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# Adaptive Epistemology: Embracing Generative AI as a Paradigm Shift in Social Science

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**Abstract**

This paper examines the epistemological transformation prompted by the integration of generative artificial intelligence technologies into social science research, proposing the "adaptive epistemology" paradigm. In today's post-digital era—characterized by pervasive infrastructures and non-human agents endowed with generative capabilities—traditional research approaches have become inadequate. Through a critical review of historical and discursive paradigms (positivism, interpretivism, critical realism, pragmatism, transformative paradigms, mixed and digital methods), here I show how the advent of digital platforms and large language models reconfigures the boundaries between data collection, analysis, and interpretation. Employing a theoretical–conceptual framework that draws on sociotechnical systems theory, platform studies, and the philosophy of action, the core features of adaptive epistemology are identified: dynamism, co-construction of meaning between researcher and system, and the capacity to generate methodological solutions in response to rapidly evolving contexts. The findings demonstrate the need for reasoning in terms of an adaptive epistemology that could offer a robust theoretical and methodological framework for guiding social science research in the post-digital society, emphasizing flexibility, reflexivity, and ethical sensitivity in the deployment of generative tools.

**Keywords:** adaptive epistemology; generative artificial intelligence; social science research; post-digital paradigm

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## 1. Introduction: Epistemological Evolutions and Paradigmatic Foundations in Social Research

The evolution of paradigms in the social sciences has long been a subject of profound debate, forming the backbone of epistemological reflection within the field. At the heart of this discussion lies the notion of the *paradigm*, a term that has come to encapsulate far more than a methodological orientation. Traditionally, a paradigm has been understood as a comprehensive framework that defines what constitutes scientific knowledge, delineating the methods, standards, and assumptions that guide inquiry. This conception gained prominence with Thomas Kuhn's seminal work *The Structure of Scientific Revolutions*, where paradigms were framed as the "constellation of beliefs, values, techniques, and so on shared by the members of a given scientific community" [1]. Paradigms, in this sense, are not merely abstract constructs or theoretical orientations; they represent entire worldviews that govern what questions are posed, what methods are considered legitimate, and how reality is interpreted.

In the context of social inquiry, paradigms offer essential epistemological and ontological grounding. They define the scope of what is deemed knowable and the means by which

knowledge can be accessed and verified. As Guba and Lincoln noted, paradigms embody "a basic set of beliefs that guide action", encompassing assumptions about the nature of reality (*ontology*), the nature of knowledge (*epistemology*), and the way knowledge is acquired (*methodology*) [2]. These paradigmatic foundations shape how researchers engage with the social world and structure the very architecture of scientific legitimacy within the social sciences.

The present paper aims to illuminate the ongoing paradigmatic transformations in the social sciences by tracing their co-evolution with the accelerating shifts in social, technological, and methodological landscapes. The argument rests on the premise that social research does not exist in an epistemic vacuum but rather is inextricably shaped by the historical conditions, sociotechnical contexts, and institutional configurations within which it operates. Paradigms evolve in dialogue with the world they aim to interpret; thus, moments of societal transformation often provoke deep epistemological and methodological reconsideration.

Moving among many trajectory—from positivist to interpretivist, from mixed to digital, and toward AI-mediated research—this paper proposes the conceptual development of an *adaptive epistemology*. Such an epistemology would be characterized by its reflexivity, inclusiveness, and openness to continuous revision. It would not seek closure in fixed methodological rules but rather embrace complexity, hybridity, and sociotechnical entanglement as constitutive of the research process. This perspective aligns with recent calls for *situated knowledge* [3] and for the development of *epistemologies of the digital* [4] that acknowledge the dynamic interplay between humans, machines, and the environment in the co-production of knowledge. Adaptive epistemology thus results in a novel epistemological paradigm capable of responding to the complex challenges posed by the post-digital condition. At its core, adaptive epistemology conceptualizes knowledge as emergent, relational, and co-produced within hybrid sociotechnical assemblages that include both human and non-human agents. Unlike positivist paradigms that privilege objectivity and replicability, or interpretivist models centered on hermeneutic understanding, adaptive epistemology foregrounds responsiveness, reflexivity, and generativity as key epistemic orientations. This means acknowledging that in the age of generative AI and algorithmic mediation, knowledge is no longer a stable product extracted from reality but a dynamic process shaped through ongoing interactions between cognitive agents and technical systems [5,6]. Operationally, adaptive epistemology entails a shift from linear and methodologically pre-structured research designs to more iterative and exploratory modes of inquiry, where questions, data, and interpretations co-evolve. For example, while a traditional interpretivist approach might involve analyzing interview transcripts to derive thematic patterns, an adaptive epistemological stance would engage generative AI in surfacing latent semantic structures or alternative framings, treating the machine's outputs not as final results but as prompts for dialogical and situated interpretation [7]. In this way, adaptive epistemology reconfigures both the role of the researcher and the epistemic function of technological tools, situating both within a broader ecology of sense-making.

The paper thus sets out not simply to describe the chronological evolution of paradigms but to critically examine how these shifts correspond to broader societal changes and to articulate a forward-looking framework. By doing so, it aims to contribute to the re-foundation of social research in a context marked by uncertainty, acceleration, and digital saturation toward a post-digital society more and more connoted by the pervasive presence of artificial intelligence and generative models. Ultimately, it offers a roadmap for navigating epistemological complexity with intellectual agility, ethical sensitivity, and methodological innovation. In the end, this paper would act as a meta-theoretical contribution without the ambition to present itself as conclusive and definitive and with the

aim to inform future empirical developments within this emerging epistemological framework, which will in turn be able to contribute to the construction and structuring of the framework itself.

