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From empiricism to algorithm: a literature review of the scientific method in the age of AI

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Background

Scientific knowledge has long relied on the hypothetico-deductive method, rooted in observation, experimentation, and causal inference (Velthoven & Marcus, 2024). With formal logic (Boole, Frege) and early computing (Turing), AI emerged as an extension of rational processes (Feng, 2019). Today, machine learning shifts this paradigm, favoring data-driven correlations over deductive rules (Alvarado, 2023). This raises new epistemological challenges about the nature, validity, and explainability of AI-generated knowledge (Bao & Zeng, 2024).

Objetive

To epistemologically assess the limits and scope of the knowledge generated by AI models, considering the difference between correlation and causality, as well as the problem of explainability. Using as a starting point a database of articles from the last three years in a bibliographic repository, highlighting universities and journals interested in studying the method in the era of AI.

Methodology

A qualitative approach was used, based on a systematic literature review focused on epistemology, artificial intelligence, and science. Only articles that explicitly addressed the core concepts of this study—or whose content contributed to the philosophical understanding of knowledge—were selected.

Search

Selection Criteria

The selected articles were further analyzed using metadata such as institutional affiliation, country of origin, publication language, and the gender of the lead author. This enabled not only a conceptual but also a sociocultural perspective on knowledge production in this field.

Analysis

Final Selection

Results

From an initial set of 700 articles, 55 met the strict criteria of addressing both epistemology or philosophy and artificial intelligence. The UK led in publication output, and all articles were published in English. Of the authors, 37 were men and 18 women, highlighting ongoing gender disparities and the dominance of English in academic discourse.

The peak year for publications was 2024. These trends suggest a concentration of epistemic authority in the Global North, echoing Dussel's (1996) call to question the persistence of geopolitical centrality in knowledge production.

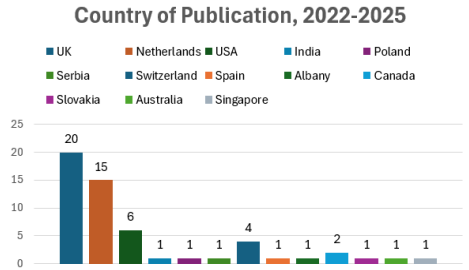

Figure 1. Country of publication, 2022-2025. Graph by the author.

Conclusions/Recomendations

- This review identifies a growing, yet limited, philosophical and epistemological discourse on AI. While the impact of algorithms is recognized, debates on validity, causality, and explainability remain central. The shift from empiricism to algorithms represents a redefinition of truth and validation.
- The study calls for broader interdisciplinary dialogue, incorporating critical and Global South perspectives, and advocates for expanding ethical and epistemological training beyond academia to foster public engagement with AI.

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Conflict of interest: none