The Grammar of Inquiry

Helen Longino's Critical Contextual Empiricism and the Closure Framework: How Scientific Communities Constitute Objective Knowledge Through Structured Criticism

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> *Objectivity is to be found in the critical and responsive interactions of a community of inquirers, not in the psychological state of the individual scientist.*
> Helen Longino, Science as Social Knowledge, 1990

> *Every finite closure generates remainder. The remainder is not noise. It is the proof that the grammar is finite.*
> CF Dietz, Consciousness, Closure, and the Cosmos, 2026

Abstract

Helen Longino is Professor of Philosophy at Stanford University and one of the most important philosophers of science working on the relationship between social values and scientific knowledge. Her critical contextual empiricism, developed in Science as Social Knowledge and The Fate of Knowledge, argues that scientific objectivity is not the property of individual scientists free from social influence but the property of scientific communities organized to subject their knowledge claims to transformative criticism from diverse perspectives. Objectivity is procedural and social: it emerges from the structure of critical inquiry, not from the purity of individual investigators. This paper argues that Longino's critical contextual empiricism and the closure framework developed in Consciousness, Closure, and the Cosmos converge at a philosophically significant point: the scientific community is a shared social closure regime, and Longino's four norms for knowledge-producing communities are the constitutive conditions for a closure regime capable of supersession. A community organized with recognized avenues for criticism, shared evaluative standards, responsiveness to criticism, and equality of intellectual authority is a closure that can update its constituted facts when remainder presses against them: when evidence or argument that the current closure cannot absorb challenges the accepted account. Without these norms, the community's closure becomes rigid: it constitutes its current facts without the organizational structure needed to revise them when the world presses back. Longino's insight that values are not merely a source of bias to be eliminated but are constitutive of what counts as evidence, what counts as an explanation, and what counts as a relevant criticism is the closure framework's account of how every closure regime is value-laden in its very operation: the identity criteria and distinctions that any closure draws are never merely given by the world but are shaped by the interests and commitments of those who draw them. Objectivity is not the elimination of this value-ladenness but the organization of a community capable of challenging and revising its values from within a structure that prevents any particular set of values from becoming permanently and unilaterally dominant.

1. The Gap Between Evidence and Theory

No observation is self-interpreting. Raw data does not come labeled with the hypothesis it supports. The same measurement can confirm one theory and disconfirm another, depending on what background assumptions connect the measurement to the theoretical claim. Whether the blood pressure of a group of subjects taking a new drug constitutes evidence that the drug reduces blood pressure depends on assumptions about how blood pressure is measured, what counts as a clinically significant change, what confounding factors have been controlled for, and what comparison group the treatment group is being measured against. None of these assumptions are given by the data. They are brought to the data by the scientists who interpret it.

Helen Longino recognized this logical structure as the central problem of a philosophical account of science that was honest about its own methods. The standard empiricist picture, that science is objective because it relies on evidence rather than values, cannot survive the observation that evidence does not determine theory interpretation. Every step from data to hypothesis requires background assumptions that go beyond the data. And background assumptions are not neutral: they reflect the interests, values, and prior commitments of the scientists who hold them. Feminist critics of biology had demonstrated this with striking precision: assumptions about gender roles, about the significance of sex differences, about what counts as a natural baseline, had shaped the design of experiments, the description of results, and the interpretation of data in ways that were not derivable from the data themselves.

Longino's response was not to abandon the aspiration to objectivity but to relocate it. If objectivity cannot be the property of individual scientists free from social values, perhaps it can be the property of communities organized to subject their value-laden background assumptions to critical scrutiny from diverse perspectives. Not the elimination of values from science, which is impossible, but the organization of a community that can challenge and revise the values that shape its knowledge claims. Science as Social Knowledge is the argument for this conclusion, and The Fate of Knowledge is its extension and elaboration.

The closure framework receives this argument with structural precision. Every closure regime is value-laden in its very operation: the distinctions it draws, the identity criteria it establishes, the lawful relationships it maintains are never merely given by what it opens onto but are shaped by the interests and commitments of those who operate the closure. What Longino establishes in philosophy of science, the closure framework establishes as a structural consequence of what any finite organizational system that draws distinctions must do. The question is not whether values shape knowledge but whether the closure's organizational structure allows the values to be challenged, revised, and superseded when the world presses back through remainder.