## 2. The Evolution of Disciplinary History of Social Sciences

### 2.1. The Shape of the Duality

The early disciplinary history of social science reveals a constant struggle to define its scientific status in comparison to the so-called *hard sciences* such as physics and mathematics. As Comte envisioned with his positive philosophy, the ambition was to develop a "science of society" grounded in empirical observation and generalizable laws [8]. This positivist heritage strongly influenced the quantitative tradition, which prioritized objectivity, replicability, and causal explanation through statistical models and experimental designs. Techniques such as survey research, hypothesis testing, and multivariate analysis flourished under this model, reinforcing the association between social science and natural scientific standards.

Conversely, the interpretivist tradition—rooted in the works of Weber, Dilthey, and later symbolic interactionists—challenged the applicability of natural science methods to social phenomena, arguing for an understanding of meaning, context, and subjectivity. Here, the emphasis shifted from explaining behavior to understanding social action (*Verstehen*) through qualitative methodologies such as in-depth interviews, participant observation, and ethnography [9,10].

Rather than being a simple methodological divergence, this duality reflects two distinct epistemological commitments: one grounded in the search for causal regularities, the other in the interpretation of situated meaning. This duality between positivism and interpretivism has shaped much of the methodological and theoretical debate in the 20th century [11–13]. It made the history of the social sciences deeply marked by what Guba and Lincoln termed the *paradigm wars*—a period of intense theoretical confrontation that pitted positivist and post-positivist approaches against interpretivist and constructivist frameworks in debates over the nature of reality, knowledge, and valid inquiry [2].

This tension exemplifies not only an academic divergence but also a broader epistemic competition over the definition of legitimate knowledge production. This exemplifies the contentious dynamics between competing worldviews. Positivist paradigms, rooted in the logic of natural sciences, seek objectivity, causality, and generalizability, which emphasize objective measurement and empirical validation [14]. They have evolved in various strands, from classical positivism to post-positivism, which acknowledges the limits of objectivity but maintains a commitment to empirical rigor and hypothesis testing. In contrast, interpretivist and constructivist paradigms emphasize the subjective nature of social reality foreground the co-constructed nature of social reality and the importance of situated knowledge practices [15,16]. Reality, in this view, is co-constructed through human interpretation and meaning-making processes. This epistemological orientation gave rise to methodological pluralism and qualitative inquiry, focusing on understanding rather than explaining social phenomena [17]. This dialectic has underscored the need for methodologies that not only capture observable phenomena but also account for the complexity of human experience.

The disciplinary tension between *hard* and *soft* sciences is not merely a matter of technique but of *epistemological authority*. Social sciences have historically had to justify their scientific rigor by borrowing legitimizing models from natural sciences—a dynamic that has shaped both curriculum and publication standards. As Flyvbjerg argues, the very classification of disciplines as *hard* or *soft* reflects power relations in the production of knowledge, with profound implications for how different types of inquiry are valued [18]. This dualism

structured much of twentieth-century methodological thought, but it ultimately proved inadequate in addressing the growing complexity and dynamism of contemporary society.

As sociotechnical systems grew in intricacy and as the world became increasingly interconnected, particularly under the forces of globalization, urbanization, and mediatization, the epistemological divide between explanation and understanding began to erode. Theoretical advancements in the philosophy of science, including Heisenberg's uncertainty principle and Kuhn's theory of scientific revolutions, challenged the notion of neutral observation and cumulative knowledge [1,19]. The growing influence of constructivist theories, such as those of Berger and Luckmann, further destabilized foundationalist claims, instead positing that social reality itself is produced through ongoing processes of negotiation and institutionalization [20].

These developments set the stage for the emergence of new epistemological orientations—such as the adaptive epistemology proposed in this article—that attempt to integrate, rather than oppose, the strengths of both traditions. In response, the social sciences gradually moved toward epistemological pluralism. New paradigms emerged not as alternative silos but as hybrid frameworks that sought to transcend the limitations of monolithic thinking.

### 2.2. A Promising Perspective

Recent developments in the philosophy of science and social theory have begun to destabilize this binary. Rather than abandoning one pole in favor of the other, several contemporary paradigms have worked toward their integration—thereby laying important groundwork for the adaptive epistemology proposed in this article. Paradigms such as critical realism, pragmatism, and transformative approaches offer hybrid epistemologies that seek to bridge objectivity and subjectivity, explanation and understanding in the attempt to transcend the binary opposition between positivism and interpretivism. Critical realism, as advanced by Bhaskar, accepts an objective reality but emphasizes the fallibility of our knowledge and the importance of social structures in shaping human agency [21,22]. This paradigm introduces the crucial idea that causal mechanisms operate beneath observable events—a notion that directly informs adaptive epistemology's concern with layered, emergent realities. In this sense, critical realism does not reject empirical rigor but reframes it within a more reflexive and socially embedded ontology. Reality, for Bhaskar, is real but knowable only through fallible human theorizing—a view that aligns with the recognition of deep structures and causal mechanisms rather than observable regularities alone. Pragmatism, with origins in the works of Peirce, James, and especially Dewey, also gained renewed prominence in social research. As extended by Morgan [23], pragmatism resists the dichotomy between qualitative and quantitative inquiry, advocating instead for methodological choices grounded in the practical consequences of research and the problems under investigation. It promotes methodological pluralism grounded in the utility of knowledge for solving real-world problems. Pragmatism focuses on the utility of knowledge and promotes methodological flexibility [24]. This emphasis on utility and context-sensitive inquiry aligns with the adaptive stance, which likewise treats methods as tools shaped by and responsive to changing sociotechnical environments. A further development is represented by the transformative paradigm, which situates epistemology within a framework of social justice, advocacy, and structural change. Pioneered by scholars like Mertens [25], this approach views research not merely as descriptive or explanatory but as interventionist and ethically engaged. By emphasizing power, voice, and representation, especially of marginalized communities, the transformative paradigm contributes to adaptive epistemology's insistence on inclusivity and ethical reflexivity in knowledge production. It invites attention to power, voice, and representation, particularly for marginalized communities. These paradigms paved the way for the systematic integra-

