the formal participation of public and private institutions in the undertaking of space programmes – all these aspects being vital for the

[3] *Implicated actors*, *universes of discourse* and *entrepreneurs* are included in "The Social Worlds/Arenas Framework Conceptual Toolbox for Science Studies" provided by Clarke and Star (2008: 118).

realisation of those activities and their acknowledgement at different societal levels – we consider the whole enrolment process as *epistemic enrolment*.

We define the cognitive elements stated in Nasa's online spaces as *knowledge claims*, i.e. statements that convey key ideas regarding what Nasa's Artemis is meant to undertake, what it is aimed at and to whom the programme addresses its values and proposed activities and projects (both actual and envisaged). These are the constituting segments of the corpus of knowledge proposed in these spaces. The content disseminated through Nasa online spaces is thus conceived of as an assemblage of such knowledge claims and actors – as we have defined them above – discursively enrolled to sustain them.

The result of the assemblage of knowledge claims and enrolled actors is what we call *epistemic structures* (Picardi et al., 2024), in that they result from the construction – and the *hardening* – of technoscientific facts through the networks of association (Latour, 1987; 2005) that are formed by the constituting elements of knowledge and the social worlds within which knowledge is disseminated. This implies that such epistemic structures encompass the diverse dimensions – political, socio-cultural, economic – that are inherent to the construction of technoscientific facts, and that the knowledge claims and actors considered pertain to these dimensions, either at the level of a local work team or at level of global politics.

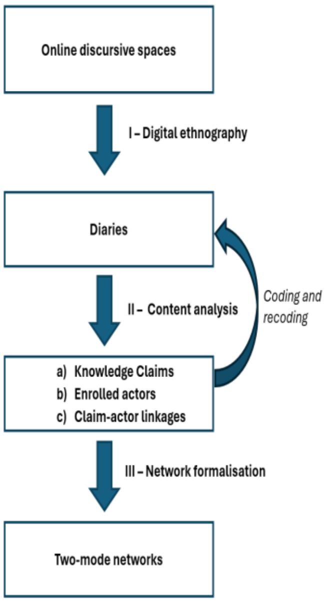
Finally, we define an *epistemic enrolment space* (Picardi et al., 2024: 142) as «the set of discursive structures that guide, focus and delimit» the processes by which knowledge is attributed credibility, relevance and legitimacy. Therefore, the aim of the analyses presented in this article is to highlight and interpret the epistemic structures that can be traced in the epistemic enrolment space of Nasa's Artemis programme, of which the online spaces that provide the material for these analyses constitute an empirical manifestation.

In the following sections, deploying this analytical toolkit, we shall provide an analysis of the data gathered from observing several online spaces by which Nasa promotes the Artemis space programme and proposes expectations and visions of future missions – which, as we will show, are intended to go beyond the sole achievements of space programmes. The epistemic structures that will be highlighted via the ensuing analysis will enable the identification of specific sociotechnical imaginaries within such communication endeavours. The methodological strategy presented in the subsequent section will be employed to this end.

3. METHODOLOGICAL STRATEGY

The methodological strategy we adopt in this work (see Picardi et al., 2024) seeks to furnish an analytical procedure aimed at identifying the networks of relations underlying the discursive universes under study, using tools from both qualitative research and SNA. This strategy is pursued through different steps displayed in Figure 1.

Figure 1. The steps of the analytical process



The first step of the analysis took the form of a digital ethnography (Hine, 2015; Marcus, 1995) carried out between March and November 2024. During this period, several Nasa online spaces, such as social network sites and institutional webpages (both the types of online space pertaining to different divisions of Nasa) aimed at promoting the Artemis campaign, were observed (Table 1). In this timespan, we collected the textual and iconographic contents disseminated in these spaces, as well as the observations and reflections that these contents contained, recording all the materials in ethnographic diaries. It must be specified that this observation concerned publicly available content and did not involve any type of interaction between the researchers and the subjects involved, i.e. neither the entrepreneurs nor the users of these online spaces who left comments to the posts analysed. These comments were not collected or analysed either. Consequently, the empirical material consists only of the content of social media posts and webpage articles.

Subsequently, these ethnographic diaries were analysed to identify the claims and actors enrolled to support these claims. The claims were then obtained by recognising the essential knowledge elements contained in the discursive material collected. To identify the actors enrolled in support of such claims, we used the tool of content analysis (Lieblich et al., 1998) and the sensitising concepts described above (see Section 2), particularly those of universe of discourse and social worlds (Strauss, 1978; Clarke and Star, 2008). The interpretative work embedded in this strategy implies that the resulting networks should be understood as *qualitative networks* and as heuristic tools that help us highlight epistemic structures strictly connected to the theoretical lenses used in this analysis.

The enrolled actors have been classified into a number of categories defined according to the following criteria: a) the sector of activity (e.g. economy, politics, technoscience – and their subsectors or subspecialties), with regard to either terrestrial or space-related domains; b) the area of outer space on which discourses are focused (e.g. the Moon or Mars and their characteristics); c) the distinction between Nasa and other space agencies; d) the distinction between these latter and the private companies that participate in Nasa activities; e) the internal organization of Nasa offices, divisions and facilities.

3.1 Network-analytic strategy

In SNA, a tradition of studies revolves around the interplay between networks and meanings (e.g. Mützel, 2009; Fuhse and Mützel, 2011; Mohr, 1998). We partly refer to this tradition in gathering data and interpreting results from a quantitative and qualitative angle. This paper deals with a way of analysing meaning structures (Mohr, 1998) in the discourses observed online, which relies upon a qualitative content analysis deployed to «map out the structure of meanings within narratives» (Mohr, 1998: 358). As shown in the bottom box of Figure 1, these structures are represented in the form of two-mode networks made of claims and actors (the two modes of the network), with connections running only between modes, such that each claim is linked to one or more actors, and vice-versa. This means, in addition, that claims are connected if they share at least one actor, and vice-versa[4].

[4] This strategy could be partly in line with Carley's *map analysis* of discourses. According to Carley (1993: 78), the term *map analysis* refers "to a broad class of procedures in which the focus

In reconstructing the claim-actor matrix, we have tried to preserve the meaning of any single word or phrase to the extent that it would unequivocally represent a specific thing or concept. Changes in the wording of enrolled actors have been made in harmony with the way entrepreneurs aim to convey specific meanings. When this way is not peculiar to a given actor, the wording is changed for the sake of homogeneity. On the same note, if a given phrase is different in some respect from other akin phrases, but it is known that the actor would mean the same thing or idea with it, the phrase's wording is harmonized with the other ones of the same kind. Broadly speaking, we avoided generalization and/or homogenization of words and phrases to keep the relevant meaning intact. Modifiers are retained when the meaning of the wording would be different otherwise.

Claims are different in terms of generality/specificity when this helps distinguish the original information in its core meaning, which may or may not be general/specific. Moreover, different contents of a claim can be both present in a sentence as well as separated and thus forming two or more sentences. We maintained this difference as well. The above choices all refer to the need to remain faithful to the original empirical material. Identical wording also applies to those originally different phrases having similar meanings.

We then analyse visually and statistically the two-mode network of claims and actors via the *Gephi 0.10.1* software. We use basic SNA metrics to support our interpretations, specifically degree and betweenness centralities for two-mode networks (Brandes, 2001; Faust, 1997). Integral to our use of *Gephi* is the application of a community detection procedure to the network data, using the Louvain algorithm (Blondel et al., 2008). This method helps us to highlight the community structure of the network by seeking to optimise the modularity of the partitions, i.e. a measure of the quality of these partitions. In this way, we attempt to better understand the patterns of connections between the different claims and actors. In the following, we shall refer to each partition resulting from this procedure mainly as "community" rather than "modularity class" (the term used in the *Gephi* modularity routine, see Figure 5).

is on networks consisting of connected concepts rather than counts of concepts". For the sake of the present work, in brief, a map "is a network of concepts formed from statements. Two statements are linked, if they share one concept" (Carley, 1997: 540). As we explicitly use SNA within an STS framework, it is also worth mentioning other studies that deal with the matter, such as Venturini et al. (2019), and Cambrosio et al. (2020), among others. Text analysis and text mining in combination with SNA is also a relevant perspective in STS (see Venturini and Guido, 2012; Neresini et al. 2020).

4. RESULTS

4.1. Nasa's Artemis programme

Artemis is a space exploration programme developed by Nasa in collaboration with US and international partners such as Esa, Jaxa and the Canadian Space Agency (Csa), aimed to achieve a new human landing on the Moon – more than fifty years after the end of the Apollo programme – in order to lay the groundwork for a long-term human presence on the lunar surface and, at the same time, to prepare for a human landing on Mars.

The Artemis programme consists of a series of space missions, each centred on launching a booster of Nasa's lunar rocket, the Space Launch System (SLS), used as a transporter for the Orion Spacecraft. During Artemis I, carried out in 2022, SLS sent the Orion Spacecraft 1.4 million miles beyond the Moon, only to return; this first mission was uncrewed and preparatory to the following ones. Next on Nasa's timeline is Artemis II, which aims to carry a crew of four astronauts on a 10-day flight to test human deep space exploration capabilities.

Through the following analysis, we aim to highlight the extent to which Artemis narratives are multifaceted, as they constitute complex assemblages of elements from different domains of knowledge and activity, either scientific, political, economic or cultural.

4.2. The network of Artemis' discourse

The network under investigation is made of 80 claims and 665 actors. As for the claims that are most central in the graph, these are connected to a high number of actors because of the discursive frame within which they appear and due to the relevant enrolling strategy[5]. Three claims with the highest degree are C17, C35 and C36. Claim C17 announces the integration of an additional nation in the Artemis Accords, which at the time of data collection included 43 countries. Since degree values indicate the number of enrolled

[5] It should be noted that the degree distribution of claims and actors is markedly dispersed, as shown in Table 4. This is due to the high variability of degree values in consequence of the enrolment of actors to support the claims. Less than 3% of the actors are tied to 10 or more claims. Empirically, these actors are "important" in the discourse as they are called upon more frequently, but this also means that their role is central in maintaining the relevant epistemic structure (as also expressed by betweenness centralities). The most part of the enrolled actors does not play such a role. As for the claims, 15% of them are tied to 50 actors or more. This can be interpreted as the extent to which highly central claims shape the foci of the discourse and, thus, gather many actors around them. Such data structure is consistent with the kind of process investigated and the coding procedure utilised, which does not affect the reliability of the results.

actors associated with a claim, the high degree value associated with this claim shows the relevance of the political dimension of Nasa's project that mobilises a high number of heterogeneous actors in supporting the Artemis Accords, indicated by the numerous blue nodes linked to claim C17 (see Figure 4). Among these nodes there are political actors, either actual (e.g. a given country) or symbolic (e.g. the American flag), and actors belonging to the category of "Value of humanity", which are invoked to legitimise the political dimension of space missions.

Indeed, considering actor attributes (Figure 4), enrolling political entities turns out to be different from enrolling technologies, with the former being mostly located on the left-hand side of the graph, while the latter are mostly placed on the right-hand side. For instance, claim C17 and the actors associated with it form a distinct community (i.e. community 11, see Figure 5), while, on the right-hand side, claims C28, C30, C31, C35, C36 form a bunch of nodes that belong to community 2 (see below) and refer to the deployment of technological advancements as well as to the challenges and expectations regarding new lunar areas to be explored (e.g. C30 - "Moon's permanently shadowed regions could help reveal the origin of water throughout our solar system", C35 - "New Nasa science and technology instruments will be heading to the Moon in 2027", and C36 - "The Moon's South Pole is a challenging but scientifically interesting site"). This area of the graph represents what Nasa sets forth as the core business of the Artemis mission in its next steps to start exploring the lunar surface, and specifically the lunar South Pole.

The actors "lunar surface" and "lunar South Pole" are the first two in the ranking by degree scores, enrolled to sustain a large number of claims in the relevant discourse, which is virtually reflected in their degree centrality. These are also non-human actors that gain centrality in the network as they act as drivers of future exploration, either human-made or automated.

Indeed, in this context, the discourse about Nasa's Artemis programme depicts an imagined future in which technology – and autonomous technology in particular – will open avenues for brilliant scientific achievements. Furthermore, enrolling knowledge about lunar geography – in conjunction with the act of naming lunar sites of interest for future exploration – constitutes an instance of the colonisation of extraterrestrial territories. It is worth noting, however, that the five claims mentioned above are connected to a single actor of the category "Astronauts and space crews", which means that the human factor – represented by the "crew" as an implicated actor – seems to be set aside or at least minimised in the narratives of technologically advanced exploration[6]. This assemblage of non-human actors concerning

[6] Indeed, astronauts and space crews are mostly present in community 10, which is embedded in

mainly technological devices and lunar geography, with a weak enrolment of human actors or discursive entities related to humanity (such as "the benefit of all"), is captured by the composition of community 2, the second largest in the network (Figure 5), which is located on the right-hand side of the graph.

Interestingly, community 2 also includes the actor "water", namely one of the most important resources that scientists are seeking on the Moon. Yet, another resource that is sought to be extracted from the lunar surface is "oxygen", which, as an actor in this network, belongs to community 9, along with claim C84 ("Researchers are working to enable human life on the Moon"). As for the enrolled actors, this latter community is all the more concerned with artificial intelligence (AI) and robotics, namely the automated technologies that will pave the way for establishing human settlements on the Moon.