2. Longino's Four Claims

Longino's critical contextual empiricism has four interconnected components.

2.1 Contextual Empiricism: Values Are Constitutive of Evidence

Evidence is relational: it is always evidence for or against something, relative to background assumptions about what kinds of data can support what kinds of hypotheses. The background assumptions that determine evidential relevance are not epistemically neutral. They reflect prior commitments about what kinds of causes are worth studying, what kinds of mechanisms are plausible, what kinds of differences matter, and what kinds of outcomes count as significant. These commitments are shaped by the social, cultural, and political context of the investigators.

Longino calls these contextual values, distinguishing them from constitutive values. Constitutive values are widely shared across scientific communities: accuracy, predictive power, consistency, breadth. Contextual values are specific to particular investigators and communities: the value placed on certain kinds of explanations, the preference for certain research methods, the assessment of what questions are worth asking. The received view of science treats contextual values as sources of bias that should be minimized or eliminated. Longino argues that contextual values cannot be eliminated because they are constitutive of evidence: they determine what counts as evidence, not merely what investigators do with evidence.

This is not relativism. Longino does not argue that all value-laden claims are equally valid or that science cannot give us genuine knowledge. She argues that the path to objective knowledge runs through the social organization of inquiry, not through the impossible ideal of value-free individual investigators.

2.2 Social Objectivity: The Community as the Locus of Objectivity

If objectivity cannot be located in the value-free individual scientist, it must be located somewhere else. Longino locates it in the community: objectivity is a property of well-organized scientific communities, not of individual knowers. A community achieves objectivity not by eliminating values from its inquiry but by organizing itself so that its value-laden claims can be subjected to transformative criticism from diverse perspectives.

Transformative criticism is Longino's key concept: criticism that can actually change the content of accepted knowledge claims, not merely the ways they are expressed. For criticism to be transformative, it must be able to challenge the background assumptions that structure the evidence-hypothesis relationship, not just the surface features of the hypotheses themselves. This requires critics with different background assumptions, different contextual values, different ways of approaching the domain, who can see what the current dominant approach takes for granted and cannot see.

Objectivity is therefore inseparable from diversity: a community that excludes perspectives, that silences dissent, that admits only investigators with the same background assumptions, cannot be objective because it cannot subject its own assumptions to genuine challenge. The diversity that supports objectivity is epistemic diversity, diversity of background assumptions and contextual values, not merely demographic diversity, though the latter often tracks the former.

2.3 The Four Norms: The Social Conditions for Transformative Criticism

Longino proposes four norms that a scientific community must satisfy to generate objective knowledge through critical interaction. First, there must be recognized avenues for criticism: public forums, journals, conferences, peer review, where critical challenges can be registered and cannot simply be ignored. Second, there must be shared evaluative standards: some criteria that all members of the community recognize as relevant to assessing claims, sufficient to make criticism intelligible and response possible, even if those criteria are themselves subject to critical discussion. Third, the community must be genuinely responsive to criticism: challenges must produce uptake, must change what the community believes and does, not merely be registered and dismissed. Fourth, there must be equality of intellectual authority: no voice can be excluded from the critical dialogue by virtue of social position alone, and the merits of contributions must be assessable on epistemic rather than purely social grounds.

These norms are constitutive conditions for objectivity, not merely procedural requirements. A community that satisfies them to a higher degree is more objective; a community that systematically violates them is less objective regardless of the epistemic virtues of its individual members. The social structure of inquiry is not merely an organizational matter. It determines the epistemic character of the knowledge produced.

2.4 Scientific Pluralism: The Implications of Multiple Valid Frameworks

In Studying Human Behavior, Longino extends her framework to address cases where multiple scientific approaches to the same domain produce different but partially valid knowledge. Different research programs for studying human aggression and sexuality begin from different causal commitments, use different methods, and produce different kinds of knowledge. None of them is simply wrong. Each captures something about the phenomena that the others miss. The appropriate response is not to adjudicate which approach is correct but to maintain the plurality and understand what each contributes and what each misses.

Scientific pluralism is a consequence of contextual empiricism: if background assumptions shape what counts as evidence and what counts as an explanation, and if different background assumptions produce different but partially valid accounts, then scientific progress cannot always be understood as convergence on a single correct theory. It must sometimes be understood as the maintenance of a productive tension among multiple partially valid approaches, each illuminating dimensions of the phenomena that others cannot see.