tion of mixed methods, seen as a pragmatic response to the limitations of monomethod research designs. These contemporary frameworks seek to integrate diverse ways of knowing by acknowledging that both quantitative and qualitative methods contribute essential insights. Such an integrated approach has underscored the increasing importance of mixed methods in social research—an approach that aims to integrate data and embrace multidimensional perspectives [26]. Far from being a mere technical choice, the integration of quantitative and qualitative strategies reflects an epistemological recognition that complex social realities require multiple, complementary ways of knowing. Mixed methods have thus become a key feature of adaptive epistemology, enabling researchers to navigate multidimensional problems without reducing them to singular explanatory models. The mixed methods approach, combining qualitative and quantitative strategies within a single coherent framework, became increasingly popular in response to the growing complexity of social phenomena in a dynamically evolving society and recognizes the value of methodological integration not for its own sake but as a means of grasping the multidimensionality of contemporary social issues. This approach exemplifies a dynamic posture: plural in theory, flexible in design, and responsive to the specificity of contexts.

Together, these integrative paradigms signal a profound response to the epistemic demands of a rapidly transforming society. In a society marked by acceleration [27], fluidity [28], and increasingly digital infrastructures [29], traditional paradigms rooted in static assumptions and linear causality fall short. The complexity of globalized life—characterized by interdependence, pluralism, and unpredictability—requires that researchers adopt epistemologies capable of learning, adapting, and evolving alongside the phenomena they study. Adaptive epistemology builds on this imperative by proposing not just a mix of methods but a shift in epistemic posture—one that is open-ended, iterative, and attuned to both human and non-human agencies shaping knowledge in the post-digital age.

### *2.3. When the Digital Age Came*

Historically, these paradigms have provided a framework for understanding social reality in a manner responsive to gradual societal changes. However, the pace of change accelerated dramatically with the advent of the internet and the exponential diffusion of digital infrastructures, which disrupted this slow evolution, ushering in a new epistemic condition.

The onset of the digital era has introduced an entirely new epistemic condition characterized by the ubiquity of digital infrastructures, the algorithmic mediation of social life, and the increasing autonomy of sociotechnical systems fundamentally reshaping how knowledge is produced, interpreted, and validated in contemporary social research.

The so-called *digital turn* marks a rupture not only in the objects of social inquiry but also in its ontological and epistemological foundations. As the digital became both a field site and a methodological apparatus, researchers began to confront the fact that platforms, algorithms, and user-generated data are not merely tools or outputs of social life but active participants in shaping social phenomena [29].

Rather than repeating earlier characterizations, this shift can be better understood as a transformation of epistemological categories themselves. Concepts such as causality, agency, and evidence are reconfigured under conditions of platform mediation and algorithmic logic. Researchers now harness digital methods that conceptualize the digital not only as an object of study but also as a methodological tool. Platforms, algorithms, and user-generated data are increasingly seen as integral to understanding contemporary social phenomena [30]. This shift has led to the consideration of digital data as the product of users' active engagement as well as passive digital traces—challenging traditional epistemologies and inviting new methodological approaches [31–34]. It is in this

context—not simply due to data abundance but because of structural and ontological shifts—that the digital turn marks an epistemic rupture. The proliferation of digital data, the increasing centrality of platforms, and the algorithmic mediation of social interactions have redefined both the objects of study and the means by which they can be accessed and interpreted, while simultaneously transforming the very architecture of knowledge production in highly mediated environments [32]. Digital methods emerged as a response to this shift, emphasizing the use of digital traces, platforms, and data for studying social phenomena. Here, digital content is increasingly produced through the interaction between users and automated systems, generating what Rogers calls *natively digital* data—artefacts that are born within digital environments, structurally shaped by the platforms through which they circulate [33]. Yet, these methods often favored technical efficiency and scalability over deep epistemological reflection. In doing so, they risk reducing complex sociotechnical processes to quantifiable patterns, without interrogating the embedded assumptions and values that shape such data. The epistemic horizon was gradually emptied of its foundational assumptions, as smart methods conceptualized the digital simultaneously as a field site, a methodological tool, and an analytical object [34].

This reconceptualization necessitated a rethinking of the epistemological grounds of research. If traditional paradigms emphasized stable, observable objects of inquiry, the digital condition destabilized these notions, presenting instead dynamic, co-produced, and often opaque processes as the primary units of analysis. Digital methods, initially introduced to navigate the abundance of web-based data, thus evolved into a broader methodological movement that integrates digital tools, traces, and environments as both sources and sites of knowledge [33]. Yet, as Marres warns, the expansion of digital methods must be accompanied by a critical epistemology that does not take digital infrastructures for granted but instead interrogates their affordances, limitations, and embedded assumptions [32].

Indeed, the emergence of *platform society*—a term coined by Van Dijck, Poell, and de Waal [35]—has intensified the urgency of such a reevaluation. As platforms such as Google, Facebook, TikTok, and Amazon become the primary mediators of information, interaction, and access, they transform the logics of visibility, participation, and meaning-making. These platforms do not merely reflect social processes; they algorithmically shape them, introducing new forms of power, hierarchy, and inequality [35]. The epistemic consequences are profound; what is knowable, for whom, and under what conditions is increasingly governed by the proprietary logic of platform capitalism [36].