The third most central actor in terms of degree centrality score is "Orion Spacecraft", with 20 claims associated with it. Orion was already the protagonist of recent achievements of Nasa for an uncrewed Artemis I mission. Now, and in the discourses that we observed, it conveys a more "humanised" vision of space activities, along with "Gateway" (degree = 14), "humanity's first space station around the Moon" (claim C52). The actor "Orion Spacecraft" is linked to different claims than those expressing progress in the sole technological mastering of lunar exploration. Rather, here it seems that a *crewed* exploration of the Moon is the point, as is the case with claim C66 – which is also linked to the actor "discovery" – and C67, which concerns "the possible places on the Moon's surface where Artemis III astronauts could land" (both C66 and C67 are connected to "the benefit of all"), along with the idea that "space belongs to everyone" (claim C10) and recalling the legacy of past exploration achievements (C26), like those of the Apollo programme.

Interestingly, linked to Orion are also claims C3, "Artemis IV astronauts will be the first to live and work aboard a lunar-orbiting space station", and C4, "Nasa and its partners are working to explore our Moon safely". The human venture is, here, at the core of an imaginary that depicts not only the giant technological leaps in gaining knowledge of the Moon's characteristics, but also on how this endeavour will be experienced by the crews, with an inevitable link to "long-term exploration" as the actor that connects this area of the graph and the relevant discourse to claims C35 and C36 (see above).

Space humanisation also pertains to the narratives concerning Gateway. The latter is a distinct enrolled actor and the constitutive element of several claims (e.g. C51, C52, C53, C54, C55, and others; see Table 3). Claim C55

the core of the graph, with close connections to communities 2 and 6 (see Figure 5, and below in the text).

asserts that aboard Gateway "astronauts will prepare missions to investigate the lunar South Pole region", which denotes a connection between the ambitions of the next crewed steps with Artemis and the hard, everyday work that astronauts are now doing to be trained for the future missions. This narrative can be said to paint a "Nasa workshop" imaginary, in which the expectations of future missions are anchored to a prospective humanisation of the Moon.

The latter theme might also happen to be interrelated with the actual human endeavour made aboard the "International Space Station" (ISS) an actor having a peculiar location in the graph (Figure 2): it is tied to claim C45 ("Nasa fosters international cooperation"), which, in turn, connects the ISS to the rest of the graph, along with Claim C59 ("Nasa helps research on climate on Earth"). Indeed, the dyad ISS-C59 looks peripheral with respect to the main network, with C59 being associated with half of the 10 actors belonging to the category "Earth and earthly environment" (which includes the actor "Earth" that can be found in the core of the network, besides Moon-related actors and claims). The distance between these nodes and the rest of the network can lead to the following interpretation.

Earthly environment as an actor category does not appeal much to the discursive material with which we are dealing. This discourse seems, instead, more focused on the potential of human and/or technological efforts to reach other planetary surfaces. Further, considering this relational pattern, the ISS appears to be more "earthbound" (Latour, 2017) than other actors in this network (particularly among those of the same type, i.e. "Spacecraft and space facilities").

Both Orion and Gateway are part of community 4, the largest one, which holds a sparser pattern of connections than that of community 2 (Figure 5). Community 4 includes 20 claims, some of which pertain to Gateway, while others seem more explicitly to propose a far-reaching vision of humans in space, as is the case with claim C71 ("Gateway is going to allow Nasa to do many years of scientific study in a place where humans have never worked and lived long-term"), attempting to make the human adventure on the Moon – and subsequently on Mars – much closer to reality but also safe enough for astronauts.

Community 6 – which lies between communities 4 and 2 (Figure 5) – is again centred on the combination of future-oriented and actual/practical concerns, but with a slightly different strategy than the one informing the assemblage of community 4. In community 6, the diversity and equity causes are enrolled (e.g. through actors like "first person of colour", or "first woman")[7]

[7] An edit on this point is required due to the current political situation in the US (as of April 2025), where the Diversity, Equity, and Inclusion (DEI) policy has been banned by President

as well as the technical peculiarities of spacecraft, including Nasa partners like SpaceX.

And what about the actor “Mars”? It follows “Orion Spacecraft” in the degree centrality ranking and it is the third most central as for betweenness centrality (following “lunar South Pole” and “lunar surface”). As an actor, Mars belongs to community 14, in which the technology already used to study the Red Planet is at the core of several claims concerned with Nasa’s Farside Seismic Suite (C11, C12, C15 and C16), a set of instruments that will be employed to obtain seismic data from the Moon, leveraging the technology that enabled the detection of marsquakes. In fact, community 14 is centred mainly on the Moon and lunar geography, with few actors (4 out of 56) concerning Mars and Martian geography, the latter category being, instead, mostly present in community 5, which is more centred on Mars exploration through the Perseverance rover, which provides the wider public with images of the planet – the production of which places visualisation technologies at the core of the social organization of space scientists’ work (Vertesi, 2012).

Therefore, Mars appears to be part of a narrative that foregrounds the enhancement of knowledge about the lunar surface – with an eye to mastering such knowledge for lunar exploration and the possibility of exploiting lunar resources (e.g. oxygen and water) – and the future human landing on the Moon. As an actor, the Red Planet is placed between the two main Moon-related actors (Figure 3), while the knowledge acquired on its characteristics takes place in a peripheral area of the graph (community 5, on the upper-right side).

Trump’s directives in the beginning of his current term (https://www.whitehouse.gov/presidential-actions/2025/01/ending-radical-and-wasteful-government-dei-programs-and-preferencing/, accessed 9 April 2025). Consequently, the claims and actors we included in our analysis that were related to DEI programmes may have disappeared from the content of the agency’s media outlets, accompanying the decision of Nasa to drop «its longstanding public commitment to land the first woman and person of color on the moon» (https://www.theguardian.com/us-news/2025/mar/21/nasa-drops-plan-first-woman-moon, accessed 9 April 2025).

Figure 2. Two-mode networks of claims and actors relevant to Nasa's Artemis programme (March-November 2024), with node sizes proportional to degree centralities (orange and blue nodes represent claims and actors, respectively)

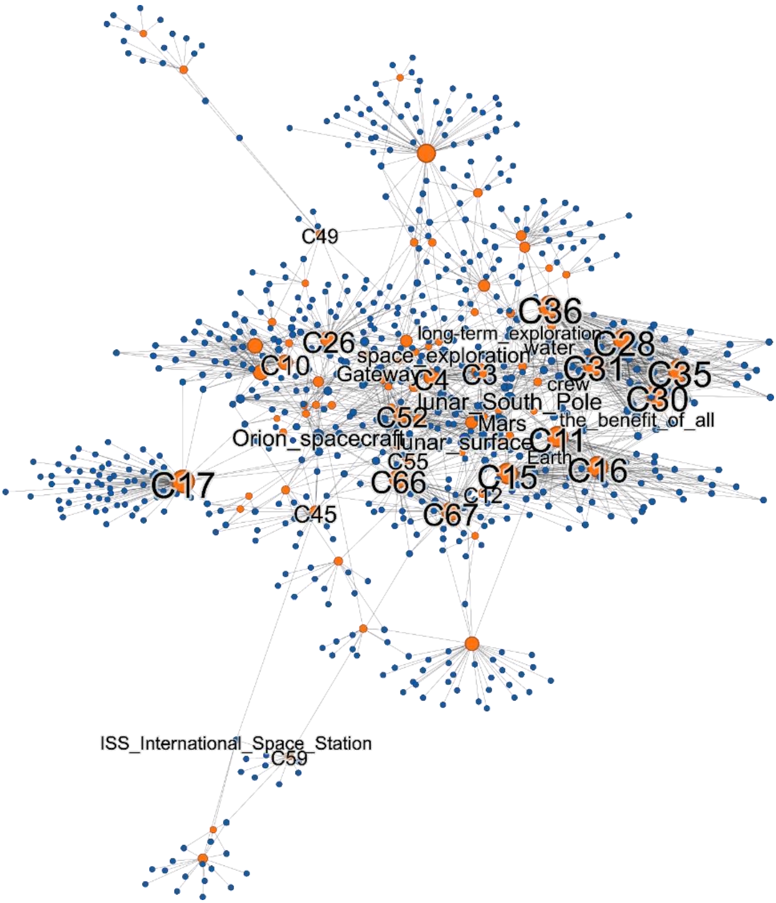


Figure 3. Two-mode networks of claims and actors relevant to Nasa's Artemis programme (March-November 2024), with node sizes proportional to betweenness centralities (orange and blue nodes represent claims and actors, respectively)

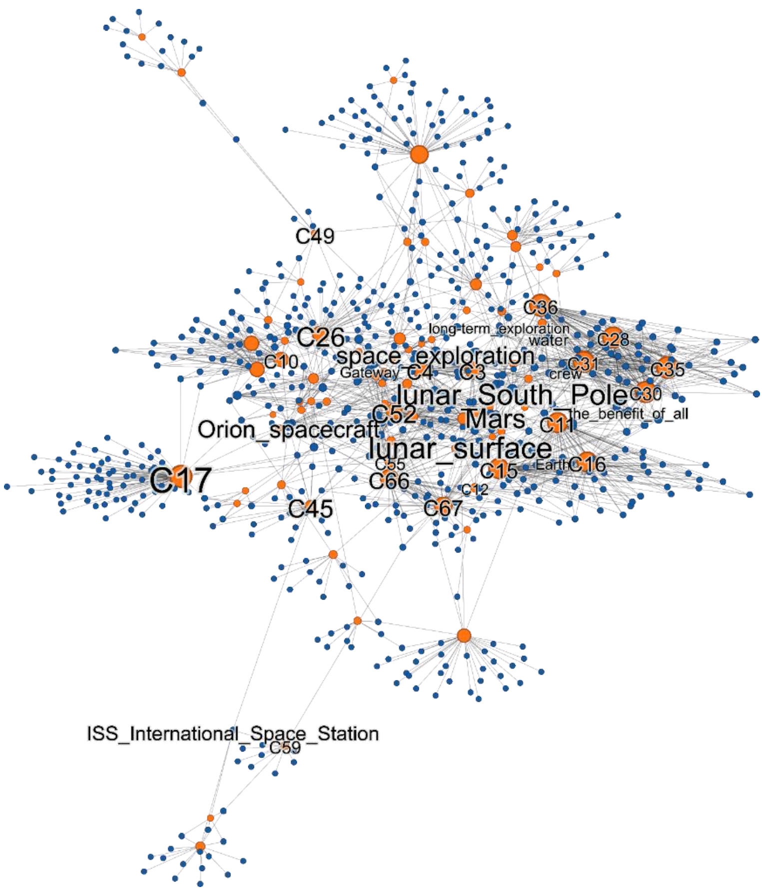


Figure 4. Two-mode networks of claims and actors relevant to Nasa's Artemis programme (March-November 2024), with node sizes proportional to betweenness centralities and colours denoting actor attributes (grey nodes represent claims)

