The Crisis of Scientific Objectivity in Ultra-Specialized Knowledge Regimes

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Abstract

This article examines the epistemological and ontological consequences of ultra-specialization in contemporary science. We argue that the increasing fragmentation of knowledge undermines intersubjective intelligibility, producing a form of objectivity detached from shared meaning and ontological resistance. Drawing on Kantian and phenomenological traditions, particularly the works of Husserl and Bachelard, we show that ultra-specialization leads to a redefinition of the scientific object as a procedural artifact rather than a point of rational encounter. We introduce the distinction between the intentionality of the scientist and the systemic intention of science, highlighting the dissociation between epistemic agency and formalized knowledge production. This condition generates cognitive opacity, institutional technocracy, and political distrust. In response, we propose structural reforms: deep interdisciplinarity, reintroduction of philosophical reflection within scientific practice, and the creation of epistemic translation platforms. Ultimately, we advocate for a pluralistic and reflexive model of science grounded not in technocratic closure but in the intersubjective articulation of reality. Science must not only produce valid results—it must make them intelligible and meaningful.

1. Introduction

In contemporary science, the ever-increasing specialization of research fields has generated unprecedented advances in technical problem-solving. Yet this process

has also brought about a growing crisis of intelligibility. As knowledge fragments into ever narrower domains, the possibility of maintaining a unified perspective on scientific practice—and of engaging in critical discourse across disciplinary boundaries—appears increasingly remote. What emerges is a paradoxical form of objectivity without intersubjectivity: claims validated by rigorous internal standards, yet inaccessible to any epistemic community beyond the narrow confines of their origin. This situation poses a philosophical problem of the first order. If science is to remain a collective enterprise grounded in rational justification, its claims must not only be correct within their domain, but also intelligible and revisable across domains. When no individual—nor even any community—can oversee the epistemic structure of a result, what remains of the ideal of public reason?

In this article, we explore the epistemological and ontological consequences of ultra-specialization in contemporary science. Drawing on resources from Husserl (1936), Bachelard (1934; 1940), and recent work in social epistemology and philosophy of science (Kitcher 2011; Chang 2012), we argue that the fragmentation of knowledge has led to a dislocation of scientific objectivity. We characterize this dislocation as a shift from collective justification to procedural opacity, and we analyze the consequences of this shift for the normativity, authority, and intelligibility of scientific discourse.

Rather than merely lamenting this development, we propose a conceptual framework for understanding it. We distinguish between the intentional structure of the scientist (as an agent of inquiry) and the formalized intention of science (as a system of practices). This distinction allows us to trace how epistemic goals become distorted under hyper-specialization, and why the objectivity of science risks losing its ontological grip.

2. Epistemology of Ultra-Specialization

The 20th and 21st centuries have witnessed an unprecedented expansion of scientific subfields, leading to a condition that may be termed ultra-specialization: a state in which the internal complexity of each domain renders its epistemic content unintelligible outside its boundaries. This specialization is not merely a practical division

of labor; it is a structural transformation in the very architecture of knowledge, one that reconfigures the relationship between expertise, validation, and justification.

The traditional epistemic ideal of science—stretching from Kant's regulative use of reason to Popper's falsifiability—is based on the assumption that scientific claims are, in principle, accessible to rational adjudication by a community of peers. However, when the content of a scientific statement becomes inseparable from the mastery of a vast, domain-specific formalism, this ideal breaks down. As Kitcher (2011) notes, the authority of modern science increasingly relies on the trust in institutions, rather than on the transparency of epistemic procedures.

This produces what may be called a diaspora of formal systems: each subfield elaborates its own models, its own mathematics, its own ontological commitments, and its own experimental infrastructure. These formalisms often develop without cross-verification, producing zones of epistemic opacity. As Chang (2012) argues, this state undermines the epistemic pluralism necessary for scientific self-correction, and fosters a technocratic model in which validation is internal to specialized communities, yet inaccessible to general scrutiny. Bachelard already anticipated this tension in his concept of "epistemological obstacles" (Bachelard 1938). He showed that scientific progress is discontinuous, marked by ruptures and reconfigurations of meaning. But what he could not foresee is that these ruptures would cease to be collectively traversable: the epistemic subject is no longer humanity or even a disciplinary community, but a fragmented constellation of micro-competences, each producing claims that exceed the grasp of shared rationality.

This condition is not a sign of epistemic failure but of transformation. Yet it raises critical questions: What remains of objectivity when the justification of a result is opaque to all but a handful of insiders? And how can scientific authority maintain legitimacy when it no longer functions as a space of intersubjective deliberation?

