

Epistemology in the Algorithmic Era: A Critique of Digital Rationality through the Lens of Post-Positivism, Critical Theory, and Constructivism

Salsabila Citra Devi^{1*}, Agung Winarno², Subagyo³

¹ Master of Management, Faculty of Economics and Business, Universitas Negeri Malang

^{2,3} Faculty of Economics and Business, Universitas Negeri Malang

Corresponding Author: Salsabila Citra Devi

salsabila.citra.2404138@students.um.ac.id

ARTICLE INFO

Keywords: Algorithmic Epistemology, Digital Rationality, Post-Positivism, Critical Theory, Constructivism

Received : 01, November

Revised : 18, November

Accepted: 28, November

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ABSTRACT

This article analyzes the formation of epistemology in the algorithmic era through the perspectives of post-positivism, critical theory, and constructivism. Employing a qualitative approach based on literature study and interpretive-critical analysis, this research explores how algorithms shape digital rationality and claims of technological objectivity in the production of knowledge. The findings indicate that algorithms do not merely represent reality, but actively construct it through mechanisms of datafication, classification, and prediction. Post-positivism reveals the tentative and biased nature of digital knowledge; critical theory uncovers the power structures and politico-economic interests embedded in the operation of algorithms; while constructivism highlights that algorithmic objectivity is a socially constructed notion legitimized through technocratic discourse. This article underscores the importance of critical and interdisciplinary understanding of digital epistemology in contemporary society.

INTRODUCTION

The advancement of digital technologies and algorithms has increasingly permeated all domains of social, economic, and political life. The function of algorithms and machine learning systems extends beyond mere tools for efficiency or data prediction; they now operate as knowledge producers, mediating social reality through processes of datafication, classification, and automated decision-making (Maalsen, 2023). Within this context, claims of algorithmic objectivity and neutrality frequently emerge, even positioned as definitive empirical evidence, thus presenting a pressing epistemological challenge: Are algorithms truly neutral, or do they perpetuate power structures and embedded biases?

For instance, studies on the epistemology of digital journalism reveal that algorithms and filter bubbles generate a new form of “metanarrative” which, while appearing absolute, is in fact constructed (Serafini, 2023). This transformation necessitates a critical reassessment of the major paradigms in the social sciences, namely post-positivism, critical theory, and constructivism, which have long interrogated issues of objectivity, the power-knowledge nexus, and the construction of social reality.

While post-positivism presents the idea that scientific truth is fallible and subjective, thus requiring researchers to acknowledge limitations and contextuality (Bentley, 2024), critical theory highlights how power structures, ideology, and epistemic politics shape knowledge production (Berry, 2025). In parallel, constructivism asserts that social reality is an intersubjective construction, not an objective fact detached from human interpretation. However, when applied to the phenomenon of algorithms and the production of digital knowledge, these paradigms have yet to be integrated into a cohesive analytical framework that critically examines the epistemic implications of purportedly objective digital rationality.

For example, recent investigations into epistemic welfare in algorithmic recommendation systems demonstrate that algorithms influence individual epistemic agency and give rise to structurally problematic epistemic conditions. Nevertheless, interdisciplinary studies that synthesize post-positivism, critical theory, and constructivism in this domain remain limited (Hyzen, 2025). These developments suggest that the radical transformation in knowledge production within the algorithmic era is not merely technical or methodological, but fundamentally epistemological and philosophical.

Over the past five years, a growing body of research has emphasized the role of algorithms in mediating digital reality and shaping patterns of information access; however, these studies predominantly conceptualize algorithms as technological instruments rather than epistemic entities. Investigations into algorithmic objectivity tend to interpret data as neutral and unproblematic empirical facts (Gritsenko, 2022; Beer, 2023; Neuberger, 2023), while a post-positivist perspective that foregrounds the fallibility of scientific truth has not been widely applied in assessing such claims of objectivity. For instance, critical approaches to algorithmic objectivity in data-driven journalism and datafication research largely focus on technical bias and predictive accuracy

(Maalsen, 2023; Shin, 2025), yet they fail to address the epistemological limitations of algorithms within a post-positivist framework that questions the boundaries of digital empiricism (Bentley, 2024). Consequently, a notable gap persists in the literature concerning how post-positivism can be systematically employed to critique claims of objectivity in algorithmically-generated knowledge as a purportedly natural form of reality.