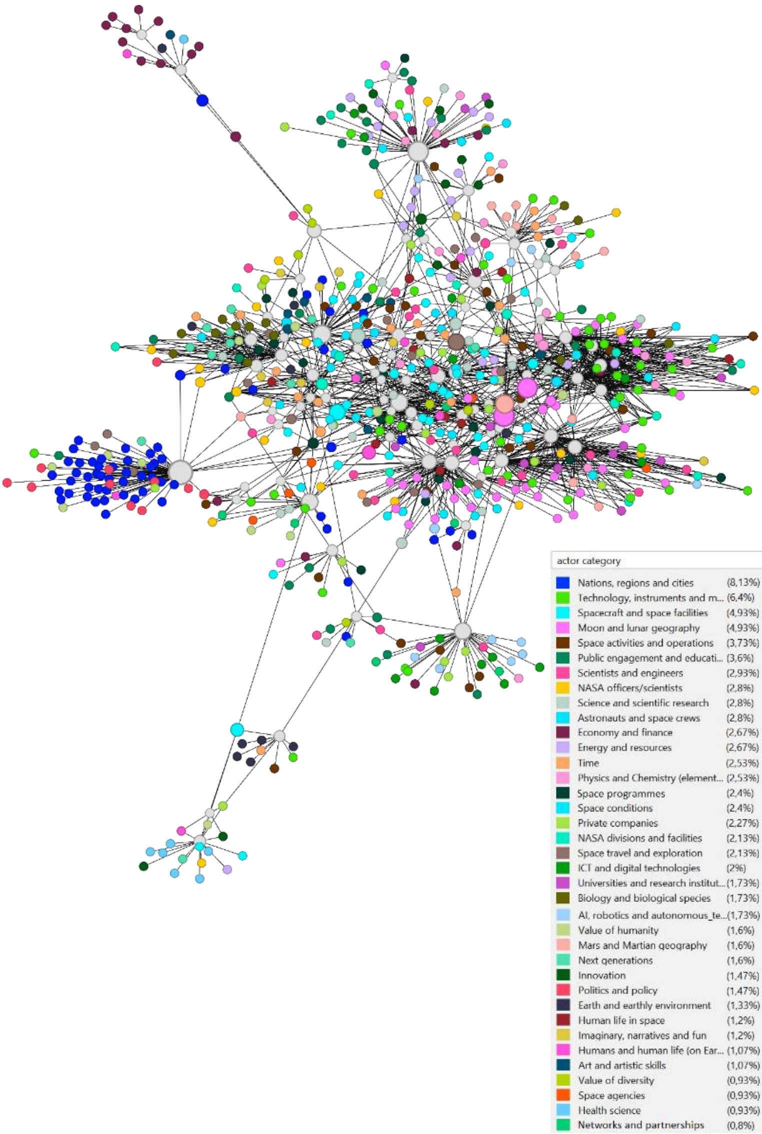
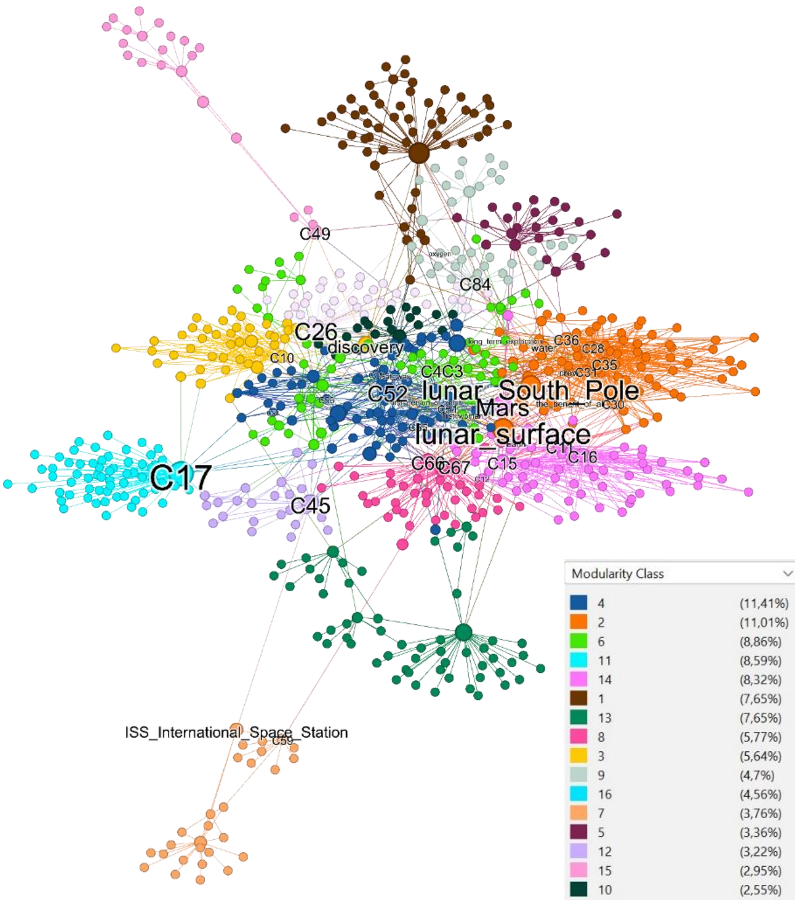


Figure 5. Two-mode networks of claims and actors relevant to Nasa's Artemis programme (March-November 2024), with colours denoting modularity classes



5. DISCUSSION AND CONCLUSIONS

In this article, a study of the sociotechnical imaginaries (Jasanoff and Kim, 2015) pertaining to Nasa's Artemis programme, aimed at landing astronauts on the Moon more than five decades after the end of the Apollo programme, was presented. The focus was on the discursive online spaces run by Nasa to promote the Artemis campaign, relying on the social world framework (Clarke and Star, 2008) and providing a network analysis of the content displayed on webpages and social media channels relevant to the Artemis programme. Such empirical endeavour is based on a mixed-method strategy derived from a methodological protocol devoted to the analysis of scientific knowledge and rooted in Science and Technology Studies (STS). This strategy led us to assemble a network made of knowledge claims and the human and non-human actors discursively enrolled as allies to sustain and legitimise them.

The concept of enrolment is derived from Latour (1987; 2005) and adapted to our context so that we could investigate how the communication about the Artemis programme relies on associations between key ideas about this programme and the plurality of other ideas, concerns, objects, categories of people called upon to foster Nasa's perspective regarding future missions beyond Earth. In so doing, we were able to highlight the epistemic structures relevant to discourse around the Artemis campaign.

The network structure described in the previous section represents the epistemic enrolment space purporting the sociotechnical imaginaries of outer space relevant to Nasa's Artemis programme. The analysis of these structures explored how different actors are discursively engaged in the shaping of these sociotechnical imaginaries. In this section, we discuss these findings and describe expectations and visions of the future proposed as desirable in such imaginaries, together with the forms of life and social order embedded in the scenarios of current and future space missions.

The community structure of the network of claims and actors pertaining to the observed epistemic enrolment space allows us to identify a *multiplicity of sociotechnical imaginaries of outer space* that combine visions of *multi-planetary life* and expectations of *multi-planetary infrastructures* and *hybrid (human and non-human) exploration of outer space*.

One of the main visions promoted in the observed online spaces is that human life in outer space might be a concrete possibility: multi-planetary life is the «grand challenge» (Konrad et al., 2016) that underlies Nasa's Artemis narratives. Humans are not, however, meant to abandon Earth, but rather to expand the frontiers of the territories of human habitation – i.e., the humanisation of space (Dickens and Ormrod, 2007). In the discursive universe with which this work is concerned, the Moon is the first outpost for outer space exploration, the springboard for expeditions to Mars and beyond, namely the *places* where human life will soon be possible (Messeri, 2016).

As the Deputy Associate Administrator for the Exploration Systems Development Mission Directorate at Nasa, Cathy Koerner, says in an interview for the Nasa website in July 2023:

> We're really trying to do [sic] is create a blueprint for exploration beyond Earth. So exploration to any destination in the future, if we do this right, we should be able to say, 'we want to go explore this moon of this planet, or this other planet' [...]. We create a capability. And then, it's the, 'if you build it, they will come' kind of mentality[8].

Multi-planetary life futures are permeated by technological infrastructures spread across our planet, on its surface and orbit, on the Moon (and its orbit), and in outer space more broadly. The Space Launch System (SLS), Orion Spacecraft, Exploration Ground Systems, Gateway, Extravehicular Activity and Human Surface Mobility Program (EHP), and Human Landing System (HLS) are Nasa's Artemis core sub-programmes for human and non-human transportation in space, which will enable exploration activities beyond the Moon and eventually on Mars. This complex sociotechnical architecture draws *multi-planetary infrastructures* that inform the outer space imaginaries of *hybrid (human and non-human) exploration*.

Terrestrial launch bases communicate with lunar bases, where a complex technological architecture connects the paths between Earth and outer space. Through the technological and digital infrastructures that are expected to be built on the Moon, it will be possible to conduct scientific experiments, as well as to obtain resources aimed at supporting human life in outer space, such as oxygen, water, and energy. These infrastructures will be equipped with sophisticated hardware and autonomous technologies. AI, robots and automation technologies have recently entered the imagination of space missions to perform activities that are risky for humans, such as entering the "dark side of the Moon" where automated devices will build pipelines to carry the oxygen that is expected to be found in lunar resources, at the Moon's South Pole (and in collaboration with private companies).

On the lunar surface, robot astronauts are gradually joining human astronauts where «[A]utonomous systems allow spacecraft, rovers, and robots to operate without relying on constant contact with astronauts or mission

[8] Podcast "Houston we have a podcast 14 July 2023" (https://www.nasa.gov/podcasts/houston-we-have-a-podcast/ep-297-moon-to-mars-architecture/), accessed 2 April 2025.

control» (Nasa website, 8 October 2024)[9]. In the sociotechnical imaginaries depicted in the discourse about Nasa's Artemis programme, the future scenarios of a completely automated colonisation of other planets (Campa et al., 2019), made possible by advancements in the use of autonomous technology, would coexist with those of human exploration of space.

As described in the previous section, constructing such infrastructures in multi-planetary imaginaries (Tutton, 2018) requires the enrolment of a large network of partners that participate in the construction of sociotechnical imaginaries of outer space. The analysis of the epistemic enrolment space has shown the role of nations enrolled in the Artemis project through the Artemis Accords – the Multilateral Agreement of International Cooperation of the Artemis Lunar Program. Formally, Artemis and the Artemis Accords in particular claim that space exploration will be of interest to global partners, but the US leadership does not remain in question.

Through coalition building, the Artemis Accords aims to engage other countries in the construction of the sociotechnical imaginaries of outer space thus proposed. Indeed, following Sheila Jasanoff (2015: 4), it can be said that only when Nasa's vision «comes to be communally adopted, however, does it rise to the status of an imaginary». Obviously, this is why the more nations join Artemis, the more credible it becomes as a (global) scientific undertaking. As an entrepreneur (Clarke and Star, 2008) in the online discursive space we have investigated, Nasa enrols many partners in the Artemis venture, including the reference to humanity as a concept on which the principle of communitarianism is based. In other words, for Nasa, *Artemis is humanity's next giant leap, and an international coalition is helping to make it a reality.*

Furthermore, in such discursive spaces, we recognise a latent tension between the Mertonian *ethos* of *universalism* and *communitarianism* (Merton, 1973), invoked by "the benefit of all" to legitimise the Artemis programme, and the involvement of large private corporations in the construction of sociotechnical imaginaries of space missions and in the more general development of the new space economy. This tension is expressed for example in the removal of the extractivist and commercial motivations of the new space economy implicit in the analysed discursive spaces.

According to the first *Handbook on Measuring the Space Economy*, the latter is defined as «the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilising space» (OECD, 2012). Space missions are not only a growing technoscientific sector aimed at expanding knowledge on outer space, but they are also conceived as a vital enabler of

[9] https://www.nasa.gov/directorates/stmd/student-lunar-autonomy-challenge/, accessed 2 April 2025.

growth in the economic sector.

Some analysts believe that the space industry could become the next trillion-dollar industry by 2040; this explains the huge private investment in space ventures attracted by possibilities of development of commercial activities worldwide (such as the ones based on SmallSats/CubeSats) and in fields like micro-launchers and space flights. Nevertheless, notwithstanding its pertinence, the economic dimension of the Artemis mission in the analysed online spaces remains beneath the radar, while the construction of future imaginaries of life in space is mainly called upon with respect to human values. The Artemis programme boasts the distinction of bringing the first woman and the first man of colour to the Moon, making the narratives on "Diversity, Equity, and Inclusion" (DEI) one of the pillars on which the epistemic enrolment space aimed at legitimising space missions is built – at least during the period of our observation (see below).

Nevertheless, *humanity* in these discursive spaces appears as a neutral and abstract concept, which does not clarify which actors will concretely benefit from the future "enclosures" (Polanyi, 1944) and the exploitation of extraterrestrial territories, which, notwithstanding Donald Trump's 2020 statements claiming the right to use extraterrestrial space[10], still constitute *global commons according to the 1967 United Nations Outer Space Treaty*. Finally, it should be noted that the web-ethnography conducted for this study covered the period preceding Donald Trump's victory in the 2024 presidential election. One of the initial actions undertaken under this mandate was the removal of the DEI policies in scientific programmes (see above, footnote 7). Consequently, in recent months, a rapid transformation of the argumentative frames that Nasa mobilises to legitimise its actions and sociotechnical imaginaries has been observed. The focus and analysis of these transformations may be the subject of future research.

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[10] https://trumpwhitehouse.archives.gov/presidential-actions/executive-order-encouraging-international-support-recovery-use-space-resources/.