3. The Crisis of Scientific Objectivity

Scientific objectivity has long been anchored in its intersubjective legitimacy—the notion that claims can, in principle, be evaluated and validated by any rational subject

embedded in a shared epistemic space. This ideal, traceable to Kant's transcendental philosophy (Kant 1787) and developed by logical empiricists in the 20th century, positions the object of science as something public, stable, and reproducible across conceptual frameworks. However, the rise of ultra-specialization destabilizes this structure. Scientific objectivity no longer denotes a common grasp of the object, but rather a formal trace embedded within disciplinary procedures. The object becomes technically verifiable but ontologically inaccessible—what we might call an "indexed verification artifact," detached from a shared ontological referent. This shift aligns with Husserl's warning in *Krisis* that science risks becoming a "technique of empty formalism" disconnected from the lifeworld (Husserl 1936).

Where classical objectivity required the constitution of an object by a subject through conceptual forms, contemporary science often bypasses this process via automated instrumentation, algorithmic modeling, and uninterpreted data pipelines. As a result, what is called an "object" may be no more than a stabilized output within a formal framework whose internal consistency substitutes for ontological grounding. In this way, objectivity is conflated with procedural stability, and the intentional act of constitution—so central to Husserlian phenomenology—is replaced by functional reproducibility. This is not merely a technical concern. The ontological status of the object is being redefined: it no longer stands as that which resists and conditions our conceptual grasp, but as that which emerges from a closed system of procedural validation. The object becomes the output of the scientific apparatus, not its anchor. As such, objectivity is no longer a marker of shared access to the real, but an epistemic placeholder within specialized enclaves.

The consequence is a profound epistemic estrangement: the scientific object loses its capacity to act as a point of reference for collective meaning and critique. It ceases to be a site of confrontation between theory and experience, and becomes a sealed product of disciplinary formalisms. This transformation raises a crucial philosophical question: Can objectivity survive without ontological resistance?

4. Scientific Intention vs. Scientist's Intention

The transformation of scientific objectivity under ultra-specialization is not only epistemic or ontological—it is also intentional in a deep philosophical sense. What is at stake is the disjunction between the intention of the scientist as an agent of inquiry, and the intention of science as an institutional and procedural system. This split generates a condition in which the subject of science no longer controls, nor fully understands, the meaning of what is produced in their name. In classical epistemology, particularly in Kantian and phenomenological traditions, intentionality refers to the directedness of consciousness toward objects of thought. In the scientific context, this means that a scientist's activity is meaningful insofar as it is guided by a conscious relation to a problem, a hypothesis, or a phenomenon. However, in the contemporary structure of science, the systematization of procedures and delegation to technical infrastructures leads to the automation of epistemic intention: the system acts, verifies, and validates, while the individual scientist may merely operate within formal constraints they do not fully comprehend or master.

This process can be described as a depersonalization of epistemic agency. The scientist becomes a functional node in a broader apparatus of publication, funding, and methodological repetition. As Mirowski (2011) argues in his critique of neoliberal science, the intentional horizon of the researcher is absorbed into institutional imperatives: productivity metrics, methodological orthodoxy, and the logic of technocratic validation. The result is that the act of knowledge is no longer situated within a coherent subjective intentional arc; it is dispersed across fragmented procedures. Moreover, the intention of science—that is, the systemic directionality of research practices—becomes decoupled from philosophical or existential reflection. It is governed by technological imperatives, algorithmic optimization, and grant-driven agendas. This leads to a subtle but critical shift: scientific outputs are produced without being truly willed, and therefore without bearing the full responsibility of intention. The scientist may execute a method successfully while lacking any ontological commitment to the meaning of the result.

This is not merely a sociological fact—it is a philosophical rupture. It transforms the act of knowing from an encounter with the real into a compliant performance within a

technical regime. In this rupture, the intentionality that once grounded objectivity is replaced by procedural reproducibility, and the capacity of science to articulate truth is replaced by its capacity to produce consistency. In such a condition, the subject of science is no longer an agent of meaning, but an executor of protocols. The intentional fracture between the person and the system is thus the existential counterpart to the ontological weakening of the object. The crisis is not merely epistemological—it is anthropological.

5. Epistemic Consequences: Authority and Normativity

The disjunction between scientific intention and the scientist's intention, coupled with the loss of ontological grip on the object, generates not merely internal tensions within the epistemic system, but systemic consequences for the role of science in society. In this new regime of ultra-specialization, the legitimacy of scientific authority is preserved institutionally, but emptied normatively. Traditionally, the authority of science was justified by its public rationality: its ability to produce claims that could, in principle, be understood, evaluated, and challenged by any rational subject embedded within a shared world of discourse (Longino 1990; Habermas 1968). Scientific authority derived from its capacity to submit itself to criticism, to welcome falsifiability and revision, and to stabilize knowledge through open dialogue and empirical confrontation.