Sociological theory has responded to these developments by extending the conceptual toolkit of social science. Latour's actor–network theory (ANT) was among the first to emphasize the agency of non-human actors, arguing that knowledge production must be understood as the outcome of distributed networks of human and non-human entities [37]. This line of thought has inspired a wave of *post-human* and *material-semiotic* approaches that challenge anthropocentric assumptions and advocate for a flat ontology of research assemblages. ANT's emphasis on relationality, materiality, and the instability of boundaries between humans and artefacts directly anticipates the challenges posed by digitally mediated environments.

Simultaneously, scholars such as Deborah Lupton [34] and Sarah Pink [38] have highlighted how digital technologies mediate everyday life in embodied, affective, and situated ways, calling for *digitally reflexive* and *immersive* methods that go beyond data scraping and statistical modelling. Halford and Savage [39] further argue for a reflexive sociology of data, where digital traces are not naïvely taken as reflections of reality but interrogated for their performativity, politics, and partiality.

In response to these overlapping critiques and innovations, digital epistemology has emerged not simply as a technical development but as a paradigmatic orientation. It is con-

cerned with understanding how knowledge is shaped in and through digital environments. It seeks to bridge epistemological reflection with empirical innovation by addressing the methodological implications of working within data-intensive, algorithmically curated, and platform-governed research contexts [34]. From critical data studies to platform studies, this emerging horizon has prompted researchers to reconceive fundamental categories—such as data, agency, observation, and participation—within sociotechnical frames.

In this context, traditional epistemological distinctions are increasingly destabilized. Digital platforms simultaneously serve as field sites, data repositories, and methodological tools, blurring the boundaries between subject and object, data and context, observer and observed. Researchers now engage with data that is algorithmically filtered, user-generated, and often co-constructed through human–machine interactions, demanding new frameworks for understanding agency, reflexivity, and validity in research [40].

These conditions make visible the need for a new epistemological posture—one that is neither wholly constructivist nor positivist but reflexively attuned to the hybrid nature of knowledge production in digital environments. The convergence of these developments suggests that the social sciences are undergoing a paradigmatic recalibration. No longer anchored in human-centric models of knowledge, researchers must now grapple with *hybrid realities*—assemblages of users, algorithms, interfaces, and infrastructures—that demand pluralistic, adaptive, and critically reflexive epistemologies. The task is not simply to integrate digital tools into existing frameworks but to reconceptualize the very nature of inquiry in a world where non-human actors increasingly shape the conditions of social life.

Understanding these paradigm shifts is not merely an academic exercise—it is a critical step toward reimagining the role of social research in the contemporary world. As our social realities become increasingly complex, interconnected, and technologically mediated, the epistemic foundations of research must evolve accordingly. The paradigmatic lens, thus, remains essential for navigating the changing contours of knowledge production, offering both a map of where we have been and a compass for where we must go.

## 3. From the Digital Turn to the Post-Digital Condition: Epistemology, Generative AI, and the Reconfiguration of Social Research

Such an evolution calls for a reframing of social research from within, acknowledging that knowledge is no longer produced in isolation from the sociodigital systems in which both researchers and participants are embedded. As social phenomena become increasingly co-constructed across human and algorithmic agents, epistemological reflection must keep pace—not only to understand the world but also to equip social science with the tools to engage with it meaningfully and ethically.

In the contemporary epistemic landscape, we are witnessing the emergence of what scholars increasingly refer to as the *post-digital condition*—a sociotechnological reality in which digital infrastructures, algorithmic systems, and sociotechnical agents are no longer seen as external, supplementary tools but are deeply embedded in the fabric of everyday life, institutions, and systems of knowledge production [41]. The post-digital is not merely a chronological successor to the digital era but denotes a saturation point where digital technologies, platforms, and sociotechnical artefacts have become infrastructural and ubiquitous, shaping not only the modalities of interaction and expression but also the very epistemological foundations of how we understand the social world [42].

Rather than representing a shift in technological stages, the post-digital condition signals a transformation in the epistemic infrastructure of research, where digital environments are internal to the very processes through which knowledge is constituted, validated, and circulated.

This transformation marks a *new epistemological revolution*—one in which the rise of generative artificial intelligence (AI) fundamentally reorients the way social scientists conceptualize knowledge production. In traditional paradigms, whether rooted in qualitative, quantitative, mixed, or even digital methods, the foundational task of epistemology was to provide adequate answers to socially emergent questions [43]. The question driving scientific inquiry was: *How do we make sense of the social world and its processes*? In the age of generative AI, this directionality is inverted. The production of knowledge now begins with the ability to formulate optimal, strategic, and reflexive questions—not merely to discover existing truths but to co-construct interpretive frameworks through interaction with computational systems capable of producing probabilistically generated knowledge flows [44].

In this context, the direct connection between researcher and phenomenon becomes increasingly mediated by platform logics, algorithmic filters, and automated interpretive models [30]. Research environments are no longer neutral spaces for observation but dynamic configurations in which meaning is operationalized through multilayered systems of mediation. Meaning is not passively extracted from reality but actively composed through generative processes, echoing the epistemological reconfigurations introduced by theories of situated knowledge [3] and actor–network theory [37]. As Barad [5] suggests, knowledge does not pre-exist independently from the apparatus that generates it; rather, it emerges through *intra-actions* between agents, environments, and epistemic tools. In the case of generative models, the process is cumulative and mosaic-like: *standing on the shoulders of giants* [45], as Newton famously stated, the AI builds interpretive scaffolding from massive corpora of human-generated data, recombining it to produce new insights that are contextually tailored. However, this recursive dynamic also introduces a significant epistemological shift: the data generated by generative AI systems are not neutral reflections of reality but artifacts of iterative interactions between human and non-human agents. Over time, these interactions contribute to a feedback loop in which the boundaries between original knowledge production and synthetic generation become increasingly blurred, challenging conventional distinctions between empirical observation and automated synthesis.