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APPENDIX: DATA TABLES

Table 1 Online spaces related to Nasa's Artemis programme

Online space name
Nasa (website)
Nasa Artemis
Nasa Mars
Nasa Moon
Nasa Technology
Nasa's Gateway Program
Nasa's Orion Spacecraft
Nasa's Gateway
Nasa's Gateway Program
Nasa's Johnson Space Center
Nasa's Marshall Space Flight Center
Nasa's Space Launch System

*Except for the Nasa website, all spaces are denoted by the name of the relevant Facebook page

Table 2. Actor categories

Actor category	%
Nations, regions and cities	9.17
Technology, instruments and machinery	7.22
Spacecraft and space facilities	5.56
Moon and lunar geography	5.56
Space activities and operations	4.21
Public engagement and education	4.06
Scientists and engineers	3.31
Science and scientific research	3.16
Astronauts and space crews	3.16
Nasa officers/scientists	3.16
Time	2.86
Energy and resources	3.01
Economy and finance	3.01
Physics and Chemistry (elements and concepts)	2.86
Space programs	2.71
Space conditions	2.71
Private companies	2.56
Space travel and exploration	2.41
Nasa divisions and facilities	2.41
ICT and digital technologies	2.11
Biology and biological species	1.95
Next generations	1.80
Mars and Martian geography	1.80
Universities and research institutions	1.80
Value of humanity	1.80
AI, robotics and autonomous technologies	1.65
Politics and policy	1.65
Innovation	1.65
Earth and earthly environment	1.50
Human life in space	1.35
Imaginary, art, narratives	1.35
Art and artistic skills	1.20
Humans and human life (on Earth)	1.20
Space agencies	1.05
Value of diversity	1.05
Health science	1.05
Networks and partnerships	0.90

Table 3 Claim codes and description

Claim Code	Claim
C1	Caitlyn Durham a role model of women who make difference at Nasa
C2	The launch director Charlie Blackwell-Thompson thanks JoAnn Morgan for being a role model for women in Nasa
C3	Artemis IV astronauts will be the first to live and work aboard a lunar-orbiting space station
C4	Nasa and its partners are working to explore our Moon safely
C5	Industry partners make possible the Space Launch System
C6	The Artemis campaign includes increasingly complex missions
C7	A new era of Moon trees will one day stand tall in communities across America
C8	Nasa is bringing the spirit of exploration back down to Earth
C9	Seeds that journeyed during Artemis I were germinated and grown into seedlings and are now ready to be planted
C10	Space belongs to everyone
C11	Nasa Farside Seismic Suite will gather the agency's first seismic data from the Moon in nearly 50 years
C12	Nasa's Farside Seismic Suite (FSS) will answer a lingering question about fewer moonquakes on the far side of the Moon
C15	The technology behind the two seismometers that make up Nasa's Farside Seismic Suite was used to detect more than a thousand Red Planet quakes
C16	Nasa's Farside Seismic Suite, the most sensitive instrument ever built to measure quakes on other worlds is getting closer to its journey to the Moon
C17	Armenia has joined 42 other nations that have committed into Artemis Accords
C18	1,000 tiles protect the Orion Spacecraft from the heat of re-entry from the Moon
C19	Nasa has celebrated the 55th anniversary of Apollo11
C20	Nasa has transported the core stage of Nasa's Space Launch System to Nasa's Kennedy Space Center for the Artemis II mission
C21	Nasa scientists have designed the route for Perseverance to ensure that it goes to areas with the potential for interesting scientific samples

Claim Code	Claim
C22	Now it's time to look to the future
C23	Nasa's Perseverance Mars Rover has found a rock that could be one of the signs of ancient microbial life that may have once existed on the Red Planet
C24	Nasa school projects involve students in testing flight simulators on the lunar surface
C25	The Perseverance Mars Rover is beginning its 5th science campaign
C26	Nasa's Johnson Space Center has selected the defining moments of space exploration
C27	On Aug. 21, the first piece of hardware manufactured at Nasa's Marshall Space Flight Center for Nasa's SLS (Space Launch System) rocket that will launch a crewed Artemis mission was moved for shipment
C28	A new set of Nasa science experiments and technology demonstrations will arrive at the lunar South Pole in 2027
C29	Commercial Lunar Payload Services initiative will help Nasa conduct science and continue working toward a long-term human presence on the Moon
C30	Moon's permanently shadowed regions could help reveal the origin of water throughout our solar system
C31	Nasa Awards Intuitive Machines Lunar South Pole Research Delivery
C32	Nasa will explore more of the Moon than ever before
C33	The instruments on flights developed by Commercial Lunar Payload Services could advance our exploration efforts on the Moon and help us with continued exploration of Mars
C34	The instruments on flights developed by Commercial Lunar Payload Services will help us achieve multiple scientific objectives and understand the Moon's environment
C35	New Nasa science and technology instruments will be heading to the Moon in 2027
C36	The Moon's South Pole is a challenging but scientifically interesting site
C37	A pressurized rover will enable astronauts to travel farther and conduct science in geographically diverse areas
C38	Breakthrough power transmission and energy storage technologies developed in the Watts on the Moon Challenge could

Claim Code	Claim
	advance the nation's lunar exploration goals
C40	Collaborations provide opportunities for Nasa and other countries to work together to integrate and fly technology and experiments as part of Artemis
C41	Nasa is increasing access to space for the international community and enabling its partners to expand scientific and technological knowledge
C42	Power transmission and energy storage technologies developed in the Watts on the Moon Challenge could have implications for improving power systems on Earth
C43	Power transmission and energy storage technologies developed in the Watts on the Moon Challenge seek to improve our ability to explore and make discoveries in space
C44	The energy solutions developed by Watts on the Moon Challenge support Nasa's recently ranked civil space shortfalls
C45	Nasa fosters international cooperation
C46	Nasa is working to fly satellites that will study the effect of the space environment on electrical components
C47	High-fidelity virtual simulations allow Nasa to anticipate and improve how systems, both software and hardware, will function in the physical world
C48	To embark on long-duration missions on the Moon with Nasa's Artemis programme, we're going to need cutting edge software that can accomplish pre-defined tasks without help from humans
C49	Nasa will land the first woman and first person of colour on the Moon
C51	Gateway is a safe and functional artifact for Nasa's Artemis crews
C52	Gateway will be humanity's first space station around the Moon
C53	Gateway will chart a path for the first human missions to Mars
C54	Gateway will return humans to the Moon
C55	In the Gateway space station astronauts will prepare missions to investigate the lunar South Pole region
C56	Teams from Nasa and Esa tested a mock-up for the Gateway lunar space station
C57	Artemis II astronauts put Orion to the test

Claim Code	Claim
C58	The Nasa's Artemis II crew recently practiced opening and closing an Orion crew module side hatch to ensure they can safely enter and exit the spacecraft in the event of an emergency
C59	Nasa helps research on climate on Earth
C60	Nasa invests in cutting-edge technologies to help maintain America's competitive advantage
C61	Nasa space inventions will find practical uses on Earth
C62	Nasa strengthens the US economy
C63	Nasa's Moon to Mars endeavours generated economic output and jobs
C64	Research in space helps improve health on Earth
C65	Nasa missions inspire future generations
C66	Artemis will return humanity to the Moon
C67	Nasa is working to define the possible places on the Moon's surface where Artemis III astronauts could land
C68	Artemis II will be the first mission to send humans to the Moon since 1972
C69	Artemis III will be the first landing in the lunar South Pole region
C70	Artemis IV mission in 2028 will be the first lunar mission to include an orbiting space station
C71	Gateway is going to allow Nasa to do many years of scientific study in a place where humans have never worked and lived long-term
C72	Gateway is set to advance science in deep space, bringing groundbreaking research opportunities to lunar orbit
C73	Gateway sounds so science fiction, but it's real
C74	Gateway will return humans to the Moon
C75	Halo will host science experiments to understand how to protect astronauts and hardware during deep space travels to places like Mars
C76	In a few years Gateway is going to be around the Moon
C77	Nasa is building Gateway for a 15-year lifespan or more
C78	An exciting new era of space exploration is coming

Claim Code	Claim
C79	Artemis campaign will pave the way for the first crewed mission to Mars
C80	Gateway will support a new era of lunar exploration and deep space discovery
C81	Gateway will support human spaceflight
C82	Gateway's first two modules will launch to lunar orbit ahead of Artemis IV
C83	The lunar space station will serve as a central hub where crew spacecraft and supply modules dock and prepare for missions to the Moon's surface.
C84	Researchers are working to enable human life on the Moon

Table 4. Degree centrality (descriptive statistics)

	Degree centrality	
	Claims	Actors
Mean	21,6	2,6
Median	11	2
Mode	6	1
St. dev.	20,6	2,6
Min	4	1
Max	71	23
N	80	665

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SOCIAL RESEARCH IN THE METAVERSE
Innovations, implications and ethical challenges

*by Salvatore Monaco**

Abstract

This article contributes to the academic debate on the Metaverse as both an object and a tool of social research, analyzing its potential, critical aspects, and the broader transformations it introduces into the discipline. In particular, the paper examines the new sociological questions emerging from the spread of the Metaverse, considering its implications for social structures, identity construction, and collective behavior. The paper then explores its applications in social research. This includes an analysis of how the Metaverse can enhance research methodologies by enabling the simulation of social phenomena, real-time manipulation of variables, and novel forms of data collection. The article also highlights significant challenges, particularly concerning accessibility, external validity, and the ethical dilemmas of conducting research in a digital space where identity, privacy, and informed consent take on new and complex dimensions. Given the Metaverse's evolving nature, it is crucial to examine how social research can navigate the balance amongst technological innovation, inclusivity, and ethical responsibility, ensuring that these emerging digital environments function as equitable, transparent, and scientifically rigorous spaces for social research.

Keywords

Metaverse, digital sociology, social research, methodology, web 3.0

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1. INTRODUCTION

In recent decades, the digital landscape has undergone an unprecedented transformation, driven in part by the proliferation of advanced technologies such as Artificial Intelligence (AI), blockchain, and, more recently, the Metaverse. These technologies have fostered the development of a decentralized digital ecosystem characterized by interactive environments that challenge traditional conceptions of physical and digital reality (Gadekallu et al., 2023). In particular, the Metaverse is gaining increasing attention in contemporary society for its ability to offer users immersive three-dimensional experiences, accessible through devices such as headsets.

According to Ball (2022), the Metaverse can be conceived as a network of interconnected and persistent digital worlds that allow users to share experiences. These virtual environments range from realistic to highly stylized and imaginative, combining elements traceable to the physical world with novel digital simulations (Riva and Wiederhold, 2022). Augmented reality plays a crucial role in this context by overlaying digital objects and information onto what is seen and perceived, thus creating "hybrid" experiences that integrate physical and virtual dimensions (Brown and Drakeley, 2023).

In this ever-evolving scenario, new horizons are emerging for theoretical and methodological reflection in the field of social research. The Metaverse not only introduces novel sociological questions concerning identity, interaction, and social structures in digital environments but it also has methodological implications that encourage a reconsideration of certain research protocols. As it becomes increasingly integrated into social and economic structures, it is necessary to examine how it may transform traditional approaches to social research, offering advantages in terms of data collection, experimental possibilities, and interactive methodologies. At the same time, its role in facilitating the study of social behaviors and interactions needs to be analyzed in relation to the challenges it presents, particularly concerning methodological rigor, data validity, and the risks of bias introduced by the specific nature of digital environments. Furthermore, conducting research in a space where personal identity, privacy, and informed consent take on new and complex dimensions raises significant ethical concerns that also require careful consideration.

This article aims to contribute to the academic debate on the Metaverse as both an object and a new space for social research by analyzing its potential, critical aspects, and the broader transformations it introduces into the discipline. The paper is structured into several sections that focus on key themes related to the use of the Metaverse in social research. The first part provides an overview of the Metaverse, highlighting its role as a key component of Web 3.0 and its interaction with other emerging technologies. The discussion then focuses on the new sociological questions raised by the spread of the Metaverse. Following this, the applications of the Metaverse in social research are examined, with an analysis of its advantages for both quantitative and qualitative studies and the complexities it introduces. The challenges associated with its use are then discussed, with particular attention to issues related to data collection, validity, and potential biases. Finally, the ethical implications of managing personal data in virtual environments are explored, alongside a reflection on the future prospects of using the Metaverse as an environment for social research.

2. THE METAVERSE

The concept of the "Metaverse" is not entirely new. Although the term has gained widespread popularity in recent years, its foundations can be traced back to early virtual worlds that sought to create immersive digital environments. One of the most notable precursors was *Second Life*, launched in the early 2000s as an online platform where users could develop their digital identities within a persistent, user-generated world (Messinger et al., 2009). While *Second Life* did not fully realize the vision of a seamlessly interconnected Metaverse, it introduced key principles that continue to shape contemporary developments, such as social immersion, virtual economies, and digital self-representation. The early solutions laid the groundwork for what has now become a more complex, technologically advanced, and economically viable digital ecosystem. Unlike the earlier virtual worlds, which largely operated as self-contained experiences, today's Metaverse is envisioned as an expansive and interoperable network of platforms, where virtual and physical realities converge through technological advancements.

Over the years, the technological infrastructure supporting digital environments has evolved significantly, driven by multiple factors. A crucial turning point in this development was the Covid-19 pandemic, which accelerated the adoption of digital spaces as alternatives to in-person interactions. The necessity to overcome restrictions on travel and physical gatherings spurred a surge in demand for more immersive and interactive online experiences (Anderson and Rainie, 2022; Monaco, 2021). During this period, virtual reality (VR), augmented reality (AR), and spatial computing technologies saw increased investment, as businesses, educational institutions, and social groups sought new ways to replicate physical interactions in digital spaces. The pandemic thus acted as a catalyst, highlighting both the potential and the limitations of existing virtual platforms and prompting renewed interest in the development of a fully functional Metaverse.

At the same time, major technology companies—including *Google*, *Microsoft*, and *Nvidia*—have invested heavily in the development of Metaverse-related technologies. In particular, *Meta*, which rebranded from *Facebook* in 2021 to reflect its strategic focus on immersive digital environments, has played a central role in this transformation. Beyond its flagship social media platform, *Meta* encompasses a broader ecosystem, including *Instagram*, *WhatsApp*, *Messenger*, and *Oculus*, positioning itself at the forefront of Metaverse development. The company has dedicated significant resources to developing VR and AR devices, such as the *Meta Quest* series, and has introduced virtual collaboration tools like *Horizon Workrooms*, designed to facilitate remote work in virtual environments. Other major players, such as *Apple* and *Tencent*, have also entered the race to shape the future of the Metaverse, each bringing distinct technological innovations and business models to the evolving landscape (Mosco, 2023).

These investments reflect a broader shift in consumer behavior, where digital engagement increasingly transcends traditional boundaries among goods, services, and social interactions.