Conversely, critical theory-based approaches have been employed to examine digital capitalism, data surveillance, and platform power, but existing analyses remain concentrated on economic-political relations and rarely engage with the epistemological dimensions of knowledge production itself (Berry, 2025; Fuchs, 2022; Ovalle et al., 2023). Studies of surveillance capitalism and algorithmic ideology demonstrate how algorithms regulate actions, preferences, and consumption (Zuboff, 2019; Couldry & Mejias, 2020), yet they do not sufficiently explicate how algorithmic knowledge functions as a mechanism for reproducing epistemic hegemony through processes of selection, classification, and weighting of particular informational inputs (Floridi, 2022; Yeung, 2022). Thus, although critical theory provides conceptual tools for analyzing power in the digital sphere, there remains a shortcoming in the literature regarding its explicit linkage with the epistemology of algorithms as a mode of knowledge production, rather than merely as an instrument of social control.

Meanwhile, constructivist-oriented scholarship suggests that social reality emerges through symbolic interaction and social processes, yet studies situating this constructivist lens within the production of digital reality remain limited (Gillespie, 2020; Rakova & Dobbe, 2023). In numerous works on recommendation systems, filtering, and algorithmic curation, algorithms are treated as technical devices influencing user experience rather than as epistemic actors that participate in defining social reality (Shin, 2025; Hyzen, 2025). This absence of perspective leads to a lack of recognition of algorithms as co-constructors of reality—entities that do not merely mediate information, but actively shape knowledge horizons and interpretive structures within society. Accordingly, there is a pressing need for research that explicitly positions algorithms within a framework of social constructivism that conceives truth as an intersubjective construction—one increasingly mediated and accelerated by algorithmic technologies.

Therefore, to date there remains no study that comprehensively integrates post-positivism, critical theory, and constructivism to formulate a unified epistemological framework for analyzing how algorithms shape knowledge production and digital rationality. This article addresses that gap by proposing a theoretical synthesis enabling a multidimensional reading of algorithmic epistemology—one that critically incorporates the limitations of digital empiricism, the structures of epistemic power, and the constructive nature of digital reality—thereby offering a significant academic contribution to advancing epistemological understanding of knowledge in the algorithmic era.

The urgency of this research arises from the growing realization that the development of algorithmic technology and artificial intelligence has transcended its function as a technical instrument and evolved into an epistemic

framework that mediates, filters, and produces social reality. In this context, algorithms function as epistemic actants, agents that not only organize data but also shape the horizon of knowledge and establish new patterns of rationality perceived by the public as objective. Recent studies have demonstrated that algorithms possess the capacity to construct preferences, perceptions, and even social values through processes of datafication and opaque automated decision-making mechanisms (Maalsen, 2023).

This phenomenon raises fundamental questions about how truth, objectivity, and reality are constructed within digital environments saturated with structural biases, economic interests, and symbolic power, conditions highlighted in critiques of surveillance capitalism and algorithmic governance, which emphasize the inherently political nature of data and digital technologies (Zuboff, 2019; Gritsenko, 2022). These conditions reveal the urgent need to develop a more comprehensive epistemological analysis by drawing upon the three major paradigms in the social sciences, post-positivism, critical theory, and constructivism, each of which offers distinct theoretical tools for interrogating the problems of digital objectivity, algorithmic bias, and power relations in the production of knowledge.

Based on these phenomenological and conceptual concerns, this study formulates the following core research problems. The first question asks: How is digital rationality, and the claim of algorithmic objectivity, constructed and maintained within the contemporary technological context that increasingly centralizes knowledge production in automated systems?

The second question explores: How can post-positivism, critical theory, and constructivism be applied to provide an epistemological critique of the digital objectivity claims, which are often constructed as neutral and empirically grounded? The third question focuses on: How can these three paradigms be synthesized into an alternative epistemological framework that more holistically and reflectively explains the dynamics of knowledge in the algorithmic era?

Accordingly, the objectives of this research are threefold: 1) To critically examine the epistemic character and rationality that define the algorithmic era; 2) To analyze the specific critiques that post-positivism, critical theory, and constructivism can offer in evaluating the operations of digital epistemology; 3) To develop a synthesized epistemological model capable of providing a more comprehensive understanding of the relationship between algorithms, knowledge, and the construction of social reality.