The emergence of generative artificial intelligence (AI) has introduced epistemic rupture. These technologies not only expand the repertoire of research instruments, enabling novel forms of data collection, coding, and synthesis but also *challenge the foundational assumptions of human-centric inquiry*. The capacity of generative AI to autonomously generate content, identify patterns, and simulate interpretive work complicates the researcher's role and calls for an urgent reconsideration of epistemic authority and methodological ethics [46,47]. Unlike previous methodological tools, generative AI is capable of ingesting diverse sources, learning from massive datasets, and producing outputs that transcend the researcher's predefined frameworks. In doing that, generative artificial intelligence (AI) becomes digital agents that not only supplement human inquiry but also challenge the process of knowledge attribution and selecting data, thereby expanding the analytical possibilities in unanticipated ways [46]. Therefore, social scientists need to reconsider the epistemological status of non-human agents in knowledge production. The *epistemology of the non-human technological actor* refers to the processes through which intelligent systems not only mediate but actively participate in the co-construction of meaning, decisions, and epistemic trajectories [48,49]. As AI systems increasingly demonstrate autonomy in pattern recognition, content generation, and inferential reasoning, they transition from mere tools to epistemic partners—entangled in the very fabric of interpretive processes [49,50]. This challenges the anthropocentric foundation of traditional epistemology, demanding a reconceptualization of the human researcher's role not as sole originator of inquiry but as part of a hybrid assemblage of cognition and sense-making [4,51]. The increasing

pervasiveness, indistinguishability, and symbiotic interaction between generative AI and human researchers calls for an epistemological reconciliation—a dialogical negotiation between human interpretive intentionality and machinic generativity. This convergence does not dilute human agency but reframes it in terms of reflexivity, stewardship, and ethical co-design within evolving technosocial ecosystems. Recognizing AI as a situated epistemic actor foregrounds the urgency of developing critical, adaptive frameworks that navigate the epistemic interdependencies between human and non-human agents [40].

This shift poses a fundamental *challenge to the role of the researcher* in society. In traditional research paradigms, scholars positioned themselves as observers, interpreters, or explainers of social phenomena, often assuming a neutral or objective standpoint. However, the current epistemological condition, characterized by algorithmic mediation, platformization, and generative artificial intelligence, destabilizes these assumptions and demands a more reflexive and participatory stance [32]. As Haraway [3] famously argued in her call for situated knowledge, all knowledge is produced from a particular standpoint, and recognizing the researcher's embeddedness is crucial to ensuring epistemic integrity. The human agent is no longer the sole interpreter of meaning but becomes a *designer of epistemic contexts*, curating the prompts, constraints, and ethical boundaries within which meaning is generated [40]. This necessitates renewed reflection on the *positionality* of the researcher—not only as an observer but as a co-constructive participant in knowledge systems increasingly shared with non-human agents [32]. Such a reframing of positionality is not a theoretical embellishment but a methodological imperative. Researchers operate within sociotechnical ecosystems that both enable and constrain their access to knowledge. Data is no longer "out there" waiting to be discovered; it is generated, filtered, and structured through platform logics, algorithmic recommendations, and infrastructural constraints [34]. It also raises critical questions about the *nature of data*: in the post-digital environment, data is no longer a neutral, extractable artifact but an entangled outcome of interactions between users, platforms, and algorithms [51]. In this view, data must be treated not as a fixed object but as a product of dynamic relations—encoded, contextualized, and often contested. Thus, in post-digital research environments, the emphasis must shift from data as a static informational object to data as a *processual, relational, and meaning-laden entity*.

Consequently, the dichotomy between *extractive and participatory methods* becomes a central axis for reconsideration. Traditional methods often prioritized the passive collection of data with *extractive research models*, which treat participants and digital environments as sources of data to be mined, often without full transparency, accountability, or engagement. Instead, scholars increasingly advocate for *participatory approaches* that frame research as a process of co-construction between the researcher, the researched, and the platforms that mediate their interactions—emphasizing shared agency, mutual learning, and situated knowledge practices [52]. Participatory digital methods—ranging from co-creative elicitation to platform ethnography and data donation frameworks—allow participants to contribute to the design, interpretation, and contextualization of research processes [53]. This reorientation is not only ethically grounded but also epistemologically robust, as it recognizes the distributed nature of knowledge production in sociodigital systems. This aligns with the growing recognition that knowledge production in digital societies is not only about the volume or structure of data but about the semantic architectures, communicative dynamics, and sociotechnical assemblages through which meaning circulates [33]. As Lupton [34] argues, the challenge of digital sociology is not just to capture digital traces but to interpret how they are constructed, mediated, and experienced in real-time sociotechnical systems. Within this framework, generative models emerge as epistemic collaborators rather than mere analytical instruments. Their epistemic value depends on how they are trained, prompted, and evaluated by researchers embedded in evolving platform ecologies.

Moreover, the *models of analysis* used in social research must evolve to reflect the complexity of contemporary data environments. Traditional static models are increasingly insufficient for making sense of high-volume, high-velocity, and high-variety data. Instead, *computational and generative models*, including those based on machine learning and large language models, offer new ways to capture dynamic patterns, emergent behaviors, and multilayered meanings [46]. These tools, however, are not neutral. They must be critically trained, interpreted, and situated within reflexive research frameworks that prioritize openness, inclusivity, and responsiveness over control and closure [54].