Some gaming platforms, such as *Fortnite* and *Roblox*, have also played a crucial role in making the Metaverse more accessible and familiar to a broad audience (Yoo et al., 2023; Yu, 2022). Online games, initially developed as entertainment environments, quickly became social spaces where players began to interact, work, and even participate in virtual concerts and events. For example, in 2020, *Fortnite* hosted a virtual concert by rapper Travis Scott, attracting millions of viewers and demonstrating the platform's potential to engage a large audience beyond the "real world" (Korsgaard and Jirsa, 2023). Over time, the use of avatars and participation in immersive virtual environments have been normalized, paving the way for the broader adoption of the Metaverse as a space where people not only play but also spend a significant part of their digital lives.

For instance, the Metaverse is also opening new possibilities in education and skills development. Some educational institutions are beginning to experiment with its use to create immersive learning environments, where students can engage in realistic and interactive simulations. In doing so, learners can literally "immerse" themselves in content and interact with educational materials (Beck et al., 2023; Dahan et al., 2022).

The Metaverse also has impacts on the economy. Users can engage in various virtual activities that enable real-world earnings. Jobs range from designing virtual spaces and creating digital products to organizing events and managing online businesses (Park & Kim, 2022). Notably, several fashion brands are already experimenting with selling "digital clothing" that users can purchase for their avatars, suggesting that the Metaverse could become an integral part of future marketing and commerce strategies (Dionisio et al., 2013). One of the most evident developments in the economic field is the virtual real estate market. Similarly to the physical space, virtual structures in the Metaverse—such as land or buildings—are bought and sold. Demand for properties in virtual areas considered prestigious—due to high user traffic—has driven up prices, reflecting dynamics similar to those of the traditional real estate market (Singla et al., 2024; Yang, 2024). Moreover, through blockchain technology, users can own and exchange digital assets such as Non-Fungible Tokens (NFTs), ensuring the uniqueness and ownership of these items within the virtual world (Edwards, 2022). Nonetheless, this new economy also raises ethical and social justice issues. Since many economic activities in the Metaverse remain unregulated, workers and consumers may find themselves without adequate protections, exposed to uncertain working conditions or not entirely transparent transactions (De Stefano, 2016).

Beyond its economic implications, the Metaverse has also brought about significant socio-cultural changes. Like other platforms—such as social networks—the Metaverse allows people to connect and interact with others, overcoming geographical and physical limitations. However, unlike traditional forms of online interaction, which rely primarily on textual or verbal communication, the social experiences offered by the Metaverse appear richer and more participatory. The use of avatars and the existence of virtual environments enhance the sense of presence and immersion in interactions (Oh et al., 2023). This has the potential to strengthen virtual social networks and create new forms of sociality, belonging, and community with unique characteristics (Wang et al., 2022).

3. BETWEEN RECONCEPTUALIZATIONS AND NEW SOCIOLOGICAL QUESTIONS

The evolution of the Metaverse is prompting sociology to expand its horizons, directing social research toward emerging phenomena. In particular, the Metaverse offers a unique opportunity to investigate new issues, such as the relationship amongst technology, identity, and social relationships. More specifically, the interactive experience through customizable avatars provides a space for experimentation and self-representation, challenging traditional sociological conceptions of identity. Avatars, unbound by the actual characteristics of the user, allow for the creation of alternative versions of oneself, introducing a new dynamic to the relationship between real and digital identity. This possibility invites sociology to study how individuals construct their self-image in digital contexts, focusing on the motivations behind aesthetic and behavioral choices. In this regard, one of the key questions might concern the level of disconnection or overlap between the identities expressed in the physical world and those present in the Metaverse. The adoption of an avatar that does not reflect the user's real characteristics—such as gender, ethnicity, or social status—opens new research perspectives on the motivations behind these decisions. Avatar customization could reflect a form of emancipation from the real world, enabling individuals to overcome perceived limitations or, conversely, could represent conformity to dominant social and cultural norms within the Metaverse.

Similarly, empirical research could clarify how and to what extent the identity dynamics that develop in the Metaverse influence behaviors and actions in the real world. Some studies (Lee and Kim, 2023; Manfredi and Gabbiadini, 2023) have highlighted that various individuals tend to conform to the roles and expectations tied to the avatars they create, even after the virtual experience. This phenomenon, known as "Proteus," is suggesting that digital identities can influence individuals' actions and decisions.

Sociological research could also focus on the construction of communities and intra- and inter-group relationships. Digital environments facilitate the creation of social networks that transcend geographic and cultural boundaries, allowing users to connect based on shared interests rather than territorial constraints (Bibri, 2022). The experience of "virtual presence," where users perceive themselves as genuinely situated in a shared space with others, can impact the sense of community and solidarity. Thus, it becomes sociologically relevant to analyze how these phenomena influence behaviors and attitudes in the physical world, as well as to examine whether virtual interactions foster more inclusive communities or, conversely, reinforce existing divisions.

The potential for forming virtual communities also brings forth complex dynamics of inclusion and exclusion. While the Metaverse provides opportunities for greater connectivity and participation, it may simultaneously generate new forms of inequality or replicate and even amplify existing power hierarchies from the physical world. This raises fundamental sociological and ethical questions about access, representation, and governance in virtual spaces. As platforms within the Metaverse are often controlled by private corporations or decentralized organizations, issues of decision-making power, rule enforcement, and digital governance become central to analyzing the social order in these environments. Social research must critically examine who establishes the norms and regulations within virtual communities, what mechanisms regulate power relations, and how control is exercised over user behavior (Coeckelbergh, 2020; Turner, 2023). Analyzing these aspects requires a transdisciplinary perspective, integrating insights from political science, philosophy, law, and technology studies to assess how digital governance frameworks shape virtual interactions and whether they reinforce or challenge existing social and economic inequalities.

Furthermore, as the Metaverse evolves, it is crucial to consider the ethical and political implications of algorithmic governance and automated decision-making in these spaces. Algorithms play an increasing role in moderating content, filtering interactions, and enforcing community standards, raising concerns about transparency, bias, and accountability. The reliance on AI-driven governance within virtual communities prompts important questions regarding who designs these systems, what ethical frameworks guide their implementation, and how algorithmic power may shape user experiences and reinforce social stratification. The intersection between AI ethics and digital sociology becomes particularly relevant in studying how these automated governance structures impact democratic participation, freedom of expression, and collective agency in the Metaverse.

In an environment where interactions are mediated by avatars and the boundaries between real and digital identities are often blurred, deviant behavior can take on new and complex forms. Acts of cyberbullying, virtual fraud, and other manifestations of digital deviance may proliferate in spaces where social norms and sanctions remain fluid and not yet well-defined. The governance of social behavior within the Metaverse thus becomes a critical area of study, requiring interdisciplinary contributions from sociology, criminology, digital ethics, and law. Addressing the challenge of regulating digital spaces while preserving the principles of fairness, inclusivity, and individual rights demands the development of novel frameworks for social control that balance user autonomy with the need for security and community well-being (Wu et al., 2023).

The concept of "gig work" also requires specific attention from sociology, as it contributes to a redefinition of consumption, labor, and production. Far from being exclusively a space for pure entertainment, the Metaverse appears as a context where the boundary between work and consumption is highly fluid. Participants in this ecosystem are not only workers but also users who actively contribute to the creation of economic value (Levytska, 2024). This scenario opens new avenues of investigation into consumer behavior and the perceived value of virtual goods compared to physical ones. In particular, the sociology of consumption could analyze how the desires and motivations that drive users to purchase virtual goods differ from or reflect the dynamics of traditional consumption. The growing trend of investing real money in virtual goods and properties raises fundamental questions about the nature of value and economic dynamics within the Metaverse. New forms of digital consumption could also influence social hierarchies, creating new forms of distinction based on the possession of prestigious virtual goods or access to exclusive spaces within the Metaverse. Moreover, the concentration of ownership of production and distribution means in the hands of a few major tech companies represents a new form of digital capitalism, in which platforms exercise near-total control over economic dynamics (Zhang, 2023). On the one hand, the Metaverse appears to offer opportunities for greater individual control over one's work. On the other hand, dependence on digital platforms to access these markets can result in a new form of subordination. Furthermore, according to some authors (Andrejevic, 2022; Doctorow, 2020), work in the Metaverse can be seen as a way for platforms to learn behavioral patterns and develop new business models, exposing users to the risk of being unknowingly commodified. Within this framework, sociology is called upon to analyze how forms of economic control influence power relations between workers and platforms.

Another area of sociological interest concerns the precariousness of work in the Metaverse, amplified by the absence of contracts, lack of access to social benefits, and variable earnings conditions often tied to market fluctuations and demand for virtual services. Additionally, access to resources and work opportunities in the Metaverse is not distributed equitably. Platforms that dominate the Metaverse can establish economic conditions that favor only certain segments of the population. For instance, access to advanced content creation tools or participation in high-level virtual markets may be limited by economic or technical barriers, excluding large segments of potential workers. This could lead to a new form of digital social stratification, where only people with the necessary resources can benefit from new economic opportunities (Esen et al., 2023).

Consequently, there is a need for a critical and contemporary reinterpretation of some central concepts in the sociological reflection on labor, such as precariousness, autonomy, worker protection, and alienation.

Finally, an area of research could focus on the consequences of Metaverse abuse on people's lives and well-being. For instance, the use of mobile devices often requires maintaining the same posture for extended periods, which can lead to issues such as "Text Neck Syndrome" (Neupane et al., 2017). This is a postural disorder caused by the continuous downward tilting of the neck to look at a screen, leading to tension and pain in the cervical area and shoulders, often accompanied by eye strain and headaches. The widespread use of the Metaverse could amplify such effects, given the time spent within immersive virtual activities. Moreover, highly engaging experiences in the Metaverse may result in overstimulation, hindering the relaxation necessary for proper rest. This can interfere with normal circadian rhythms, compromise sleep, and contribute to sleep deprivation. The blue light emitted by digital device screens, which reduces melatonin production, may further aggravate this issue, making it even more difficult for users to relax and fall asleep after prolonged sessions.

Beyond sleep-related effects, active participation in the Metaverse is often accompanied by real-life sedentary behavior, as opportunities for movement and physical activity are limited (Bale et al., 2022). This behavior, associated with prolonged Metaverse use, can lead to related health problems, such as being overweight and other metabolic complications. It is therefore crucial for social research to focus on developing strategies to raise awareness among users about the importance of taking regular breaks and integrating physical activities during online sessions, thus balancing immobility with moments of exercise and physical well-being.

Some studies have also already highlighted how prolonged use of the Metaverse can also impact individuals' interpersonal skills (Belk, 2024; Yasuda, 2024). Interaction through avatars, mediated by digital representations, can limit the development of face-to-face communication skills, reducing individuals' ability to pick up on non-verbal cues, facial expressions, and body language. Reduced real-world interaction practice may result in a loss of essential relational skills, with potential negative effects on interpersonal and professional relationships in the physical world. Another relevant phenomenon is the tendency of some individuals to prioritize interactions in the Metaverse at the expense of meaningful connections with friends, family, or colleagues, reducing their sense of belonging and social participation. Digital isolation could be particularly problematic for people already experiencing marginalization or social difficulties in the physical world, as they may see the Metaverse as a sort of refuge. Sociology can play a crucial role in studying these phenomena, analyzing how prolonged interaction in the Metaverse influences social dynamics and individual identities. Researchers could investigate how the virtual nature of the Metaverse impacts individuals' relational capacities, also examining the dynamics of dependency that may arise. Based on empirical evidence, researchers could contribute to the development of intervention strategies aimed at promoting a more mindful use of the Metaverse. This might include raising awareness about the importance of maintaining a balance between virtual and real life, reinforcing the necessity of actively participating in community life, and building meaningful relationships.

4. Conducting Social Research in the Metaverse

Conducting social research in the Metaverse opens up a range of unprecedented possibilities, allowing researchers to overcome some of the practical and logistical barriers encountered in the real world while introducing new challenges that the scientific community must critically address. One of the primary advantages is the reduction of costs and time. Traditional social research often requires significant resources to cover expenses such as renting facilities for in-person interactions, travel and accommodation costs for participants and researchers, and other logistical expenses. In the Metaverse, these needs are significantly reduced or eliminated altogether. Researchers do not need to rent rooms, laboratories or organize travel, and logistical constraints become less restrictive since interactions occur within a single virtual environment. This ease of access broadens the possibility of involving participants from different geographic areas, regardless of their location, and facilitates the inclusion of individuals with mobility impairments. As a result, the Metaverse appears particularly useful for research requiring large and diverse samples, promoting inclusivity in ways that traditional settings often fail to achieve (Zallio and Clarkson, 2022). Nevertheless, access to the technologies necessary to use the Metaverse remains uneven, potentially reinforcing existing digital inequalities. Economic and geographic factors may limit participation, leading to the exclusion of some segments of the population, such as individuals with low incomes or those living in areas with insufficient internet infrastructure. In social research, this digital divide raises concerns about sample heterogeneity, as studies conducted exclusively within the Metaverse might not accurately reflect broader social realities (Monaco and Sacchi, 2023).