This study offers a significant theoretical contribution by proposing an inter-paradigmatic approach, a rarely employed strategy in the domain of digital epistemology. Moreover, it makes a conceptual contribution by offering a critical reading of algorithms as epistemic agents, whose complexity requires evaluation through multiple paradigms within the social sciences. Such an approach enables a more accurate and contextually grounded understanding of algorithmic knowledge production in contemporary society.

THEORETICAL REVIEW

Post-Positivism

The post-positivist paradigm, rooted in the notions of fallibilism and critical realism, is essential for understanding the epistemological limitations of algorithmic claims to objectivity. While algorithms assert truth through large-scale empirical data correlations, post-positivism reminds us that scientific truth is inherently tentative and probabilistic rather than absolute (Bhaskar, 2016). This framework becomes crucial when considering how machine learning models are often treated as neutral representations of reality, despite being constructed from historical datasets already infused with structural bias. The post-positivist paradigm demands falsification, critique, and independent evaluation of knowledge claims—requirements that are exceedingly difficult to apply to algorithmic systems operating under conditions of epistemic opacity, where much of their internal structure is inaccessible to public scrutiny (Burrell, 2016). From this perspective, algorithms do not meet the standards of epistemic transparency required within post-positivist logic, as neither scientific communities nor the public can properly examine the assumptions, variables, and parameters underlying their predictive outputs.

Furthermore, post-positivism asserts that scientific knowledge must be continually tested across contexts through triangulation of data, methods, and perspectives. Algorithms, however, crystallize a single statistical interpretation of data and patent it as a singular predictive output treated as “ground truth.” When, for instance, algorithms categorize criminal risk in cases such as COMPAS, these classifications are perceived as objective facts even though they are merely statistical inferences derived from prior criminal data already biased against particular communities (Angwin et al., 2016). Post-positivism thus exposes the epistemic paradox of algorithmic knowledge: systems that claim objectivity cannot be fully subjected to falsification due to limitations in access and reproducibility. Consequently, the assertion that algorithms are neutral entities cannot be epistemologically sustained when examined through post-positivist criteria of critical inquiry.

Critical Theory

Critical theory provides an analytical framework that reveals the power dimensions embedded within algorithmic epistemology. Whereas post-positivism focuses on the epistemic limitations of knowledge, critical theory demonstrates that technological objectivity is an ideological construct serving particular interests. Zuboff (2019) argues that algorithms function as instruments of surveillance capitalism, where personal data are monetized and user behavior becomes the subject of economic manipulation (Zuboff, 2019). In this sense, algorithms act not merely as cognitive structures processing information but as economic-political tools shaping human action in the service of capital accumulation. This perspective explains why platforms such as Google and Meta design recommendation systems not on the basis of informational accuracy but to optimize monetizable engagement.

Critical theory thus enables the understanding that algorithms are not neutral representations of reality but instruments of social construction shaped by dominant structures of interest. Algorithmic bias, in this context, is not an isolated error but a product of power relations; it not only reflects data inequities but reinforces them through structural feedback loops. If post-positivism asserts that algorithms lack sufficient epistemological verifiability, critical theory reveals that such structural opacity is not merely a technical issue but an ideological strategy that upholds claims of objectivity while masking economic interests. Moreover, Horkheimer and Adorno's concept of instrumental rationality illustrates that modern technology is inherently non-neutral; it is directed toward optimizing output, commercial efficiency, and social control rather than promoting rational communication or epistemic emancipation (Horkheimer & Adorno, 2002).

From this vantage point, the limitations of algorithmic verifiability noted by post-positivism are understood within critical theory as symptomatic of broader power structures: digital knowledge is monopolized and institutionalized by major technological actors who shape how reality is filtered, organized, and made visible to the public, without permitting equal deliberative engagement among users.

Constructivism

In contrast to post-positivism, which constrains objectivity claims, and critical theory, which exposes the ideological nature of objectivity, constructivism begins from the premise that social reality is never objective to begin with but is always produced through sociolinguistic construction and intersubjective interaction. Applied to algorithms, constructivism demonstrates that algorithmic outputs do not reveal digital reality but shape it through processes of selection, curation, and classification that underlie user experiences online. Berger and Luckmann (1967) argue that social facts are products of institutionalized meaning-making, and in the context of algorithms, such meaning is produced by mathematical computation that increasingly substitutes human deliberation (Berger & Luckmann, 1967).