3. What Longino Needs

Longino's critical contextual empiricism is the most developed available account of how social values constitute scientific knowledge without making science merely subjective, and of what conditions a community must satisfy to generate objective knowledge through social interaction. Her four norms provide a concrete, practically applicable account of the social conditions for transformative criticism.

There are two questions Longino's framework addresses but does not fully resolve. The first is why the four norms support objectivity. Longino argues that they do and demonstrates this

through case studies and philosophical analysis. But the structural account of why organizing a community according to these norms would produce knowledge that is more responsive to the world, more capable of being corrected by what the world contains, is not fully developed. The norms are presented as procedural conditions for objectivity. The structural explanation of why satisfying these conditions makes the community's closure more capable of supersession is what the closure framework provides.

The second is the relationship between Longino's account and the wider question of what knowledge is. Longino develops her account primarily for scientific communities. The closure framework shows that the same structural account applies to any knowledge-producing closure: individual cognitive closures, scientific communities, cultural traditions, and the entire lineage of human inquiry. The norms Longino identifies are the conditions for any closure's capacity for supersession, not merely for scientific communities, though Longino's focus on science provides the most rigorous available account of what those conditions require in practice.

4. The Framework in Epistemological Terms

The closure framework is introduced here in the minimum terms needed to ground Longino's account.

4.1 The Scientific Community as a Shared Social Closure

A closure regime is a system that stabilizes some content by drawing distinctions, establishing identity criteria, and maintaining lawful relationships among its elements. A scientific community is a shared social closure regime: a community of investigators whose shared standards, methods, and practices jointly draw distinctions within their domain, establish identity criteria for what counts as evidence and explanation, and maintain lawful relationships among the elements of their shared knowledge.

The community's closure constitutes the scientific facts that the community accepts: the claims that its collective inquiry has ratified as knowledge, the background assumptions that structure its evidential reasoning, the theoretical commitments that organize its research. These facts are not merely the opinions of individual investigators. They are constituted by the community's shared organizational structure, maintained through its practices of publication, peer review, replication, and critical discussion.

Remainder is what the community's closure generates at its boundary: the phenomena its current framework cannot explain, the anomalies that do not fit the accepted account, the questions its methods cannot address, the perspectives its dominant background assumptions cannot see. Remainder is the pressure that drives scientific change: the accumulation of what the current closure cannot absorb, pressing against the accepted facts and eventually producing the supersession that revises or replaces them.

4.2 Longino's Four Norms as Conditions for Supersession

Longino's four norms are the organizational conditions that determine whether a community's closure can supersede when remainder accumulates or whether the closure becomes rigid. A community with recognized avenues for criticism has a mechanism through which remainder can enter the closure's deliberative space: the forums in which what the closure cannot absorb can be registered as a challenge rather than simply ignored. A community with shared evaluative standards has the common vocabulary needed for one perspective's criticism to be intelligible to another's: without shared standards, challenges cannot be formulated in terms the challenged party is obligated to address. A community that is genuinely responsive to criticism is one that updates its constituted facts when criticism reveals that the current account cannot absorb an important portion of its remainder. And a community with equality of intellectual authority is one where the remainder generated at the boundary of any particular perspective can enter the deliberative space regardless of the social position of those who identify it.

Without these norms, the community's closure becomes rigid in a specific structural sense: it continues to generate remainder but lacks the organizational capacity to use that remainder as a resource for supersession. Established investigators with dominant background assumptions can ignore criticism from those with different values. Recognized challenges can be acknowledged but produce no uptake. Shared standards can be manipulated to exclude the perspectives that would generate the most revealing criticism. The closure still constitutes facts, but its constitution becomes increasingly divorced from what it opens onto, because the organizational structure prevents the remainder from driving revision.

5. Four Claims, One Structure

The vocabulary correspondence between Longino's critical contextual empiricism and the closure framework is the most epistemological in the series, operating at the level of communities rather than organisms. What Longino calls background assumptions, the closure framework calls the identity criteria and distinctions that determine what the community's closure constitutes as a fact. What Longino calls contextual values, the framework calls the interests and commitments that shape how any closure draws its distinctions. What Longino calls evidence, the framework calls the remainder that the community's closure opens onto: the sensory and instrumental signals that the community's organizational structure interprets relative to its background assumptions. What Longino calls transformative criticism, the framework calls supersession: the process by which the community's closure updates its constituted facts when remainder accumulates beyond what the current organizational structure can absorb. And what Longino calls the four norms for knowledge-producing communities, the framework calls the constitutive conditions for a shared closure's capacity for supersession.