Under ultra-specialization, however, scientific discourse becomes technically impenetrable and socially opaque. Expertise is no longer grounded in a form of shared rational access, but in the possession of credentials and domain-specific fluency. This generates what may be called cognitive opacity: the inability of non-experts—not only laypersons, but also scientists from neighboring fields—to grasp or contest the basis of authoritative claims (Collins and Evans 2007). This opacity reconfigures the very nature of scientific normativity. No longer anchored in collective deliberation, normativity becomes delegated to systems of peer-reviewed legitimacy that often operate in closed epistemic loops. The verification of a claim is no longer accessible, and the refusal to accept it may be interpreted as anti-scientific—even when it expresses a demand for

intelligibility. This dynamic fosters a circular epistemic authority, in which validation is internal and justification is deferred.

The political consequences are far-reaching. In an environment where the content of science is inaccessible, scientific authority becomes indistinguishable from technocratic command. The public is no longer a deliberative partner but a passive receiver of non-negotiable expertise. This fosters both technocratic overreach and populist backlash: the former imposes expert consensus without epistemic transparency, the latter rejects expertise as inherently illegitimate, driven by alien power structures (Wynne 2006).

This dual erosion—of intelligibility from above and trust from below—marks the contemporary crisis of scientific legitimacy. It reveals the urgent need for a re-grounding of normativity in structures of shared meaning, beyond formal validation. Without such grounding, science risks becoming both epistemically insulated and politically isolated—a paradoxical regime of knowledge without understanding, power without resonance.

6. Counter-strategies and Structural Reforms

The epistemic and ontological disruptions induced by ultra-specialization demand not only critique but reconstruction. If scientific authority is to regain its intelligibility, and if objectivity is to be reanchored in shared intentionality, then new structural and conceptual frameworks must be developed. These must confront both the internal dynamics of scientific practice and its relation to broader forms of human rationality.

One avenue of reform lies in a renewed commitment to interdisciplinary structures—not merely as administrative or curricular frameworks, but as genuine epistemic environments in which heterogeneous modes of reasoning can encounter, resist, and transform one another. True interdisciplinarity requires more than cooperation; it entails the deliberate exposure of formal systems to conceptual tension, allowing for reflexivity and ontological renegotiation (Repko and Szostak 2020).

Second, we must recover a philosophical dimension within scientific formation. The collapse of the scientist's intentional control over the epistemic object can be

resisted by reintroducing critical metaphysical reflection, epistemological contextualization, and historical awareness into scientific education. Such reintegration would allow scientists to reposition themselves as agents of meaning, not merely functionaries within formal regimes.

Third, institutional reforms must aim at creating forums of epistemic translation, where specialized results can be interpreted, debated, and recontextualized across domains. These may take the form of interdisciplinary journals, open peer commentary platforms, or institutional bodies tasked with mediating between technoscientific innovation and public meaning. What is needed is a new infrastructure for intersubjective reconstruction of scientific meaning.

Finally, we must reconsider the telos of science itself. If scientific production is detached from any conception of its role in shaping human understanding, it becomes vulnerable to instrumentalization by market, military, or ideological imperatives. A post-specialist vision of science would affirm that the objectivity of science is not the elimination of subjectivity, but its structuration through shared intelligibility. Such a shift would not regress to pre-specialist holism, nor advocate naïve unification. Rather, it would propose a pluralistic ontology of knowledge grounded in structural openness, inter-domain communication, and intentional responsibility. This is not a matter of restoring past ideals, but of inventing new forms of rationality adapted to the complexity of modern science—forms that preserve transparency, resist opacity, and reassert the normative force of understanding.

7. Conclusion

Ultra-specialization has transformed the epistemic structure of science. What was once a shared enterprise of rational inquiry now risks becoming a mosaic of isolated procedures, each intelligible only to its initiates. In this condition, objectivity no longer guarantees intelligibility, and authority no longer entails normativity. The result is a science that speaks with power, but not with meaning. We have argued that this transformation must be understood not only as a sociological development, but as an ontological and intentional shift. The scientific object is no longer constituted through

intersubjective engagement, but generated within opaque formal systems. The scientist, in turn, becomes a vector of procedures rather than an agent of understanding.

To meet this crisis, we must reconfigure the architecture of knowledge itself. This means cultivating new forms of interdisciplinarity, embedding critical reflection within scientific practice, and constructing infrastructures for epistemic translation. Most importantly, it means reasserting that the telos of science is not mere control or prediction, but the shared articulation of the real. Without such a reorientation, science may retain its power, but lose its place within reason.

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