

Algorithmic Knowledge: Generative AI and the Transformation of Scientific Communication

Conocimiento algorítmico: IA generativa y la transformación de la comunicación científica

Conhecimento Algorítmico: IA Generativa e a Transformação da Comunicação Científica

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Abstract: This article explores the impact of generative artificial intelligence (AI) on academic and scientific communication, analysing how the automation and mediation of AI-generated writing destabilises authorship, authenticity and the credibility of scientific communication. Drawing on existing literature and a qualitative methodology based on case study analysis of synthetic bibliographic references, the algorithmic reuse of retracted scientific literature, and the degradation of synthetic data, the study seeks to understand the impact of AI on the academic and scientific environment. It further discusses the epistemological and ethical implications of the dependence on generative models in the construction and validation of knowledge. It is argued that AI should be understood not merely as a support tool for research, but as a new communication infrastructure, within which what we term "synthetic scientific memory" is constructed — created through probabilistic means of knowledge generation and recombination.

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Keywords:

Generative artificial intelligence; scientific communication; algorithmic culture; knowledge production

Resumen: Este artículo explora el impacto de la inteligencia artificial (IA) generativa en la comunicación académica y científica, analizando de qué manera la automatización y mediación de la escritura generada por IA desestabiliza la autoría, la autenticidad y la credibilidad de la comunicación científica. A partir de la literatura existente y de una metodología cualitativa basada en el análisis de estudios de caso sobre referencias bibliográficas sintéticas, la reutilización algorítmica de literatura científica retractada y la degradación de datos sintéticos, el estudio busca comprender el impacto de la IA en el ámbito académico y científico. Se discuten asimismo las implicaciones epistemológicas y éticas sobre la dependencia de los modelos generativos en la construcción y validación del conocimiento. Se argumenta que la IA debe entenderse no solo como un apoyo a la investigación, sino como una nueva infraestructura de la comunicación, en la cual se construye lo que denominamos «memoria científica sintética», creada por medios probabilísticos de generación y recombinación del conocimiento.

Palabras clave:

Inteligencia artificial generativa; comunicación científica; cultura algorítmica; producción del conocimiento

Resumo: Este artigo explora o impacto da inteligência artificial (IA) generativa na comunicação acadêmica e científica, analisando de que forma a automatização e mediação da escrita gerada por IA destabiliza a autoria, autenticidade e credibilidade da comunicação científica. Com base na literatura existente e numa metodologia qualitativa assente na análise de estudos de caso sobre referências bibliográficas sintéticas, a reutilização algorítmica de literatura científica retractada e degradação dados sintéticos, o estudo procura compreender o impacto da IA no meio académico e científico. Discute ainda as implicações epistemológicas e éticas sobre a dependência dos modelos generativos na construção e validação de conhecimento. Argumenta-se que a IA deve ser entendida não apenas como um apoio à investigação, mas como uma nova infraestrutura da

comunicação, na qual se constrói o que chamamos de “memória científica sintética” criada por meios probabilísticos de geração e recombinação de conhecimento.

Palavras-chave:

Inteligência artificial generativa; comunicação científica; cultura algorítmica; produção do conhecimento

1. Introduction

The integration and use of generative models in academic and scientific environments has drastically transformed the processes through which knowledge is produced, circulated, and validated (Liu et al., 2024). Known as large language models (LLMs), and endowed with the ability to generate textual content that mimics human writing, these systems have rapidly shifted from being tools to becoming agents capable of (re)producing academic work.

The impact of these systems goes beyond the automation of writing. Phenomena such as synthetic bibliographic references, partially fabricated content, the algorithmic reuse of invalidated scientific literature, and the degradation of synthetic data reveal more complex problems in the mechanisms of knowledge validation, legitimation, and circulation (Walters & Wilder, 2023; Yao et al., 2025). These transformations suggest a reconfiguration of scientific authority in ecosystems increasingly mediated by algorithms, in which textual coherence and the automated circulation of information may come to outweigh traditional means of validation (Azzam, 2023). Nevertheless, the debate surrounding AI remains largely focused on plagiarism, ethics, or productivity. Although these perspectives are important, they tend to treat the issue as an instrumental problem, thereby underestimating its serious structural implications (Krenn et al., 2022).