Constructivism explains why two individuals searching for the same term online may encounter entirely different results: because algorithms construct digital reality based on personal histories, interaction trajectories, and social profiling. Here, the algorithm functions as an epistemic agent transforming reality into something radically personalized. This perspective reveals that digital reality is not merely filtered reality, but fabricated reality, actively assembled by predictive models. Unlike post-positivism, which demands falsifiability, constructivism implies that there is no singular truth to falsify because truth itself is the product of algorithmic construction.

Constructivism thus helps us understand that algorithms do not simply process data but organize social meaning, reinforce certain interpretive patterns, and suppress alternative epistemic possibilities – ultimately shaping the cognitive horizons of digital society. The constructivist lens also reveals that algorithmic bias is not merely a technical failure but an inherent condition of reality construction based on data, always grounded in interpretive frameworks embedded in technological design itself.

METHODOLOGY

Research Approach

The research approach employed in this article is qualitative, with an analytical-interpretive orientation that positions texts, concepts, and theoretical frameworks as the primary objects of inquiry. A qualitative approach is chosen because this study seeks to develop an in-depth understanding of the epistemological relationships among algorithms, digital rationality, and the three major paradigms, post-positivism, critical theory, and constructivism, through theoretical interpretation and conceptual exploration.

Within the context of epistemological and philosophy-of-science inquiries, the qualitative approach offers space for reflective engagement with reality, inter-theoretical connectivity, and the analysis of knowledge discourses produced by algorithmic technologies as complex social phenomena. In line with Creswell and Poth's assertion that qualitative research serves to understand the meanings of concepts and social structures through critical interpretive methods, this approach enables not only descriptive but also evaluative analyses of the architecture of digital knowledge (Creswell & Poth, 2018).

This study adopts a library research or literature-based method, grounded in a systematic review of recent scholarly works relevant to the epistemological challenges of algorithms and the three aforementioned paradigms in the social sciences. Literature research enables the researcher to engage with an extensive scientific corpus, ranging from foundational works in the philosophy of science to high-impact articles published in reputable international journals over the past decade.

The strength of this approach lies in its ability to produce a comprehensive conceptual synthesis, as the empirical foundation of this study is not based on field data but on scholarly arguments critically constructed through textual, theoretical, and research-based examination. As Snyder has noted, library research is particularly effective for developing new theoretical perspectives through the process of literature synthesis (Snyder, 2019).

Data collection in this study was conducted through the selection of scholarly literature that is relevant, credible, and up-to-date, including academic books and peer-reviewed journal articles. The process began with the identification of keywords such as algorithmic epistemology, post-positivism, critical theory, constructivism, datafication, and digital rationality.

Subsequently, the retrieved literature was evaluated based on the quality of the publication, the reputation of the journal, and its theoretical relevance to the research focus. Data collection was carried out through digital access to academic databases such as Scopus, Web of Science, ScienceDirect, and SpringerLink, to ensure academic validity and intellectual integrity. This data collection method aligns with qualitative research procedures that emphasize the systematic and reflective selection of literature (Bowen, 2009).

Data analysis in this study was conducted using a critical interpretative synthesis approach, which enables the researcher to critically integrate theoretical findings and construct a more holistic understanding. This technique is particularly relevant for conceptual research as it does not center on empirical

data categorization, but rather on abstract reasoning, interpretation, epistemological evaluation, and the construction of inter-paradigmatic relationships. Within this analytical framework, the researcher reads and interprets arguments from each theoretical tradition and connects them to the phenomena of algorithms and the production of digital knowledge.

Aligned with Dixon-Woods' notion of interpretative synthesis, this method allows the development of new perspectives through a process of argumentative synthesis and consistent conceptual critique (Dixon-Woods et al., 2006). The purpose of the analysis is not only to map each paradigm's viewpoint, but also to establish theoretical coherence across paradigms, which is essential for formulating a new epistemological construction.

The validity of data in this study is maintained through conceptual triangulation and critical evaluation of literature quality. Conceptual triangulation is performed by comparing arguments from various theoretical sources to ensure logical consistency and epistemological alignment between the theories examined and the digital technological phenomena under analysis.

Validity is further reinforced by using up-to-date literature and original works by the foundational thinkers representing the paradigms utilized in this study. This is in accordance with qualitative research validity principles that emphasize credibility, confirmability, and interpretive transparency (Nowell et al., 2017).

In addition, the entire process of literature selection and analysis is conducted systematically to minimize interpretive bias, ensuring that the construction of arguments remains within academically accountable boundaries. The aim is to guarantee that the theoretical synthesis reflects a robust and critically grounded epistemological inquiry.