In this regard, meaning production in digital environments depends not solely on the data itself but on the semantic architectures and communicative dynamics through which data is framed, circulated, and reinterpreted. As Rogers [33] argues, methods should not merely be "digital in context" but must become "digital in practice"—capable of engaging with the affordances, biases, and infrastructural conditions of digital life. In platform-mediated spaces, the researcher is no longer the exclusive source of analytic meaning; they are part of a broader assemblage of human and non-human actors—including algorithms, interfaces, user behaviors, and institutional protocols—that co-produce knowledge [37].

According to all these premises, we must reconsider the role of the researcher and the meaning of knowledge itself. The researcher is no longer the sole arbiter of methodological choices and interpretive frames. Instead, they must now collaborate with digital actors that possess a degree of generativity and adaptivity previously unseen. The challenge lies not only in mastering these tools but in reimagining epistemology as adaptive and reflexive in nature.

This paradigm shift signals the need for an epistemic frame capable of navigating a landscape in which humans, machines, and data co-construct social meaning. Such a frame must be both analytically rigorous and contextually responsive, capable of evolving alongside the systems it seeks to understand. This entails abandoning rigid, preconfigured paradigms in favor of mosaic-like frameworks that assemble interpretive strategies on the basis of evolving contexts and stakeholder engagements. In doing so, social research can reclaim its relevance not only by describing the world as it is but by shaping the questions through which new understandings emerge. In the post-digital condition, it is not just what we know that matters but how we ask, for whom we ask, and under what sociotechnical conditions our knowledge is produced: the epistemic future of social research will depend not only on methodological rigor but on epistemic agility, ethical sensitivity, and a renewed capacity to ask generative, context-aware, and better questions, which may, in turn, create new worlds of understanding.

## 4. Adaptive Epistemology: Paradigmatic Shift Toward a Generative Framework

As it was argued, the current expansion of generative technologies marks a profound epistemological rupture, compelling the social sciences to revisit their foundational assumptions about how knowledge is produced, validated, and applied. As AI—and especially generative models—becomes increasingly integrated into research practices, it no longer suffices to update methods or adopt new tools. Rather, researchers must confront an ontological shift: the *agentic capacity of non-human actors* in the process of knowledge generation. In this emerging ecosystem, the traditional role of the researcher as the sole arbiter of meaning is disrupted by AI systems capable of autonomous pattern recognition, hypothesis suggestion, and even synthetic theorization [55]. These developments signal a new paradigmatic shift that cannot be confined within the epistemic boundaries of existing models such as positivism, interpretivism, or even pragmatic pluralism. Instead, what is

urgently required is the formulation of a new epistemological stance—one we may call *adaptive epistemology*.

This paradigm recognizes the sociotechnical entanglement of human and non-human agents in the co-production of knowledge. In the adaptive epistemological framework, knowledge is not fixed or merely triangulated; it is dynamically generated through interactions across multiple systems and actors. The distinction between data collection, analysis, and interpretation becomes blurred, as AI systems simultaneously perform these functions.

Adaptive epistemology conceptualizes knowledge as a dynamic, reflexive, and co-constructed process in which both human and non-human agents participate in the formulation of inquiry, interpretation, and sense-making. This orientation extends beyond earlier models that integrated quantitative and qualitative perspectives (e.g., mixed methods) by embedding responsiveness into the epistemological core. In contrast to paradigms that view knowledge production as bounded by static frames, adaptive epistemology recognizes the fluidity of digital environments and the algorithmic infrastructures that shape what can be seen, said, and studied [10]. AI systems, in this sense, are not just tools for analysis but epistemic collaborators, reconfiguring what counts as data, what questions are askable, and which answers are intelligible [54].

This shift also challenges the traditional processes of selecting sources, defining frames, and narrowing analytical scope. Generative models, by their very nature, operate through expansive combinatorics, surfacing unanticipated correlations, perspectives, and thematic clusters that would be difficult to obtain through human analysis alone [56,57]. This capacity revitalizes earlier calls for triangulation [58], not merely by combining diverse methods but by enabling the *generation* of epistemic alternatives that deepen understanding and expand interpretive horizons. It echoes and extends the epistemological ambitions of digital methods [33], platform studies [35], and actor–network theory [38], which already foregrounded the co-constitutive nature of sociotechnical assemblages.

Although adaptive epistemology echoes the ambitions of early mixed methods research—triangulation, integrative analysis, methodological pluralism—it expands them by introducing an additional layer: the *imperative of adaptivity* as *follow the generativity*. Within this framework, researchers and digital agents collaborate in constructing hybrid conceptualization and framework that will be fluid, complex, and multiprocessable. This approach not only bridges the gap between traditional and digital methods but also honors the early ambitions of mixed-methods triangulation by continuously adapting to the dynamics of the digital environment [33]. Knowledge production becomes a process of ongoing negotiation, recalibration, and contextual alignment. It calls for a renewed attention to epistemological reflexivity and a deeper engagement with the ethical, political, and ontological implications of delegating cognitive labor to digital agents.

Still, the adaptive epistemology framework is not without tensions. Its strengths lie in its capacity to mirror the complexity, speed, and non-linearity of contemporary social life. It permits research designs to remain sensitive to the emergent properties of digital phenomena and acknowledges the entangled agency of both human and algorithmic actors. Yet, the very fluidity that defines adaptive epistemology also entails risks: epistemic overstretch, loss of focus, and difficulties in standardizing procedures for replication, validation, and comparison. Moreover, the interpretive work required to translate generative outputs into sociological meaning necessitates higher reflexive awareness and transdisciplinary expertise [32].