This study introduces the concept of “synthetic scientific memory” to describe forms of circulation, recombination, and reorganisation of AI-mediated knowledge. The concept refers to the capacity of generative models to reproduce and reorganise scientific content through probabilistic processes that do not always depend on direct human verification, thereby creating imprecise references and plausible fragments of knowledge that are not necessarily validated (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023; Yao et al., 2025). Unlike traditional scientific processes, which are anchored in institutional systems of review, referencing, and

correction (Latour & Woolgar, 1986), this concept seeks to frame the transformation of scientific communication in a context in which AI is no longer merely a tool but becomes part of the very infrastructure through which knowledge is produced and circulated.

It is important to clarify that synthetic scientific memory does not refer only to the accumulation of information produced by artificial-intelligence systems. Rather, the concept seeks to describe an emerging regime of preservation, circulation, and probabilistic recombination of scientific knowledge, in which valid, imprecise, or subsequently invalidated content remains available for algorithmic reuse.

This article proposes an analysis of epistemological reconfiguration in scientific communication through two case studies: the first concerns the production of synthetic bibliographic references generated by AI, while the second concerns the algorithmic reuse of retracted scientific literature and the degradation of synthetic data. These cases make it possible to observe how algorithmic mediation affects authenticity, verifiability, and legitimation in academic settings. The study is organised around two research questions:

RQ1: How do AI-generated synthetic bibliographic references challenge verifiability and authority in scientific communication?

RQ2: How does the algorithmic reuse of retracted scientific literature and the degradation of synthetic data by AI contribute to the reconfiguration of scientific memory and validation?

These questions seek to understand the circulation of synthetic scientific knowledge, in which AI participates in mediation, legitimation, and epistemological reproduction.

2. Methodology

The study uses a qualitative and theoretical-interpretive method, adding to the theoretical component an analysis of case studies related to the use of AI in scientific communication. This article explicitly assumes the character of a conceptual and interpretive study. Rather than seeking to test hypotheses through the collection of original data, it aims to develop a theoretical reflection on emerging transformations in scientific communication associated with the use of generative AI systems. Following the tradition of conceptual studies in communication and the sociology of science, the cases analysed are used as illustrative examples of broader processes of epistemological transformation, allowing us to explore mechanisms and theoretical implications that are still at an early stage of empirical consolidation (Jaakkola, 2020).

The empirical basis centres on the analysis of two cases: (i) the occurrence, in literature reviews, of synthetic bibliographic references generated by AI systems, as documented in recent studies on bibliographic errors and fabrications; and (ii) the reuse of retracted scientific literature by AI systems and the degradation of synthetic data, phenomena identified in research on the persistence of invalid knowledge in generative models. Our focus is not on technical evaluation, but on the interpretation of the mechanisms through which scientific legitimacy is constructed, simulated, and potentially destabilised in environments mediated by these same mechanisms.

3. Scientific Communication and the Algorithmic Mediation of Knowledge

The emergence of generative models has altered not only the production and speed of circulation of scientific knowledge, but also the mechanisms through which its authority and validation are established (Clelland et al., 2024). Scientific processes have generally been structured around institutional systems of review (Latour & Woolgar, 1986). However, the growing use of these models has introduced a logic of textual production built on probabilities and the recombination of information. In this sense, generative AI does not directly verify facts; it generates text by probabilistically predicting linguistic sequences on the basis of the models' training data (Brown et al., 2020; Floridi & Chiriatti, 2020).