RESULTS

The Construction of Digital Rationality and the Claim of Algorithmic Objectivity

Digital rationality within the contemporary technological ecosystem is constructed through the mechanism of datafication, which transforms social phenomena into numerical data, subsequently processed by algorithms to generate predictions, classifications, and automated decisions. This process gives rise to a new form of rationality centered on calculative and probabilistic logic, wherein subjective values are reduced to measurable variables—an approach that is often perceived as neutral and objective. This phenomenon is clearly manifested in practices such as ranking systems, automated recommendations, and machine learning-based prediction systems that operate through layered statistical models.

However, the objectivity produced by algorithms is performative in nature: it not only represents reality but also actively shapes it, thereby producing a complex epistemological paradox. As noted by Beer, algorithms do not merely predict the world; they participate in constructing what is accepted as true and valid within the digital social sphere (Beer, 2019).

The construction of algorithmic objectivity is reinforced by technocratic narratives that frame data as a pure reflection of reality. In truth, processes such

as data curation, cleaning, and variable selection involve interpretive decisions that are imbued with human values, assumptions, and biases. This aligns with the findings of Barocas and Selbst, who demonstrate that algorithmic bias frequently originates from historical bias embedded in training data, including social inequalities and discriminatory structures internalized within broader systems (Barocas & Selbst, 2016).

As a result, algorithms reproduce such biases through automated decisions that appear objective only because they are cloaked in mathematical logic. In other words, the claim that algorithms operate objectively using "raw data" is an epistemic illusion, as the data themselves are socially, politically, and economically constructed entities.

This construction of digital rationality is further strengthened through black-boxing or algorithmic opacity, which renders internal decision-making processes inaccessible, even to developers themselves. The complexity of deep learning models makes interpreting algorithmic decisions an epistemological challenge. As Burrell outlines, technical, epistemic, and intentional opacity collectively contribute to the public's inability to question the basis of automated decision-making (Burrell, 2016).

This opacity amplifies the legitimacy of algorithms as epistemic authorities, since the public has no access to the internal mechanisms that convert data into decisions. Algorithms thus emerge as epistemic actors that do not merely process information but also shape the very structure of epistemic validity.

Digital rationality is also constructed through predictive mechanisms that convey an illusion of control over the future. By analyzing large-scale data patterns, algorithms appear capable of revealing hidden truths or forecasting individual behavior. Yet, this capability is inherently probabilistic and riddled with uncertainty. O'Neil warns that algorithmic predictions are often perceived as irrefutable truths, even though such predictions rely on past patterns that may not accurately reflect future realities (O'Neil, 2016).

This phenomenon illustrates how algorithmic objectivity is frequently a social construction, reinforced by technological narratives and excessive trust in the predictive power of machines.

Moreover, the formation of algorithmic objectivity cannot be disentangled from the power relations embedded within the digital ecosystem. Major technology companies possess the capacity to determine how data is collected, categorized, and operationalized, thereby shaping the structure of digital knowledge according to corporate economic and political interests.

Zuboff articulates this power-data relationship through the concept of surveillance capitalism, which describes how market logic drives the exploitation of data to control user behavior and maximize profit (Zuboff, 2019). This condition indicates that digital rationality is not a neutral scientific rationality but rather a political-economic rationality cloaked in the language of technical objectivity.

In sum, the findings of this study reveal that digital rationality and the claims of algorithmic objectivity are constructed through interrelated technical, social, epistemic, and political processes. Algorithms do not merely process

reality, they produce it through mechanisms of classification and prediction that shape how humans understand and navigate the digital world.

Epistemological Critique of Algorithmic Objectivity from the Perspectives of Post-Positivism, Critical Theory, and Constructivism

The epistemological critique of algorithmic objectivity becomes increasingly significant as digital rationality is understood not merely as a technical process, but as a constructed form of knowledge with far-reaching ontological and social implications. The perspectives of post-positivism, critical theory, and constructivism offer analytical frameworks that enable a critical reading of how algorithmic objectivity is formed, justified, and deployed to produce epistemic legitimacy in digital life. Each paradigm provides a distinct yet complementary lens for examining how algorithms produce “truths” that appear neutral, but are, in fact, the result of complex social, political, and technical configurations.