5.1 Values Are Constitutive of Closure Identity Criteria

Longino's contextual values, the interests and commitments that shape what counts as evidence and what counts as an explanation, are in closure framework terms the identity criteria of the community's shared closure: the criteria that determine what the community constitutes as a relevant fact, a valid experiment, a plausible mechanism, a significant result. These identity

criteria are never value-neutral because drawing distinctions always reflects commitments about what matters, what is relevant, and what is worth attending to. The feminist critics of biology whom Longino discusses were not demonstrating that science is merely subjective. They were demonstrating that the identity criteria of certain research communities were shaped by assumptions about gender that excluded the perspectives needed to challenge those assumptions.

This is precisely the structural point the closure framework makes about all knowledge: every closure draws its distinctions from somewhere, and that somewhere reflects the interests and commitments of those who operate it. The question is not whether values shape knowledge but whether the closure's organizational structure allows those values to be challenged. Longino's contribution is to specify what that organizational structure requires, not merely in abstract philosophical terms but in the concrete conditions of scientific practice.

5.2 Transformative Criticism Is Community-Level Supersession

Longino's transformative criticism, the criticism that can actually change the content of accepted knowledge claims by challenging the background assumptions that structure them, is in closure framework terms community-level supersession: the process by which the community's shared closure updates its constituted facts in response to remainder that has been registered through the community's critical forums and that has received genuine uptake.

The distinction between criticism that is registered and criticism that produces uptake is crucial. A community can acknowledge challenges without being transformed by them: the challenge enters the deliberative space but does not change the constituted facts. For supersession to occur, the community must not only register remainder but revise its organizational structure in response. Longino's norm of responsiveness to criticism is the organizational condition for genuine supersession rather than mere acknowledgment. Without this norm, the community's deliberative process is performative rather than substantive: it goes through the motions of critical exchange without the exchange actually driving revision.

5.3 The Four Norms Are the Structure of a Self-Correcting Closure

Taken together, Longino's four norms specify the organizational structure of a closure capable of genuine self-correction: a closure that can use its remainder as a resource for supersession rather than simply generating remainder that accumulates without driving revision.

Recognized avenues for criticism ensure that remainder can enter the deliberative space. Shared evaluative standards ensure that the remainder can be articulated in terms that the community is obligated to address. Responsiveness to criticism ensures that articulated remainder actually drives revision. And equality of intellectual authority ensures that the remainder generated at the boundary of non-dominant perspectives is not systematically excluded from the deliberative space by virtue of who identifies it. These four conditions together constitute the minimum organizational structure needed for a community to use its remainder to improve its constituted account of what it opens onto. Longino arrived at these conditions through close attention to the actual practice of scientific communities. The closure framework names the structural logic of why satisfying them produces the epistemic outcomes Longino identifies.

5.4 Scientific Pluralism Is the Acknowledgment That Every Closure Generates Remainder

Longino's scientific pluralism, the view that multiple frameworks can produce partial but genuine knowledge of the same domain without any single framework providing the complete account, is in closure framework terms the acknowledgment that every closure generates remainder and that the remainder of one closure may be the constituted fact of another. The five research programs on human behavior that Longino examines in Studying Human Behavior each constitute different facts about their domain because they draw different distinctions, use different background assumptions, and generate different remainder.

Pluralism is not the abandonment of the aspiration to knowledge but the recognition that any single closure generates remainder that other closures can constitute. The appropriate response to the plurality of scientific frameworks is not to choose one as correct and dismiss the others but to understand what each closure constitutes and what each generates as remainder, and to organize the community of inquiry to maintain productive tensions among multiple partially valid approaches. The Grammar of Knowing established this epistemologically. Longino establishes it in the concrete context of scientific practice.

6. Longino and the Grammar of Knowing

The Grammar of Knowing, the second paper in the CC-C companion suite, established that all knowledge is grammar-relative: that the facts any knower constitutes depend on the grammar that organizes their cognitive activity, and that no finite grammar captures everything. Longino's critical contextual empiricism is the institutional embodiment of this recognition at the level of scientific communities.