Compared to traditional methods of data collection, such as face-to-face or videoconferencing-based interviews, interactions in the Metaverse can offer a greater sense of presence, reducing the perceived distance between researchers and participants. The ability to use customized avatars allows subjects to represent themselves in ways that may enhance comfort and openness, making them feel more at ease during interviews or focus groups (Osborne and Jones, 2022). Additionally, interacting with a virtual environment while responding to research questions fosters a level of engagement that would be difficult to replicate in other settings (Rzeszewski et al., 2024). However, despite its immersive nature, the Metaverse remains an artificial environment that, in some cases, may influence user responses and challenge the validity of findings when applied to real-world contexts. The degree of detachment from physical reality, combined with the digitally constructed nature of interactions, may lead participants to adopt behaviors that differ from those they would exhibit in offline settings. Additionally, the Metaverse offers a high degree of freedom in avatar customization, allowing users to shape their digital identities in ways that may not necessarily reflect their real-world characteristics. This flexibility in self-representation can significantly impact behavior, interactions, and self-perception, introducing additional layers of complexity in the analysis of data. Researchers must carefully account for these factors, considering how digital identity construction influences social dynamics and the potential discrepancies between online and offline data.

The Metaverse can also serve as a fully digital laboratory for conducting experiments, offering researchers the ability to manipulate independent variables, isolate subjects from unwanted external influences, and replicate studies under controlled conditions to verify the validity of results. In contrast to the traditional laboratory settings, which are often constrained by logistical, financial, or ethical considerations, virtual environments provide unparalleled flexibility in designing and executing social experiments according to the specific needs of a research project. For instance, researchers can create digital settings that simulate economic crises, environmental disasters, or the introduction of technological innovations. Unlike traditional surveys or role-playing exercises, where participants must rely on imagination to envision such situations, the Metaverse enables the direct experience of these scenarios, potentially yielding richer and more ecologically valid data. The ability to modify environmental factors instantaneously, introduce controlled stimuli, and analyze behavioral responses in real time significantly expands the scope of experimental possibilities within social research. Another significant advantage of conducting experimental research in the Metaverse is the possibility to create and manage control groups with greater efficiency than in traditional experiments. Within virtual environments, participants can be randomly assigned to different experimental conditions, reducing selection biases and ensuring a more balanced distribution of variables. Researchers can systematically monitor environmental and behavioral factors with high precision, facilitating the collection of accurate and reliable data. This level of control enhances the ability to isolate causal relationships by minimizing external interferences that often compromise real-world experiments. Despite these advantages, conducting experimental research in the Metaverse is not without challenges. One major concern is external validity—whether behaviors observed in virtual environments accurately reflect those in the physical world. Additionally, awareness of being part of an experiment may introduce reactivity effects, where participants alter their responses due to the experimental setting. Ethical concerns also emerge when designing experiments in the Metaverse. The ability to manipulate digital environments and create controlled scenarios raises new dilemmas, particularly in studies that simulate extreme social conditions or expose participants to distressing situations. While the virtual nature of the Metaverse may provide a safeguard against physical harm, the emotional effects of digital experiences must still be carefully considered. Ensuring that participants are fully aware of the nature of the experiments, the risks involved, and their right to withdraw at any time remains a fundamental responsibility for researchers.

Beyond experimental research, the Metaverse offers significant opportunities for qualitative research, particularly netnography—or digital ethnography—a technique that studies interactions and social dynamics within online communities (Kozinets, 2006). The Metaverse represents an ideal environment for netnographic research, allowing scholars to observe interactions among avatars in real time while directly participating in the digital life of virtual communities. The "illusion of place" (Slater and Wilbur, 2009), which enables users to perceive virtual environments as tangible and immersive, creates a research setting where social behaviors and interactions unfold in a manner that closely resembles real-world experiences. This phenomenon allows researchers to study emergent forms of sociality, cultural expression, and collective identity formation within digital spaces in ways that traditional online ethnography may not fully capture. However, the disconnection between real and virtual identities may lead to a form of "digital disinhibition," where users feel freer to act in ways that do not necessarily align with their real-world attitudes or social norms. In some cases, this can foster deeper self-expression and engagement, allowing individuals to explore identities they may suppress in the physical world. Yet, it can also lead to the adoption of exaggerated or performative behaviors that complicate data analysis. The fluid nature of digital identity and the potential for anonymity require researchers to critically assess how avatars mediate self-presentation and interaction, taking into account the extent to which virtual behaviors reflect or deviate from offline identities. Furthermore, ethical concerns regarding informed consent and data privacy must be addressed, as users may not always be aware that their interactions are being studied, particularly in publicly accessible virtual spaces.

The Metaverse also expands possibilities for autoethnography, a technique in which researchers do not only observe but actively engage in the virtual worlds they study (Wood and Solomon, 2014). Through their avatars, researchers can immerse themselves in the digital environments they want to study, experiencing firsthand the social dynamics, norms, and interactions that shape virtual communities. By directly participating in the Metaverse, researchers can gain a deeper knowledge of the affective and embodied dimensions of virtual engagement, including the ways in which users form attachments to their avatars, establish relationships, and negotiate power structures within digital spaces. In this context methodological reflexivity is essential, as the researcher's own immersion within the Metaverse may influence findings, necessitating transparency in documenting their positionality and subjective experiences. Unlike traditional ethnographic settings, where the researcher's presence is physically visible and interactions occur in real-time, the Metaverse introduces additional layers of mediation that can shape both the researcher's engagement and the behaviors of those being studied. The risk of becoming too integrated within the virtual community must be carefully managed to maintain a critical distance while still achieving meaningful immersion. Moreover, ethical considerations surrounding researcher participation and disclosure remain complex, particularly in environments where the boundaries between public and private interactions are ambiguous. In this kind of research the governance and regulation of virtual environments present further challenges. Unlike traditional research settings, where ethical oversight is well-established through institutional review boards (IRBs) and ethical committees, the decentralized and corporate-controlled nature of many Metaverse platforms raises questions about who should regulate these research practices. Many virtual worlds are managed by private entities that set their own terms of service, determining how user data is collected, stored, and shared (Floridi, 2014). This raises concerns about whether researchers must seek platform-specific permissions to conduct studies, how to ensure user anonymity in digital spaces that track behavioral data, and how intellectual property laws apply to user-generated content in the Metaverse (Hennin, 2012; Molina and Borgatti, 2021). These governance issues necessitate new ethical frameworks that account for the complexities of researching within corporate-owned virtual spaces while ensuring that fundamental ethical principles—such as respect for privacy, consent, and data protection—are upheld.

A final consideration for social researchers in both qualitative and quantitative studies is the absence of sensory experiences such as touch and smell. While auditory and visual aspects of immersive environments tend to be highly realistic, the lack of other sensory inputs may lead to an incomplete analysis of the phenomena under social analysis. This limitation could influence user interactions and engagement, as sensory deprivation in virtual spaces might affect emotional responses, decision-making processes, and the authenticity of social behaviors. Researchers should account for these constraints when designing studies in the Metaverse, considering how the absence of certain stimuli may impact participants' experiences and the overall validity of findings.

5. CONCLUSIONS

The Metaverse presents itself as a new frontier for social research, offering opportunities to study emerging phenomena related to digitalization and mediated interaction, as well as a unique environment within which to conduct studies and research.

On one hand, the Metaverse represents a new object of study for sociology, tasked with examining phenomena related to identity construction and self-representation. Avatars, which serve as the primary means of interaction, provide individuals with the ability to construct profiles that do not necessarily reflect their real-world characteristics. The choices users make regarding appearance, behavior, and social interactions offer a rich source of data for researchers interested in analyzing how people negotiate their identities in virtual contexts. Studies could also focus on how digital representations reflect or challenge stereotypes related to gender, ethnicity, or socioeconomic status, including their intersections.

From this analytical perspective, the Metaverse also offers an opportunity to study phenomena of "digital disinhibition," where individuals may feel less constrained by real-world social norms. These dynamics deserve particular sociological attention as they can reveal new facets of human behavior, impacting interpersonal relationships and power dynamics.

Moreover, social research must also address problematic behaviors related to excessive use of the Metaverse - such as addiction to virtual environments - raising questions about how people balance their digital lives with their real-world existence. Sociology will need to investigate the psychosocial implications of excessive platform use, including phenomena of isolation and alienation from the physical world, and how these experiences affect individual and collective well-being.

On the other hand, the immersive characteristics of the Metaverse make it an innovative space where researchers can create controlled and customized environments to study complex social dynamics. One of its greatest strengths lies in the ability to use a kind of virtual laboratory, where sociologists can manipulate variables and observe changes in real time. The ability to simulate complex social phenomena in highly customized virtual environments allows researchers to study group dynamics, cooperation, conflicts, and leadership with a level of control that would be impossible in the physical world. Additionally, the use of avatars and the physical distance between researchers and participants reduces the risk of influencing responses and behaviors, thereby improving the quality of collected data and information, with the added benefit of reducing the time and costs associated with traditional research. Another potential of the Metaverse is its ability to facilitate large-scale cross-cultural studies. Shared virtual environments can be used to compare the behavior of participants from different parts of the world, overcoming geographical and cultural barriers.

Despite its advantages, the Metaverse presents several challenges that researchers must carefully consider. First and foremost, the issue of accessibility remains central. Not everyone has access to the technologies required to participate in studies and research conducted in the Metaverse, which can lead to a partial and non-diverse representation of participants. Individuals living in areas with poor connectivity or those lacking the financial means to acquire the necessary technologies may be excluded or underrepresented in these studies. Another critical aspect concerns the ethical dimension. The Metaverse enables the collection of an enormous amount of information, including biometric data, which must be handled with the utmost care to prevent violations or misuse. It is therefore essential for researchers to develop rigorous ethical guidelines to ensure the protection of users' privacy. A further concern involves the external validity of studies conducted in the Metaverse. Although virtual environments allow for precise manipulation of variables, the realism of simulations may not accurately reflect real-world dynamics. Interactions in the Metaverse, mediated by avatars, do not fully replicate the nonverbal cues, facial expressions, and tactile dynamics that characterize physical interactions. This limitation could undermine the ability to generalize findings from the Metaverse to the real world.

Such limitations can be partially addressed through appropriate strategies. Specifically, to improve external validity, one approach could involve combining research conducted in the Metaverse with field studies or real-world collection of data, allowing for comparisons between findings in different settings. Another strategy could be to view the Metaverse as a kind of "preliminary laboratory," useful for testing hypotheses and developing scenarios that can later be validated in physical contexts. This hybrid approach could help enhance the robustness of results.

In light of the discussion, it is clear that the Metaverse offers significant potential for social research but fully leveraging it requires a methodologically sound approach. In particular, researchers will need to continue developing tools and strategies to address challenges related to accessibility, external validity, and data protection. Beyond methodological considerations, conducting research in the Metaverse also demands a set of technical and analytical skills that extend beyond traditional social research methodologies. Social researchers must become proficient in navigating virtual environments, designing and managing digital interactions, and utilizing immersive technologies to structure their studies effectively. Moreover, familiarity with data analytics, AI-driven research tools, and blockchain-based systems may become increasingly relevant for handling large datasets, verifying digital identities, and ensuring the security of research processes. Given the interactive and decentralized nature of the Metaverse, researchers will also need to develop competencies in algorithmic literacy. Ethical considerations remain paramount, requiring researchers to acquire expertise in privacy protection, and the management of algorithmic biases that may influence user experiences and data collection. Ultimately, the integration of classical research methodologies with emerging digital tools will be essential for ensuring the rigor, reliability, and ethical integrity of research conducted in the Metaverse. Social researchers must not only adapt their theoretical and methodological frameworks but also cultivate collaborations with other scientists to fully harness the opportunities of this evolving digital landscape. The future of research in the Metaverse necessitates both an interdisciplinary and transdisciplinary approach, as the complexity of virtual environments requires expertise that transcends traditional disciplinary boundaries. Collaboration between sociologists and experts in fields such as artificial intelligence, cybersecurity, human-computer interaction, and law will be essential not only for the development of innovative tools and technologies that enhance the research process but also for ensuring ethical, secure, and inclusive research practices.

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LIBRI IN DISCUSSIONE

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BOOK REVIEW

Angela Delli Paoli
LA NETNOGRAFIA NELLA RICERCA SOCIALE
Roma, Franco Angeli, 2025, pp. 152

Valentina D'Auria[*]

Angela Delli Paoli's *La netnografia nella ricerca sociale* is both a timely and necessary theoretical-methodological contribution within the rapidly evolving field of digital studies. Published in the series "Strumenti per le scienze umane" by FrancoAngeli, the book addresses a significant gap in the literature, offering a critical reflection on epistemological, methodological, and ethical issues which, while present in the current discourse on qualitative research in digital contexts, are not always examined with sufficient depth.

As stated in the introductory chapter, the book has multiple aims: to explore how the digital environment impacts ethnographic practice; to analyse the way netnography challenges and reconfigures the assumptions of traditional

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ethnography; and to provide practical guidance to preserve the qualitative nature of the method against the risks of excessive datafication. The volume is structured into ten chapters, leading the reader through the full design of a netnographic study: from its ethnographic roots and the implications of digitalisation for the social sciences, to the operational, analytical, and ethical issues that arise in fieldwork. It opens by addressing the epistemological foundations of netnography (Chapter 1), framing it in relation to Marradi's (2007) distinction between "standard" and "non-standard" approaches, which roughly correspond to quantitative and qualitative paradigms. From the outset, Delli Paoli argues that netnography should follow a qualitative path: one that privileges ideographic focus, inductive reasoning, and holistic interpretation. This triad (attention to particularity, interpretative openness, and striving toward totality) acts as a compass for the book.