The scientific community is increasingly dependent on algorithmic infrastructures responsible for organising, selecting, and distributing communication. José van Dijck's (2013) studies on algorithmic culture and digital mediation offer an essential perspective for understanding this dependence. Van Dijck shows that digital ecosystems operate through logics of datafication, automation, and connectivity, in which algorithms play a central role in organising and circulating information. In this context, scientific communication no longer depends exclusively on institutional mechanisms, but becomes part of algorithmic infrastructures of production, selection, and visibility.

This transformation can also be interpreted in light of the concept of epistemic infrastructures, understood as the set of technical, organisational, and institutional mechanisms that condition the production, circulation, and validation of knowledge. As generative systems begin to participate in research processes, bibliographic synthesis, and academic writing, they cease to perform only an instrumental function and become part of the cognitive architecture through which knowledge is produced and legitimated (Leonelli, 2016; Crawford, 2021).

The implications of this transformation become evident in cases such as AI-generated bibliographic references, in which systems produce plausible references without verifiable correspondence. In such cases, synthetic references preserve the form of scientific authority even when they no longer correspond to real sources (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023). The academic reference thus begins to function not only as a mechanism of scientific traceability, but also as a discursive structure of plausibility (Gao et al., 2023).

Jean Baudrillard's (1994) concept of simulation is useful for gaining a clearer understanding of this phenomenon, insofar as contemporary systems of representation tend to detach themselves from the real referent, producing simulacra that can replace the very logic of verification. Applied to the present study, this framework allows us to understand how generative systems can reproduce discourses of academic legitimacy without necessarily corresponding to a verifiable factual source (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023).

Similarly, Flusser (2011) writes about technical apparatuses not as neutral instruments, but as structures that configure the very conditions of cultural production and information circulation. From this perspective, generative AI can be seen as a system that reorganises the creation, circulation, and legitimation of knowledge by operating through probabilistic and always provisional selections (Alavi et al., 2024). Truth and falsehood therefore cease to appear as stable oppositions and become part of a regime of plausibility, credibility, and uncertainty (Pinell, 2024). This leads us to reflect on Félix Guattari's (1992) argument regarding contemporary dependence on machines, which creates a paradox: while it democratises access to data and knowledge, it can also restrict access to the means of producing that knowledge.

4. Case Analysis

The following analysis seeks to understand how generative AI interferes with mechanisms of validation and circulation of scientific knowledge. The selected cases make it possible to observe epistemological transformations associated with algorithmic production at the levels of verifiability, referencing, the persistence of retracted content, and the degradation of synthetic data mediated by these same models.

4.1. Literature Review and Scientific Plausibility

Literature review, including bibliographic references, plays a central role in the validation and legitimation of scientific knowledge (Latour & Woolgar, 1986; Alavi et al., 2024). Beyond identifying sources, academic citations function as mechanisms of traceability, verifiability, and epistemological stabilisation by connecting claims to works recognised and validated by the academic and scientific community (Garfield, 2006; Merton, 1973). At the same time, Merton argues that science is organised through institutional norms oriented toward the production of “certified knowledge”, sustained by principles of validation and empirical evidence. However, AI capable of producing convincing but not always verifiable references significantly alters the traditional logic of scientific authority (Walters & Wilder, 2023; Floridi & Chiriatti, 2020).

The studies by William H. Walters and Esther Isabelle Wilder (2023) and by Hussam Alkaissi and Samy I. McFarlane (2023) show that generative models are capable of creating structurally coherent bibliographic references, using real author and publisher names and correct academic formats, even though many of these references do not correspond to actually existing publications. In these cases, scientific credibility ceases to depend entirely on the verifiable existence of the source and begins to rest partly on the formal plausibility of the algorithms’ discursive structure.

This phenomenon reveals a shift in the functions of citations. The purpose of references is to connect scientific discourse with verifiable evidence. With AI, however, reference generation results from probabilistic processes of textual recombination based on statistical patterns present in training data (Floridi & Chiriatti, 2020, pp. 682-684). Scientific authority is thus partially reconstructed through the formal simulation of academic legitimacy (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023).