At this historical juncture, the social sciences stand at a threshold. The post-digital condition, shaped by datafication, platformization, and generativity, compels scholars to rethink not just how we research but why, with whom, and toward what ends. The boundaries between methodological innovation and epistemic transformation have collapsed,

exposing the inadequacy of disciplinary silos and traditional paradigmatic binaries. Therefore, the time is ripe to advance a new theoretical–paradigmatic reflection, one capable of reconciling the *discontinuous accelerations of technological change* with the *continuity of sociological imagination*.

The transformation of society—its infrastructures, interactions, and imaginaries—demands equally transformative windows of interpretation. An adaptive epistemology offers a framework that is not only responsive to change but generative of new modes of knowing, attuned to both complexity and contingency. As the line between subject and object, method and medium, researcher and algorithm becomes increasingly blurred, social research must rise to the challenge with a renewed commitment to critical, inclusive, and agile paradigms of knowledge. As social researchers, we must respond to this challenge by reclaiming the epistemological ground that underpins our work, not in opposition to technological advances but in critical engagement with them. Only by doing so can we ensure that the future of social inquiry remains grounded in meaningful, responsible, and adaptive modes of knowing.

### *4.1. Toward Empirical Applications of Adaptive Epistemology*

While this contribution has primarily advanced a theoretical elaboration of adaptive epistemology, its implications are far from abstract. In fact, adaptive epistemology offers a heuristic lens to make sense of contemporary empirical contexts where knowledge is increasingly produced through sociotechnical entanglements. Future research may concretely operationalize this framework through empirically grounded case studies that explore how generative AI technologies are already reshaping practices of inquiry, interpretation, and knowledge production in real-world settings.

For instance, adaptive epistemology may guide mixed-methods investigations into how algorithmic outputs influence decision-making in welfare systems or consumer behaviors, such as the automated allocation of social benefits based on predictive analytics in public administration [59], or the personalization of e-commerce interfaces that shape consumer choice and identity performance [60]. It may also inform qualitative analyses of how AI-mediated interactions transform narrative structures in online communities—for example, in fan fiction spaces where GPT-based bots co-author texts with users [61], or in the rise of live-selling practices, where micro-influencers use generative filters and recommendation algorithms to blend entertainment, commerce, and identity signaling [62].

Similarly, ethnographic work in digitally augmented classrooms or laboratories could explore the situated co-construction of knowledge between human agents and generative systems, mapping the epistemic agency of both [49]. A relevant example is the use of AI tutoring systems in STEM education, where students adapt their learning strategies in response to algorithmic feedback loops, creating hybrid pedagogical ecologies [63]. Such research could illustrate how epistemic roles shift dynamically across human–machine interactions and how adaptive reflexivity becomes essential for ensuring interpretive coherence.

This epistemological orientation lends itself particularly well to empirical inquiry in contexts marked by uncertainty, multiplicity, and rapid innovation—such as participatory policy design, platform governance, risk communication, and data activism [32,64]. For example, citizen science platforms increasingly rely on algorithmic infrastructures to collect, validate, and visualize environmental data, requiring researchers to co-design data pipelines with lay participants and AI systems alike [65]. Integrating adaptive epistemology into such empirical efforts may help to trace not only the outcomes of generative processes

but also the infrastructural, ethical, and relational conditions under which such outcomes are rendered to valid or socially actionable [40].

In doing so, social researchers are invited to develop methodological protocols capable of capturing epistemic hybridity—not as a methodological anomaly but as a constitutive feature of knowledge in the post-digital era [66]. This includes, for instance, the co-design of participatory prompt engineering sessions where communities reflect on how AI-generated content reflects or distorts their lived experiences [67], or the integration of platform ethnography with critical code studies to interpret how backend logics shape visible meaning structures [68].

### 4.2. Toward a Distinctive Epistemological Framework

While the concept of adaptive epistemology is indeed resonant with well-established paradigms such as actor–network theory (ANT), post-humanism, and contemporary pragmatism—particularly in its attention to co-construction, hybridity, and reflexivity—it does not merely reiterate these approaches. Instead, it offers a distinct *epistemological configuration* that is specifically designed to grapple with the challenges posed by generative, probabilistic, and feedback-intensive AI systems in contemporary digital societies.

What distinguishes adaptive epistemology is its programmatic orientation; it is not only an ontological or theoretical stance but a meta-epistemological framework that offers a method for epistemic recalibration in the face of rapid and recursive transformation. Unlike ANT, which traces associations and the relationality of actors in sociotechnical networks [37], adaptive epistemology focuses on how epistemic agents (human and non-human) evolve their interpretive strategies in real time, in response to shifting affordances, platform logic, and generative uncertainty. It does not simply describe entanglements—it foregrounds how knowledge practices themselves must adapt to remain epistemically valid and socially actionable.

Similarly, while post-humanist approaches [51,52] foreground the decentering of the human subject and the distributed nature of agency, adaptive epistemology offers *a situated heuristic for decision-making and methodological design* in environments saturated by generative computation. It is not content with asserting hybridity—it asks: *how should knowledge practices change, and how can they do so iteratively, given the constant feedback between users, models, and infrastructures?*

Contemporary pragmatism, particularly in its Deweyan and post-Deweyan forms [69], certainly aligns with adaptive epistemology in valuing inquiry as a situated, experimental, and socially responsive process. However, adaptive epistemology moves beyond the pragmatist notion of problem-solving in static social fields to address *epistemic environments characterized by continuous, automated reconfiguration*. This is particularly crucial in generative AI systems, where the boundaries of a research object—and even the ontological status of data—can shift mid-process. Adaptive epistemology, therefore, is not merely a philosophical disposition but an *operational strategy* for *tracking, reorienting, and ethically modulating* knowledge production in recursive sociodigital ecosystems.

Adaptive epistemology is not intended to replace established paradigms such as pragmatism, post-human epistemologies, or actor–network theory (ANT). Instead, it aims to critically synthesize these perspectives in light of the epistemological transformations introduced by generative AI and post-digital environments.