From a post-positivist perspective, claims of algorithmic objectivity are challenged through the principle of fallibilism, which asserts that scientific knowledge is always tentative and never free from bias or error. Critical realism, as developed by Bhaskar, explains that while reality may possess objective structures, human understanding of that reality is inevitably shaped by the theories, assumptions, and instruments used in the process of observation (Bhaskar, 2016). In the context of algorithms, these instruments include data sets, predictive models, and statistical parameters—all constructed through interpretative processes and therefore incapable of fully reflecting objective reality. Recent scientific findings further show that algorithmic models often fail when applied across different social contexts, due to the dynamic nature of social structures, which cannot easily be reduced to stable numerical patterns (Barocas & Selbst, 2016). For post-positivism, algorithmic objectivity is qualified objectivity, dependent on specific epistemic conditions, and cannot be equated with absolute truth.

In contrast, critical theory offers a sharper critique by highlighting the hidden dimensions of power embedded within claims of technological objectivity. Horkheimer and Adorno long argued that modern instrumental rationality tends to obscure power relations under the guise of efficiency and science (Horkheimer & Adorno, 2002). In algorithmic systems, instrumental rationality operates through designs that prioritize predictive efficiency, behavioral optimization, and data-driven social control.

Zuboff illustrates how the logic of surveillance capitalism uses algorithms not only to understand human behavior, but to modify it in service of market interests. As a result, digital objectivity often manifests as a product of economic and political agendas veiled in scientific legitimacy (Zuboff, 2019). This critique aligns with Beer’s findings, which emphasize that algorithms have the capacity to invisibly shape social structures through filtering, selection, and the curation of information, all of which influence the contours of the digital public sphere (Beer, 2019). In this view, algorithmic objectivity is not seen as an epistemic quality but as a strategy of power that legitimizes technocratic authority.

From a constructivist standpoint, the critique focuses on how algorithms shape reality through the social construction of data and digital representation.

Berger and Luckmann assert that social reality is produced through processes of externalization, objectivation, and internalization, such that human understanding of the world is never detached from meaning-making practices (Berger & Luckmann, 1991).

When algorithms organize data into categories, scores, or predictions, they are engaging in a new form of objectivation, transforming technical constructions into social facts that appear natural. Contemporary constructivist perspectives view datafication as a mechanism that converts social phenomena into digital entities representing the world not as it is, but through the logic of technology (Couldry & Mejias, 2019). Algorithms are thus understood as co-producers of reality, shaping how individuals perceive themselves, others, and the broader social world.

Taken together, these three paradigms reveal that algorithmic objectivity is not an inherent attribute, but rather the result of epistemological, technological, and political configurations. Post-positivism highlights epistemic limitations and the fallibility of knowledge; critical theory exposes the power relations and interests embedded in technology; and constructivism reveals that digital reality is socially constructed through data logics and algorithmic representations.

Therefore, algorithmic objectivity must be critically examined through epistemological lenses capable of uncovering the limitations, power dynamics, and meaning-making structures behind digital rationality.

Epistemological Synthesis of Three Paradigms as a New Framework for Understanding Knowledge in the Algorithmic Era

The effort to formulate an epistemological synthesis between post-positivism, critical theory, and constructivism in understanding the algorithmic phenomenon requires a comprehensive reading of how each paradigm interprets reality, truth, and the process of knowledge production. Although these paradigms stem from distinct intellectual traditions, they hold immense potential to enrich one another in constructing a more integrated and adaptive epistemic framework suited to the complexities of digital technologies.

Algorithms are no longer mere analytical tools; they have evolved into epistemic entities that produce knowledge, classify the world, and govern social interactions through automated representation and decision-making. Hence, an epistemological synthesis is necessary to understand how knowledge in the algorithmic age is formed, circulated, and legitimized within rapidly shifting technological and social dynamics.

From the perspective of post-positivism, the resulting epistemic framework is grounded in fallibilism and qualified objectivity. This paradigm asserts that algorithmic knowledge must be understood as the output of model-based constructions that are never entirely free from ontological or technical bias. The synthesis draws from post-positivism the principle that digital knowledge must always be critically re-examined, tested across varying contexts, and understood as an approximation of reality, never as a final or absolute truth.

This perspective offers an essential epistemic humility, especially amidst technocratic narratives that frequently present algorithms as objective

representations of social phenomena. Recent research findings, such as the documented failure of algorithms to accurately predict human behavior when transferred to different social domains, such as in criminal justice or healthcare, provide strong evidence that digital objectivity is a fragile and non-universal construct (Kleinberg et al., 2018).