The relevance of this phenomenon goes beyond the mere existence of incorrect references. What is at stake is a potential alteration of the mechanisms of epistemological trust that sustain scientific communication. Traditionally, the credibility of a claim depended on the possibility of tracing its underlying evidence. When plausible but non-existent references circulate in academic environments, the appearance of rigour can become partially independent of the effective verifiability of sources (Leonelli, 2016).

Returning to Baudrillard’s (1994) concepts, this system tends to detach itself from the real referent, producing plausibility without depending on verifiability. Applied to scientific

communication, this perspective allows synthetic references to be interpreted as forms of discursive authority without a verifiable referent, in which the formal structure of scientific credibility remains intact despite the cited source being non-existent or erroneous.

Generative applications therefore not only automate academic writing but also begin to interfere with scientific legitimation. Bibliographic references cease to function exclusively as instruments of validation and simultaneously begin to operate as elements of AI-mediated algorithmic plausibility (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023).

Element analysed	Observed evidence	Epistemological implication
Production of non-existent references	Generation of plausible references without verifiable factual correspondence	Dissociation between credibility and scientific validation
Use of real authors, publishers, and formats	Convincing reproduction of academic writing	Algorithmic simulation of scientific authority
Textual production generated through probabilistic plausibility	References produced through statistical patterns rather than direct factual verification	Weakening of traditional mechanisms of verifiability
Algorithmic simulation of scientific rigour	Correct bibliographic structures despite the non-existence of the sources	Reconfiguration of the function of academic references

Table 1. Literature review and scientific plausibility (Source - the authors).

4.2. Algorithmic Reuse and the Degradation of Synthetic Data

The studies by Yao et al. (2025) and Shumailov et al. (2024) are relevant here: the first focuses on generative models applied to stem-cell research, while the second addresses the possibility of generative-model collapse. Whereas the first case analyses the persistence of retracted scientific literature in outputs produced by generative models applied to stem-cell research, the second discusses the risks associated with the recursive training of models on synthetic data produced by earlier models.

According to the first study, AI continues to reproduce content associated with retracted articles even after formal correction processes. Although traditional communication mechanisms operate through institutional procedures of review, correction, and retraction in order to stabilise academic and scientific credibility (Latour & Woolgar, 1986; Alavi et al., 2024), generative models, by keeping part of this content active, contribute to the continued circulation of invalidated content through statistical patterns in the training of these models, making it available for recombination in new scientific outputs (Yao et al., 2025).

In the second study, the authors discuss the possibility of generative-model collapse, which refers to a degenerative process affecting successive generations of models, in which the data produced by one generation contaminate the training set of the next, and so on. As models are gradually trained on corrupted data, they cease to faithfully represent the original distribution, potentially losing information from the distribution at an early stage and, in more advanced phases, converging toward distributions increasingly unlike the real one (Shumailov et al., 2024).

Although the phenomenon of model collapse remains the subject of scientific debate, the available findings suggest a relevant structural risk for knowledge-production ecosystems. If growing volumes of synthetic content are incorporated into the training data of future generations of models, a progressive amplification of errors, simplifications, or biases may occur, affecting the informational diversity and epistemological robustness of generative systems (Shumailov et al., 2024). In this context, the studies suggest that the creation, validation, and algorithmic circulation of scientific knowledge is not restricted to reproducing valid information, but also involves maintaining and recombining false or weakened synthetic content.

Element analysed	Observed evidence	Epistemological implication
Reuse of retracted literature	Generative models continue to reproduce scientifically invalidated content	Weakening of traditional mechanisms of scientific correction
Algorithmic persistence of information	Retracted content remains in training data	Emergence of “synthetic scientific memory”
Probabilistic recombination of content	Invalidated information may reappear in new scientific outputs	Dissociation between institutional retraction and algorithmic circulation
Recursive training on synthetic data	Models trained on artificial outputs progressively degrade data quality	Gradual erosion of epistemological reliability
Loss of informational diversity	Reduction in the representation of less frequent or marginal information	Simplification and homogenisation of scientific knowledge
Convergence toward artificial distributions	Progressive distancing between synthetic outputs and the original distribution of data	Instability of contemporary systems of knowledge production

Table 2. Algorithmic reuse and the degradation of synthetic data (Source - the authors).