The original contribution of adaptive epistemology lies in three key aspects:

1. *Its projective and anticipatory dimension*: While existing paradigms often focus on the observational or interpretive moments of inquiry, adaptive epistemology foregrounds the researcher's capacity to design epistemic contexts within hybrid human–machine

environments—highlighting their active role in curating the prompts, constraints, and ethical boundaries within which meaning is generated.

2. *The generative performativity of non-human systems*: Moving beyond frameworks that trace associations (as in ANT) or focus on situated action (as in pragmatism), adaptive epistemology positions computational generativity as a fully fledged epistemic agent—one that produces scenarios, hypotheses, and semantic constructs through probabilistic rather than solely interpretive logics.
3. *The notion of knowledge as a dynamic cognitive ecology*: While post-humanism and ANT emphasize the symmetrical relations between human and non-human actors, adaptive epistemology foregrounds the systemic dynamism of these relations. It insists on the need for epistemic agility—methodological responses that are context-sensitive, open-ended, and capable of recombining interpretive strategies based on evolving publics, uses, and infrastructures.

Adaptive epistemology is not offered as a radical rupture from existing traditions but as an integrative and forward-oriented framework that responds to a new epistemic condition. Its novelty lies in its capacity to synthesize and mobilize insights from diverse traditions—ANT, post-humanism, pragmatism—while proposing *an epistemic grammar for action* under conditions of algorithmic indeterminacy, infrastructural opacity, and semantic fluidity. Adaptive epistemology could be framed not as an abstract alternative but as a *flexible epistemic orientation* designed to address the emerging knowledge challenges of social research in generative AI ecologies. It enables social scientists to not only interpret how meaning is co-constructed but to intervene—reflexively, iteratively, and methodologically—in the very architectures through which meaning is now made.

## 5. Conclusions: From Reframing to Reconstructing Knowledge in Post-Digital Social Research

This article has sought to lay the groundwork for an adaptive epistemology—a theoretical and methodological orientation attuned to the shifting conditions of knowledge production in the post-digital era. While the notion of adaptivity is not without precedent, its articulation here builds on and distinguishes itself from prior theoretical frameworks by integrating insights from *sociotechnical systems theory* and the *philosophy of action*. These dimensions, which were initially underdeveloped, are now brought into sharper focus to strengthen the epistemological coherence and operational relevance of the framework.

From the standpoint of *sociotechnical systems theory*, adaptive epistemology foregrounds how epistemic outcomes are produced not merely through individual cognition or discourse but through the assemblage of technological infrastructures, algorithmic procedures, institutional logics, and human practices [70,71]. This perspective highlights the co-constitutive role of platforms and generative AI systems in shaping how data is produced, filtered, interpreted, and valorized. Knowledge, therefore, is not merely situated—as in Haraway's [3] epistemology—but also infrastructurally entangled and dynamically conditioned by evolving technical ecologies [72]. Adaptive epistemology offers a way to study these hybrid epistemic configurations in situ, tracing how agency is distributed and how epistemic validity emerges from interactional and platform-mediated dynamics.

Simultaneously, insights from the *philosophy of action*—particularly as developed in pragmatist and practice-based approaches [73–75]—reframe the role of the researcher as an epistemic agent who does not simply observe or interpret but designs, configures, and curates the parameters of inquiry. In this view, knowledge production is not an end state but an ongoing, reflexive engagement shaped by purposive actions, situated constraints, and ethical commitments. The researcher becomes a "designer of epistemic contexts" [76], negotiating the conditions under which knowledge is rendered actionable and account-

able in digitally mediated environments. This reconceptualization has direct methodological implications, especially for fields like platform studies, digital sociology, and AI-assisted ethnography.

One of the central epistemological contributions of this paper lies in its reinterpretation of the research process itself in the age of generative AI. While scientific inquiry has always been iterative, adaptive epistemology proposes that the advent of generative models marks a radical intensification—if not a reversal—of traditional inquiry logics. In contrast to paradigms that emphasize the discovery of truths through hypothesis testing or data extraction, adaptive epistemology posits that the most critical and generative activity lies in the *construction of questions*—questions that are strategically formulated, computationally optimized, and ethically reflexive, in the logic of prompt construction. This shift aligns with and extends pragmatist theories of inquiry [73,77] but reframes them for environments in which *non-human agents co-author epistemic trajectories* through probabilistic reasoning, large-scale pattern recognition, and iterative feedback mechanisms [58,78].

In integrating these dimensions, adaptive epistemology not only synthesizes but extends existing paradigms—including actor–network theory, pragmatism, and post-humanism—by operationalizing them in relation to contemporary AI systems, platform infrastructures, and post-digital research environments. It provides a framework for empirically examining how epistemic authority, validity, and interpretation are collaboratively shaped across human–machine entanglements. This orientation is particularly critical in domains such as participatory policy design, data activism, platform governance, and education, where social meaning is increasingly co-constructed through complex sociotechnical dynamics [7,79,80].

Ultimately, adaptive epistemology is neither a wholesale rejection of existing frameworks nor a mere repackaging of familiar themes. Rather, it offers a re-specification of epistemological inquiry that is attuned to the generative, reflexive, and infrastructural conditions of knowledge in the post-digital condition. By embracing epistemic agility, ethical reflexivity, and strategic question design, adaptive epistemology equips social researchers to not only interpret the world but to co-create new modes of knowing that are responsive to rapidly evolving technological, cultural, and political realities. In this light, the challenge for future research is not only to ask better questions but also to build the sociotechnical architectures through which more just, plural, and meaningful forms of knowledge can emerge.

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