Meanwhile, critical theory contributes an analytical apparatus capable of deconstructing the power relations and ideological forces embedded in algorithmic technologies. An epistemological synthesis incorporating critical theory emphasizes that the production of digital knowledge is not only about truth claims, but also about the power structures that shape and disseminate those claims.

This perspective reveals that algorithms do not operate in a vacuum but are embedded within economic and political systems that prioritize efficiency, profit, and market dominance. The critical dimension of this synthesis enables us to view algorithms not as neutral tools, but as epistemic actors embedded with particular interests. Zuboff's research on surveillance capitalism provides a foundational argument that data and algorithms are deployed as mechanisms for behavioral control through predictive manipulation (Zuboff, 2019). Integrating critical theory into the epistemological synthesis cultivates an awareness that digital knowledge must be evaluated not only in terms of accuracy, but also through the lenses of ethics, power, and ideology.

At the same time, constructivism plays the interpretive role in this synthesis by asserting that the social realities manifested by algorithms are constructed, not objective reflections of the world. The constructivist perspective offers a framework in which data, categorization, predictive modeling, and automated decisions are seen as products of social processes involving values, norms, and human interaction.

Within this view, algorithmic epistemology is understood as a reality-making process that depends on how data is gathered, how variables are defined, and how digital representations are socially perceived. The work of Couldry and Mejias on datafication as a form of social colonization underscores that the construction of reality through data is not merely a technical activity but a political-epistemic act that determines what is deemed significant and what is excluded from public discourse (Couldry & Mejias, 2019).

Constructivism, within this epistemological synthesis, functions as the lens that reveals how algorithmic knowledge is socially negotiated representation, not absolute truth.

The integration of these three paradigms results in an alternative epistemological framework that positions algorithmic knowledge as tentative, shaped by power structures, and formed through social construction. This framework enables a more holistic understanding of the epistemology of the algorithmic era – one in which knowledge is not merely produced by machines, but emerges from the complex entanglement between technology, humans, institutions, and social structures.

DISCUSSION

This discussion seeks to dialectically integrate the research findings with core theoretical frameworks and recent scholarly studies, in order to construct a comprehensive and reflective argument regarding how epistemology in the algorithmic era is constructed, sustained, and problematized. Such a dialectical engagement is essential, as algorithms have emerged as new epistemic actors, not only organizing information, but actively shaping the horizon of knowledge through mechanisms of classification, prediction, and automated recommendation.

A deep analysis is thus necessary to examine how digital rationality constructs objectivity through seemingly technical means that, in fact, conceal complex layers of structural bias, power indicators, and social construction.

The first major finding reveals that digital rationality is built upon datafication, the transformation of social experience into numerical data. This finding aligns with what Couldry and Mejias describe as data colonialism, a process through which social relations are mapped and extracted as resources for economic and political exploitation (Couldry & Mejias, 2019). The dialectic between this phenomenon and critical theory shows that digital objectivity cannot be read merely as a technical matter, but rather as a mechanism of domination that wraps capitalist interests in the aesthetics of science.

When algorithms generate risk scores, job recommendations, or curate informational content, these mechanisms are often perceived as expressions of "digital truth." Yet behind this veneer lies a structure of power that determines what is emphasized, what is concealed, and what is rendered irrelevant. As Zuboff argues, algorithms produce behavioral surplus that is monetized through predictive modeling, meaning the resulting knowledge structures are not neutral, but rather reflections of market interests (Zuboff, 2019).

The findings also demonstrate how post-positivism provides an epistemological critique of algorithmic objectivity. This approach emphasizes the limitations of data, models, and statistical procedures as partial representations of social reality. The tentative and reflexive stance promoted by fallibilism underscores that algorithmic models should not be viewed as mirrors of reality, but rather as conceptual structures built through variable selection, mathematical modeling, and historically biased data.

This perspective extends the critique of Barocas and Selbst, who argue that algorithmic bias is not merely a technical flaw, but a logical consequence of how social data is produced, collected, and codified (Barocas & Selbst, 2016). Thus, the convergence of this study's findings with post-positivist thought yields an understanding that algorithms must be read as limited theoretical models, not as objective entities capable of fully capturing the essence of reality.

The dialectic with constructivism adds an interpretive dimension, allowing a deeper understanding of how digital reality is shaped. The findings indicate that algorithms create objectivity through data construction processes that appear natural but are actually products of selection, recontextualization, and social categorization. The constructivist perspective maintains that reality is never

simply given, but always produced through processes of objectivation that make constructed categories appear natural.