Chapters 2 through 4 revisit the origins and development of ethnography, from positivist evolutionary models to the interpretive turn led by Geertz (1973). Special emphasis is placed on the concept of *thick description* and its textual translation into the digital context. Chapter 4 distinguishes between digital ethnography and netnography, the latter defined by Delli Paoli as «a prolonged, and more or less participatory, observation of digital communities and cultures, aimed at producing a deep interpretation and description» (p.11). This definition, though methodologically distinct, echoes the systematisation offered by Kozinets (2015).

From this perspective, the book adopts a holistic stance, in which culture is conceived as a complex system not reducible to discrete elements. The focus is not on individual variables, but rather on the web of meanings that connects practices, representations, and social relations. This interpretive orientation, inspired by Geertz's anthropological legacy, is reframed in light of digital environments and provides the conceptual backdrop for the entire volume.

Among the most significant issues raised early in the book is the transformation of identity as an object of observation. While classical ethnography dealt with physically situated bodies and recognisable subjects within observable communities, netnography engages with dematerialised, distributed, and often fragmented identities. This does not imply a loss of reality, however. As Delli Paoli explains, «regardless of their correspondence to actual persons, representations possess their own reality and constitute the core of netnographic attention» (p. 45). The digital self, even when strategic, manipulated, or fictitious, generates meaningful social and symbolic effects, which must be read within the semiotic and relational context that gives them form.

The main epistemological risks posed by digitalisation include the opacity of information, the illusion of immediacy, the spread of fake or automated identities, and the ambiguity between identity and its representation. In this context, the distinction between factual fidelity and conformity proves especially useful in questioning how digital traces are used and in avoiding naive interpretations.

For Delli Paoli, the digital is not just a new field of inquiry but a different mode of expressing, negotiating, and performing identity. Hence, the need for a netnography that can read these texts in depth. Rather than objectifying the digital, the book emphasises the textual nature of its artefacts and the centrality of interpretive work: «in digital contexts, the self exists as text» (p. 45).

This same perspective reinforces the centrality of meaning: digital traces are not mere data, but narratives—often contradictory, ambiguous, or fragmented - that must be reconstructed in relation to their original context and the symbolic dynamics that shape them.

From Chapter 5 onward, the book engages with the practical design of netnographic research, discussing its main components and operational phases: the specificity of digital fields (Chapter 5), observation strategies (Chapter 6), data collection techniques (Chapter 7), and analytical procedures (Chapter 8). Each chapter includes examples from both Italian and international literature, chosen as useful tools for researchers, whether novice or experienced. Notably, the book does not aim to be a traditional methodological manual, but rather a guide to complexity. This is reflected in the discussion of the digital field as something constructed rather than merely discovered, defined less by geographical coordinates than by trajectories of meaning and symbolic relations. The author expands on the proposals by Rogers (2013) and Airoldi (2018), distinguishing between meta-fields and contextualised fields, and proposing strategies such as *follow the medium*, *follow the object*, and *follow the people* as ways to navigate them. These are not just sampling techniques, but epistemological decisions that shape the research process and its meaning.

The holistic character of the approach emerges precisely through this capacity to embrace the complexity of the field without reducing it to discrete units. In netnographic terms, the digital field is not a platform but a narrative environment where content, interaction, and relations intertwine in a dense network of meaning. The focus of the study is thus not only on what is said, but also on how it is said, to whom, in what context, and with what implications. This multi-level attention enables a dense description of the field, consistent with both the anthropological heritage of ethnography and the phenomenological approach of Schutz (1979).

Another relevant element is the book's ongoing reflection on the researcher's positionality. Access to the field, choices about observation methods (ranging from *lurking* to simulated participation), as well as the collection of digital traces and online interviews, all demand a high degree of reflexivity. Far from being merely technical aspects, these decisions raise epistemological and ethical questions. They interrogate the relationship between subject and object, the asymmetry between observer and observed, and the risk of naturalising what is, in fact, a socially and technologically mediated interaction.

The book adopts a critical stance against technicist or computational approaches to qualitative research. Netnography, in this view, is not just a technique but an interpretive practice. As noted in Chapter 8, netnography is inherently multi-method, requiring continuous circularity between data collection, analysis, and interpretation. These are not sequential phases, but interdependent moments in a single knowledge-making process (Glaser and Strauss, 1967). Coding cycles, the creation of analytical categories, typology-building, and the reflective use of classification tools all become devices for organising field experience without flattening its complexity. Here, interpretation is not the final step, but a constitutive act of knowledge, embedded from the outset in the observational practice.

Finally, Chapter 9 explores the ethical dimension of netnographic research. Ethics is not presented as an afterthought or a concluding matter, but as a transversal concern embedded in the entire methodological framework of netnography. Rather than being a list of rules to apply after the fact, ethics is framed as an ever-present dimension throughout the research process.

One of the most compelling aspects of this discussion is the challenge it poses to the traditional dichotomy between public and private, especially in light of online identity practices. Digital platforms do not merely reproduce offline boundaries; they constantly redefine them. What is visible is not necessarily accessible; what is shared is not always meant for a general public. This makes it difficult to rely on traditional ethical criteria, such as the assumption that anything public is automatically fair game for research.

Delli Paoli argues that the digital realm «requires us to rethink and re-code established principles» (p. 127). These include informed consent, anonymity, and the assessment of exposure risk for those observed. Digital information is often ambiguous: it may appear public but be experienced as private; it may be accessible yet not intended for archiving or research purposes.

This leads to a strong emphasis on the researcher's responsibility. It is not just a matter of complying with institutional norms, but of developing an ethical reflexivity that informs every step of the research process. The author refers to a genuine "ethics of digital observation", one that moves beyond quantitative frameworks to confront the ambiguities of online presence.

From this perspective, every access choice, every data collection method, and every representational strategy has consequences. Epistemic responsibility is not limited to the proper use of data, but also includes an awareness that to observe is to intervene - that even observation alone can produce social, relational, or symbolic effects.

In conclusion, the book opens a broader reflection on the future of netnography as a constantly evolving approach. Delli Paoli writes that «netnography today is a continuously re-elaborated approach, able to adapt to the changes in digital practices» (p. 9). This flexibility is both an operational strength and an epistemological feature: it means reading digital contexts without reducing them to rigid frameworks. Netnography, in this sense, does not merely observe; it interrogates, deconstructs, and interprets. As the author suggests, it can be seen as a "torch" capable of illuminating emerging phenomena and reframing established problems in light of digital transformations (p. 139).

This methodological openness also allows netnography to engage with new and controversial domains, such as interactions between human beings and artificial intelligence systems. In these hybrid spaces, where people attribute agency and intentionality to algorithmic entities, a netnographic perspective can offer critical tools to analyse how meaning is constructed, stabilised, or transformed.

Therefore, the book's conclusion is not a closure, but an invitation to further exploration. In a time when qualitative research risks being reduced to automated data collection, this book stands as a powerful and necessary call for researcher responsibility, not only for what we observe, but for how we choose to observe.

Ultimately, this is a book that was needed: one that restores depth and meaning to qualitative research in the digital age, without nostalgia and simplifications.

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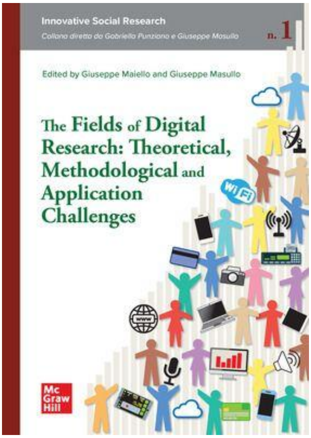
BOOK REVIEW

Giuseppe Masullo, Giuseppe Maiello
THE FIELDS OF DIGITAL RESEARCH: TOPICS AND DEVELOPMENTS. IN THE FIELDS OF DIGITAL RESEARCH: THEORETICAL, METHODOLOGICAL AND APPLICATION CHALLENGES.
Milano, McGraw Hill educational, 2024, 384 p.

by *Stefano Cesare*[*]



The advent of Web 5.0, characterized by the growing influence of artificial intelligence (AI), has led to an increasing recognition of the importance of digital technologies in understanding culture, society, and the human experience. Today, the vast amounts of data generated by the interaction between users and digital devices have taken on great importance namely. Everything we do online becomes data: every authorization, transaction, access, or piece of information we read constitutes valuable data about our profiles. The ubiquitous presence of digital technologies in people's lives has raised the question of whether there is need to adopt a new paradigm in the social sciences – known as digital turn, which is based on algorithms and computers (Stefanizzi, 2021). In this context, the book The Fields of Digital Research: Theoretical, Methodological and Application Challenges highlights how emerging

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technologies have transformed research in certain fields, forcing researchers to update their methods and approaches. The text explores the challenges sociologists face when conducting research in digital society, emphasizing two main research directions: one concerns real-world phenomena that can be better analyzed online, while the other pertains to phenomena that originate and develop within the digital field. At first, efforts were made to adapt traditional methods to the digital world, but over time it became clear that the digital space offers its own unique potential to be leveraged. In this context, the current debate points out that digital data are different from traditional data and raise theoretical, methodological, and ethical issues. Digital methods are a major innovation in social research, but to be effective, they require both technical skills and solid theoretical foundations. Although they are more recent and innovative, they cannot fully replace traditional methods, which are backed by a long and established theoretical and methodological experience. As Caliandro and Gandini (2019) point out, it is important to remember that digital technologies may not always be appropriate for studying certain social phenomena in the most complete and exhaustive way. Thus, the book emphasizes the importance of developing critical, transdisciplinary, and intersectional approaches in digital social research, encouraging researchers to understand and integrate the ways in which digital technologies are conceived and studied in other disciplines and beyond the academic sphere. The book mentioned before consists of 19 chapters, divided into five parts that correspond to specific study topics. The first part, entitled "New theoretical and methodological challenges for the study of digital", analyzes and explores key themes in the discussion, including digital citizenship, the concepts of space and time, and the influence of algorithms, among others. The first chapter by Attinà and Izzo delves into the concept of digital citizenship, emphasizing its connection with the idea of a desirable digital age. This perspective places individuals in a state of perpetual development, situated between the online paradigm and its imminent transition into the offline world. Therefore, it is essential for the authors to establish solid ontological principles and statutes that can adapt and functioning as influential factors in a digital society. The authors thus reflect on the issue of citizenship and digital citizenship, and whether these terms can be interpreted through an educational lens. The mistake we might make is to consider digital citizenship as equivalent to televoting or mere participation, when in reality these are only aspects and not the whole picture. As Jenkins (2006) notes in this contribution, regarding the concept of "convergence" between old and new media, we are witnessing the birth of a new participatory culture, in which mastering technological tools ensures the basic conditions for the exercise of citizenship in today's society. Subsequently, Piemysl Pisar analyzes a case study related to the field of advertising marketing. In a world where digital is increasingly present in everyday life, the online advertising industry is also growing rapidly, especially following the COVID-19 pandemic. As Taylor (2020) argues, the ways in which advertising is conceived have changed, and companies are also required to rethink and reinvent their advertising approaches, moving toward new forms of digital marketing. Through a study conducted on 270,250 online advertisements, it emerged that the performance of online advertising particularly programmatic advertising is highly optimized. The study was composed of two parts. In the first phase, the sample was analyzed using statistical models; subsequently, the knowledge acquired during the first phase was useful for developing a financial control model, tested on as many as 31 advertisers. The ultimate goal was to improve the effectiveness of online advertising by developing "a financial control model" that has the potential to enhance online advertising performance and mitigate costs. The test revealed that advertisers do not use tools to implement online advertising performance, but with this financial control model, the performance of online advertising increased. In the following study, Felaco and Pelliccia used a methodology that integrates principal component analysis and cluster analysis to establish distinct user profiles related to their knowledge of the TikTok algorithm, as well as their positions on content moderation mechanisms and Algospeak. In a world where algorithms represent a fundamental part of the Internet and daily life, they have influenced the condition of information presentation and consumption, as well as participation in public life (Gillespie, 2020).

The starting question was: "What are the users' experiences and assumptions regarding Algospeak and automated content moderation systems, particularly concerning their knowledge of how the TikTok recommendation algorithm works?". Their perspective allows them to help in rejecting a certain perception of algorithms, instead emphasizing the users' ability to challenge the "shadow ban." In the fifth study, Punziano conducts research to investigate the involvement of scientists in public and institutional communication. The study focuses on the strategic models and topics employed by experts during Vaccine Day amid the COVID-19 pandemic, aiming to clarify the challenges faced by public communication. As Rogers argues, the choice of tools for extracting, organizing, and constructing analysis represents a delicate moment in digital methods (Rogers, 2013); for this reason, the media intelligence platform Volocom was used for digitizing information which, together with a Python script, enabled the transcription of TV broadcasts aired on major Italian channels. The initial goal was to explore who the visible experts on TV were and the different related representations during the vaccination campaign; among these, a strong male predominance among the experts emerged, along with a differentiation in the representation of experts across the various TV channels. The sixth study, written by Lenzi et al., is the last of the first section; the study's main focus is urban vitality in the neighbourhoods of Rome. Urban vitality is a concept that represents and describes the liveliness, energy, and dynamism of urban areas. To study it, various approaches exist, differing both in tools and operational definitions. In addition to classic social research tools, such as questionnaires, the use of Big Data also emerges (Niu and Silva, 2021), which include social media data. Regarding the initial objective of understanding urban vitality in Rome, the data obtained are promising, although with some limitations. For example, high-vitality areas often coincide with attractive structures such as monuments, bars, or shopping centers, or some areas show vitality throughout the day, while others (such as universities) only at certain times of day.