5. Synthetic Scientific Memory

5.1. Conceptual Delimitation of Synthetic Scientific Memory

Synthetic scientific memory is distinct from neighbouring concepts frequently used in the literature. That is, it does not simply correspond to digital memory, which refers to the technological preservation of information, nor to the institutional memory of science, associated with libraries, databases, or academic archives. Nor does it fully coincide with the notion of algorithmic memory, usually used to describe recommendation systems or personalisation mechanisms.

The concept proposed here refers specifically to the probabilistic persistence of knowledge in generative models. It is therefore a form of memory produced by the statistical recombination of content present in training data, allowing fragments of information to continue circulating regardless of their subsequent scientific status. Synthetic scientific memory is thus characterised by three fundamental properties: (i) algorithmic persistence; (ii) probabilistic recombination; and (iii) relative autonomy from traditional mechanisms of scientific correction.

Synthetic scientific memory is established through the probabilistic persistence of the training data of these models. These systems reproduce forms of scientific authority without verifiable factual correspondence, and invalidated knowledge does not disappear completely after processes of retraction or scientific correction; rather, it remains within models and may be reused, recombined, and reproduced in new outputs (Walters & Wilder, 2023; Alkaissi & McFarlane, 2023; Yao et al., 2025). The degradation of synthetic data becomes inevitable as long as invalidated content continues to form part of the training data of new models (Shumailov et al., 2024).

Synthetic scientific memory does not correspond merely to the passive preservation of digital information, but to an active process of algorithmic circulation of knowledge. Generative models reconfigure communication and symbolic production by influencing the way information circulates (Gillespie, 2014, p. 168). In this sense, AI continuously reorganises already existing content, producing new discursive combinations through probabilistic mechanisms that are often detached from direct human supervision (Brown et al., 2020). Gradually, algorithmic plausibility comes to coexist with traditional mechanisms of scientific verifiability, creating forms of scientific authority that are partially disconnected from the factual referent. More than a simple

textual-assistance tool, we argue that generative AI begins to form part of the very epistemological infrastructure of scientific communication.

6. Conclusions

In this sense, synthetic scientific memory may be interpreted as a new intermediate layer between formal scientific production and the social circulation of knowledge. Whereas traditional systems of scientific communication depend on explicit validation processes, generative systems operate through implicit mechanisms of probabilistic association. This difference suggests that future debates on scientific integrity may need to consider not only the quality of the research produced, but also the ways in which algorithmic systems preserve, reorganise, and reproduce that knowledge.

The main contribution of this article lies in proposing the concept of synthetic scientific memory as an analytical instrument for understanding the epistemological transformations introduced by generative AI into scientific communication. By articulating contributions from the sociology of science, media studies, and the philosophy of technology, the concept seeks to offer an interpretive framework capable of explaining apparently distinct phenomena - synthetic bibliographic references, the persistence of retracted literature, and the degradation of synthetic data - as manifestations of a single logic of algorithmic knowledge circulation.

With regard to limitations, it is important to emphasise that this work is primarily theoretical and interpretive. Therefore, the results obtained do not allow - nor was it the aim of the research to make - empirical generalisations. The analysis focused on generative AI applied to writing and scientific communication, without covering other forms of mediation. In addition, the concept of “synthetic scientific memory” should be understood as an initial study, requiring further conceptual and empirical validation. The rapid development of AI also makes the conclusions provisional, especially with regard to the verification, traceability, and control of outputs.

For future research, we suggest the importance of comparing different generative models, disciplinary fields, and digital ecosystems in order to better understand the persistence of retracted, imprecise, or synthetic content. It will also be relevant to analyse the effects of generative AI on editorial processes, peer review, and current forms of scientific credibility and authority.

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