This process is visible in how digital platforms curate information, generating “versions of reality” that are consumed by users. For example, Neuberger’s research shows how media algorithms select content not just based on technical relevance, but also on platform logics that prioritize user attention (Neuberger, 2023). Algorithms thus do not merely represent the world—they restructure it according to logics designed by developers, institutions, and market forces.

The discussion of epistemological synthesis across the three paradigms illustrates how an alternative framework may be constructed to better understand knowledge production in the algorithmic era. This synthesis combines post-positivist fallibilism, critical theory’s power critique, and constructivism’s social constructionism—producing an epistemic framework that avoids both naive objectivism and extreme relativism.

When algorithms produce knowledge, the process must be seen as an approximation of reality using epistemically limited tools, surrounded by power structures that influence how that knowledge is generated, and shaped by social construction processes that make it appear natural and objective. By weaving together these three perspectives, this research positions algorithms as epistemic actors operating at the intersection of technology, institutional interests, and social construction.

This discussion reveals that algorithmic objectivity is not stable, but rather formed through dynamic relations between statistical modeling, power structures, and social construction. The dialectic between empirical findings and theoretical frameworks reinforces the argument that epistemology in the algorithmic age must be built upon interdisciplinary foundations—capable of capturing the ontological and social complexity of digital technologies.

Through this lens, digital knowledge can be interpreted as both a product and a producer of social structures—one that demands critical, reflective, and comprehensive analysis to be fully understood.

CONCLUSIONS AND RECOMMENDATIONS

The findings of this study affirm that the epistemology of the algorithmic era is characterized by a shift in how knowledge is produced, specifically through mechanisms of datafication, automated classification, and probabilistic prediction, often wrapped in claims of technological objectivity. Addressing the first research question, this study demonstrates that digital rationality constructs a form of performative objectivity, insofar as algorithms do not merely reflect reality but actively shape it through digital representations that are presumed to be neutral. Such claims of objectivity do not emerge from epistemic emptiness but rather through data structures, model configurations, and programming procedures shaped by social, economic, and institutional values.

In response to the second research question, this study finds that the perspectives of post-positivism, critical theory, and constructivism collectively reveal the epistemological foundations underlying algorithmic objectivity. Post-

positivism highlights the fallible and tentative nature of digital knowledge; critical theory exposes the structures of power and market ideology embedded within algorithmic technologies; while constructivism demonstrates that data and digital representations are products of social construction. This cross-paradigmatic reading shows that algorithmic knowledge is not a neutral epistemic entity but rather a complex phenomenon situated at the intersection of technology, power, and meaning-making.

Addressing the third research question, this study successfully formulates an epistemological synthesis that integrates qualified objectivity, critical awareness of power relations, and an understanding of the social construction of reality. This synthesis provides a new analytical framework capable of comprehending algorithms as epistemic actors functioning within particular social spaces and subtly, yet significantly, shaping human understanding of reality. The epistemological framework resulting from this synthesis constitutes an important foundation for understanding how algorithms operate simultaneously as instruments of knowledge and as instruments of power within the contemporary digital landscape.

In response to the third research question, this study successfully formulates an epistemological synthesis that integrates post-positivist fallibilism, critical awareness of power structures, and an understanding of social construction—yielding a new framework for analyzing algorithmic epistemology. This framework enables a more holistic comprehension of how algorithms shape the social world through processes that are simultaneously technical, epistemic, and political.

The proposed synthesis offers a perspective through which digital knowledge may be assessed in a more reflective, ethical, and context-sensitive manner. Based on these findings, the study puts forward several recommendations:

First, there is an urgent need to develop interdisciplinary and critical research on digital epistemology, which takes seriously the role of power and social construction in algorithmic processes.

Second, regulatory frameworks should be strengthened to incorporate an understanding of how algorithms enact and reinforce structural inequalities.

Finally, digital literacy education must be enhanced to equip the public with the capacity to interpret algorithms as socially constructed artifacts, rather than as neutral technical instruments.

FURTHER STUDY

Future research may further examine how post-positivist, critical, and constructivist epistemologies interact with digital rationality in shaping knowledge production in the algorithmic era.

ACKNOWLEDGMENT

The author expresses gratitude to all parties who provided intellectual support and constructive feedback in the preparation of this article.

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