The Grammar of Knowing establishes the structural point: knowledge is always from inside a closure, and the closure's identity criteria determine what the knower can constitute as a fact. The remainder the closure generates is the measure of its finitude: what it opens onto without fully capturing. Longino establishes the practical and institutional implications: what must be true of a community's organizational structure for its collective closure to be capable of revising its constituted facts in response to what its remainder contains. The epistemological and the institutional accounts are complementary: the Grammar of Knowing explains why communities are needed for objective knowledge and what objective knowledge could mean given the finite grammar of any individual knower. Longino explains what communities must do to fulfill that need.

The connection to Cartwright is also significant. Cartwright's nomological machine, the bounded closure that produces reliable facts within its operating conditions while generating remainder outside them, describes the structure of individual scientific experiments and research programs. Longino describes the conditions under which a community of such machines can collectively produce knowledge that is more objective than any individual machine could produce alone. Together they provide the closure framework's account of science: bounded closures generating reliable facts within their scope and systematic remainder outside it, organized into communities capable of using that remainder to improve the collective account.

7. The Grammar of Inquiry

A data point does not know what hypothesis it supports. The relationship between observation and theory is mediated by background assumptions that reflect the values and interests of those who interpret the data. This is not a deficiency of science that better methods could eliminate. It is the structural character of any finite closure that draws distinctions and constitutes facts from what it opens onto. The question for a philosophy of science honest about this structure is not how to eliminate values from inquiry but how to organize the inquiry so that the values shaping it can be challenged and revised.

Helen Longino has spent three decades developing and defending an answer to this question. Her critical contextual empiricism locates objectivity in the community rather than the individual investigator, in the organizational structure of critical inquiry rather than in the psychological purity of individual scientists. Her four norms, recognized avenues for criticism, shared evaluative standards, genuine responsiveness, equality of intellectual authority, specify what a community must be to generate objective knowledge through organized critical interaction. And her scientific pluralism acknowledges that multiple frameworks can produce partial but genuine knowledge without any single framework being complete.

The closure framework names the structural logic underlying Longino's account. The scientific community is a shared social closure regime. Its constituted facts are the product of its collective organizational activity, shaped by its shared background assumptions and contextual values. Its remainder is what its current framework cannot absorb: the anomalies, the challenges, the perspectives its dominant assumptions cannot see. And the four norms are the constitutive conditions for a closure capable of supersession: the organizational structure that allows the community's remainder to drive revision of its constituted facts rather than accumulating as unacknowledged pressure at the boundary of an increasingly rigid closure.

Objectivity is not the absence of values from inquiry. It is the organization of a community capable of challenging its own values through structured criticism from diverse perspectives. Science does not achieve objectivity by having no commitments. It achieves it by having the organizational structure to revise its commitments when its remainder requires it. That is the grammar of inquiry: the grammar of how a community of finite closures can collectively approach what no single closure can constitute alone.

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Author's Note

This paper is the eighteenth in a series engaging thinkers whose work converges with the closure framework developed in Consciousness, Closure, and the Cosmos. Helen Longino is Professor of Philosophy at Stanford University. She is a Fellow of the American Academy of Arts and Sciences and a Fellow of the American Association for the Advancement of Science. Her Science as Social Knowledge is among the most cited works in philosophy of science of the past four decades, and her development of critical contextual empiricism across three major books represents one of the most sustained and productive research programs in social epistemology. This paper occupies a specific structural position in the series: it is the paper that addresses the social and institutional conditions for collective knowledge production, extending the closure framework's account of individual cognitive closures to the level of organized communities of inquirers. The Grammar of Knowing established what individual knowers have and what limits they face. Longino establishes what communities must be to collectively produce knowledge that is more objective than any individual knower could produce alone. Together they constitute the series' account of knowledge as both individual and social, bounded and capable of improvement, value-laden and capable of objective. The author also notes that this paper connects the philosophical papers at the end of the series to the biological papers at the beginning: the four norms that Longino identifies for knowledge-producing communities are a specification, at the social and institutional level, of the same structural conditions for supersession that Noble identifies for biological organisms and that the closure framework identifies for any organized system capable of using its remainder to improve its account of what it opens onto. The author welcomes engagement from Longino directly and from philosophers of science, feminist epistemologists, and science studies researchers who find the convergence between critical contextual empiricism and the closure framework either illuminating or contestable.