The second section, entitled "Identity and the Construction of Meaning in the Digital", focuses on the impact of digital technologies on social and cultural identification processes. Through the exploration of digital spaces, the investigation centres on how these spaces can serve as platforms for individuals to express themselves and engage in new social interactions. This section pays particular attention to younger generations, who are the primary beneficiaries of online services. The first contribution by Martino and Villano offers a revaluation of the relationship between identity development, adolescence, and digital technology from a critical-pedagogical and media archaeology point of view. When thinking about digital media, they should not be perceived as simple tools, but rather as the result of human action. McLuhan said that the medium is the message; here, the separation between humans and media requires resolution. Studies on the digital, approached from various perspectives for over a decade, converge on one point: the recognition of the primary role of new media in the processes of subjective identity construction. The focus is on social networks, interpreted as sets of procedural interactions and informational structures that replace traditional ones and determine new forms of individual socialization, triggering a mechanism that transforms the urgency to exist in the world into the obligation to be connected and to participate through appearance (Boccia Artieri, et al. 2017). Adolescents today face self-construction processes that are deeply influenced by constant exposure to digital media and the blurring of the boundary between real and virtual. These transformed experiences can generate new educational needs, which is why a media education is proposed one that integrates existing approaches with greater attention to adolescent phenomenology and the aesthetic dimension of the digital experience. An education that stimulates critical thinking and promotes practical awareness of the ongoing intertwining between real and virtual. Also in this section, we can find the work developed by Coppola, Capuano, and Nufria, which highlights the complex and contradictory nature of young people's relationship with religion. In particular, in recent years, the percentage of people identifying as atheists has grown significantly. To analyze this phenomenon, the research is structured around three questions: the first is “What are the main motivations that lead one to identify as an atheist?”, the second “What attitudes do atheists show towards other religions?”, and the last “Is it possible to identify a typology among the atheists participating in the community?”

The research used the technique of netnography, a term coined by Robert Kozinets, who used it as a tool to analyze discussions among Star Trek fans. Through the analysis of 235 posts published in the Italian community “Ateismo e Agnosticismo Realistico” on Facebook. The community in question presents a high level of interaction, with a mainly male and adult composition, and low youth participation. It is hypothesized that Facebook, being a less attractive tool for the younger generations, is no longer the preferred medium for youth, who also appear to be less interested in religious topics.

The third section, titled “Inclusion and New Methodological Challenges in the Digital”, examines how resources provided by the digital society contribute to the inclusion of people with disabilities. These resources create online spaces where this group can learn, develop, express themselves, and interact with others. Moreover, it explores the challenges faced by this group in the offline society, which remains limited and non-inclusive. Battisti and Dalvit thus provide an analysis of disability and the resulting inequalities in South Africa. Their study examines the various methodological obstacles that arise when conducting research on platforms and social self-representations of individuals with disabilities in a multicultural, post-colonial, and highly unequal context. By anonymously formulating research questions through the exploration of each social media platform, the authors used a “cross-platform” perspective to critically consider the South African context and delve into self-representations. In this South African context, it emerged that the accessibility issues of these platforms are exacerbated by some of the highest connection costs in the world, consequently making them unaffordable for a large portion of people with disabilities. In addition, the constant production of content, graphic editing, and video post-production are key to online visibility, which implies a significant commitment for a creator with disabilities. In the second study of the third section, we can find the contribution of Masullo, who, together with colleagues, adopts a digital ethnographic approach to examine the primary social representations of parents who are part of a community committed to addressing the challenges faced by children diagnosed with developmental autism. The essay refers to children suffering from specific learning disorders, which are disorders based on neurobiological dysfunctions that interfere with the normal process of acquiring reading, writing, and arithmetic skills, differing depending on the impaired abilities. The essay highlights the challenges that parents face in accepting this condition, particularly within the school context. It also explores different approaches to addressing this issue, which can be categorized into two main dimensions: benevolent enabling and parental responsibility. The research made it possible to analyze and interpret the opinions and perceptions of a Facebook group of mothers with children with learning disorders, allowing the identification of both the reasons why they access online communities and four types of parental profiles. It is important to clarify that the research results are limited to the examined community. It seems that the motivations driving these mothers to join online communities are linked, on the one hand, to the search for ways to improve their child's school/social path and, on the other, to the need for support and comfort. In this sense, cyberspace becomes a place for discussion and release aimed at identifying the best possible advice for facing personal difficulties. The third section concludes with the contribution of Antonelli, who examines the relationship between school inclusion and information and communication technologies (ICT). Antonelli adopts a mixed-methods approach to analyze the inclusion tactics used by three major Italian institutions. The analysis highlights the potential barrier to the inclusion of people with disabilities in the university context. Universities still represent one of the main spaces of social life, contributing, as institutions, to breaking down the material and immaterial barriers that exclude certain categories of students. As Chiang (2020) argues, they play a key role both in the implementation of services and in the recognition of a culture of disability, emphasizing the following aspects: providing a safe and welcoming space, spreading positive aspects of disability, educating the university community and beyond not to discriminate against people with disabilities. Following the pandemic, the country's digitalization has accelerated - just like in the rest of the world which invites reflection on the power of blended learning, while being careful not to consider it as the solution to every problem, since its overuse could lead to a reversal of perspective. The fourth section, titled "Movements, Deviance, and Processes of Online Discrimination", includes essays that clarify the dual nature of digital platforms. On one hand, digital platforms provide a space for emancipation and the emergence of new forms of social engagement, such as environmental activism. In this section, we can find the contribution by Ambrosio et al., who delve into the phenomenon of environmental activism in Italy. They focus on the impact of digital technologies on activists' approaches to promoting change, analyzing the distinctions and connections between online and offline activism. The report offers a comprehensive examination of the current state of activism in Italy, also shedding light on the constraints and opportunities offered using digital resources. The essay emphasizes the difficulty today in distinguishing between online and offline life, stating the challenges in identifying differences in online and offline actions based on specific characteristics. Furthermore, regarding the relationship between sociodemographic characteristics, types of activism, and the perception of social media, the data suggest that men tend to show greater participation in offline activities compared to women. When comparing European data with studies conducted in Italy, these reveal a gender gap in political participation, with men participating more in institutional and party activities, while women participate significantly less than men (Caputo, Felaco, Monaco, 2019). In the following study, Caroleo and collaborators highlight a negative aspect of digital technology specifically, its role in enabling the spread of hate speech directed at individuals belonging to the LGBT community. Online hate speech, along with cyberbullying, has become a significant issue in many countries, with the potential to harm individuals, social cohesion, and democracy. These sensitive topics are at the centre of public and social debates seeking ways to contain the phenomenon on social media. The researchers conducted an analysis of interactions between users on digital platforms such as TikTok and Instagram. Using digital methods, they created a list of queries that could be considered offensive according to the LGBTQ+ community. Nowadays, online platforms have implemented policies and tools to combat the use of offensive language. With the help of both automated and human moderators, online content is continuously monitored to determine what can remain and what must be removed. However, these countermeasures do not always prove effective. In fact, the study shows that there are many different ways to bypass content moderation, such as not including hashtags in posts, making it difficult to trace these posts. These posts can only be flagged by users to be reviewed by moderators.

Also in this section, we can find the contribution of Padricelli, who presents a reflection on models of online participation and new forms of action in the digital landscape within the context of social movements. The research delves into a case study related to the No Tav movement, an Italian network that since the 1990s has opposed the construction of the high-speed railway line between Turin and Lyon. Through empirical results from interviews with the initiative's promoters, the study sheds light on the processes related to new temporary forms of participation and innovative communicative repertoires for collective action. In the logic of the Internet, the digital expressions of social movements have redefined the forms of knowledge sharing necessary for the development of struggles, supported by collective identities both at symbolic and organizational levels (Pilati, 2018).

In the final study of the section, Michelangelo and Pascali demonstrate the convergence of criminality within the digital landscape. The advent of digital technologies has provided criminal organizations with a favourable environment for expanding their operations online, leveraging their strategic approach. The authors state that researchers may face new obstacles related to ethics, deontology, and civil law when attempting to improve research procedures to effectively investigate deviant events. Indeed, the problem arises from the fact that cybercrime does not seem to have simple and direct definitions. It would be difficult to assume that a distinct criminal order could emerge from this phenomenon, whose boundaries are hard to define. Such an order would differ from other criminal acts not only due to the use of certain material techniques in the perpetration of crimes, but also, and above all, due to its coherence and consistency in relation to both the objectivity and subjectivity it comprises. The articles collected in the final section, titled "Lifestyles and Choices in the Digital Age", highlight how digital technologies influence decisions related to lifestyles, consumption, and other significant aspects of everyday life. In recent years, academic interest in this area has grown, with numerous studies showing how the social environment and digital resources are key in shaping choices related to leisure. In particular, there has been a proliferation of virtual communities and thematic forums, often linked to major search engines, which play an increasingly central role in the selection of hospitality structures. These phenomena have helped to redefine the concept of tourism, especially in relation to the postmodern debate, which values experiential tourism as a key element in individual self-determination paths. The first essay in this section is by Capone and collaborators, who analyze the potential of digital ethnography through an in-depth examination of an online community. The study focuses specifically on a Facebook group in the redefinition of the concept of pilgrimage, taking the Camino de Santiago de Compostela—one of the most important pilgrimages in the world as a case study. The research begins with a preliminary analysis of an online community about the Camino de Santiago, where a significant number of users interact to share their pilgrimage/travel experiences. The research then unfolds in two phases: in the first phase, historical and cultural aspects of the Camino phenomenon that contributed to its fame were analyzed, along with a review of the sociological literature concerning pilgrimage and travel. In the second phase, a digital ethnography was conducted, highlighting the main collective representations developed around the Camino, as well as the subjective reasons that group members provide to clarify their idea of travel, which refers to the need to live a deep and enriching experience. The research shows how Facebook proves to be a true social space where meanings related to spirituality and travel are built and shared, contributing to a better understanding of the motivations behind the choice to undertake the Camino and the importance of online communities in supporting and sharing this experience. Indeed, there are testimonies from people who have already undertaken this journey, encouraging others to overcome their fears and embark on this unique experience. The analysis also shows that the group conversations offer a valuable opportunity, especially for women, to re-evaluate themselves in response to early challenges posed by prevailing stereotypes about pilgrims. Following this, we can find work by Bellafronte et al, who focus on analyzing digital reviews from the TripAdvisor platform. The study centres on the examination of destinations, itineraries, and traveller profiles, starting from a widely used digital product: online reviews. Through contextual analysis, it was possible to situate the phenomenon of saltworks tourism in time and space. From this, a trend was reconstructed, revealing an interesting cyclical pattern, with a progressive decline in the following years. By comparing this result with data from the UNWTO (United Nations World Tourism Organization), this evolution was interpreted as part of a global trend in tourism, which is also reflected in the reality of the world and the Italian saltworks. The main findings show that this emerging form of tourism is closely linked to new dynamics of mobility and the growing influx of travellers. In the concluding contribution, Caputo and collaborators return to focus on digital tourism experiences, paying particular attention to a feature introduced by Airbnb during the COVID-19 pandemic. This feature involved offering digital experiences tied to specific locations, aimed at users unable to travel physically but still eager to explore the world and gain new knowledge remotely. The study begins with the hypothesis that there is a relationship between users' geographic location and the location of the digital experiences they choose. To verify this, the authors combine a content analysis of reviews with a digital ethnography, aiming to identify the factors guiding user choices and to outline meaningful spatial clusters. In conclusion, the research group sought to offer a comprehensive overview of digital research practices, focusing on areas where the impact of emerging technologies is particularly significant. This required a rethinking of methodologies, pushing researchers to adopt innovative epistemological, technical, and operational approaches. In all the studies analyzed, it clearly emerges how crucial it is to possess both technical skills and solid theoretical foundations in order to effectively use digital methods in sociological investigation. These tools undoubtedly represent a significant evolution for social research. However, despite their innovative and creative nature, it is essential to apply them with the same methodological rigor as traditional methods, which, although less advanced from a technological standpoint, have a long history of scientific validation and consolidation. Being relatively new, digital methods are still in the process of building the systematized knowledge base that will allow them to fully mature over time.

"The Fields of Digital Research: Theoretical, Methodological and Application Challenges", contributes to the debate about the implications of the complex interactions between digital technology, social research and social life. The different papers collected in this issue look both at *epistemic concerns* related to the nature of digital data and *normative concerns* related to the consequences of digital social research. On the *epistemic side*, it critically analyses the changing nature of the data collection process, the place and role of technological objects, affordances and applications, the influence and entity of digital biases by at the same time looking at the methodological principles which are not easily dismissed by the new availability of data and the strengthened potentials of methods and techniques. On the *normative side,* social research in the digital context also raises several ethical dilemmas deriving both from institutional deregulation and innovative challenges.

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