



Difference That Preserves: From Transcendental Genesis to a Genealogical Foundation of Mathematics

Andreu Ballús Santacana¹

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Abstract

This paper reconstructs the philosophical genesis of a foundational motif—**difference that preserves**—emerging at the intersection of ontology, logic, and mathematics. Through a genealogical arc spanning Fichte’s theory of self-positing, Hegelian mediation, Bergsonian duration, and the anti-psychologism of Bolzano and Frege, we identify a deep tension in modern foundations: how can a logic of differentiation account for identity across transformation? We propose that this unresolved tension structures both historical and contemporary foundational programs. To address it, we articulate a new meta-theoretical framework—*Mnēmaic logic*—which grounds preservation not in static identity, but in recursive genesis. This paper provides the philosophical foundation and conceptual justification for that framework; its formal development appears in a companion article (Ballús Santacana, 2025). We conclude by suggesting that difference-that-preserves offers a powerful alternative to existing models of identity, continuity, and foundation in mathematical logic.

Keywords German Idealism · Fichte · Simondon · Individuation · Genealogical ontology · Category theory · Mathematical epistemology

1 Introduction

The foundations of mathematics and logic have traditionally been built on the notion of identity: a relation of equivalence that enables the classification, substitution, and stability of objects within formal systems. But identity, as typically conceived, is static—it accounts for sameness, not for genesis, continuity, or transformation. This has left a structural blind spot in foundational thought: how to formally account for difference that does not negate, but preserves; for change that is not destruction, but structured becoming.

✉ Andreu Ballús Santacana
Andreu.Ballus@uab.cat

¹ Department of Philosophy, Universitat Autònoma de Barcelona, Barcelona, Spain

This paper reconstructs a conceptual trajectory—what I call difference that preserves—which challenges the dominance of identity as a foundational operator. Drawing on a long-neglected philosophical lineage, I argue that this motif underlies alternative accounts of genesis and object-formation that have surfaced intermittently across idealist, phenomenological, and mathematical traditions. What emerges is a logic not of static being, but of self-differentiating structures whose continuity lies precisely in their capacity for generative preservation.

The aim is not merely to interpret this tradition, but to excavate from it a meta-theoretical foundation for mathematics: one that justifies and motivates a logic grounded in recursive generation rather than atomic identity. While this paper provides the philosophical reconstruction, a companion article develops the formal architecture of this framework—termed Mnēmaic Logic—through category-theoretic and type-theoretic means (Ballús Santacana, 2025).

This inquiry pursues a specific genealogical line: it traces the motif of *difference-that-preserves* through those thinkers—principally Fichte, Hegel, Bergson, and Simondon—who explicitly articulate genesis as a non-atomistic, self-differentiating process. This selection is necessarily heuristic rather than exhaustive. While other major figures in the philosophy of mathematics, most notably Husserl, Whitehead, and Royce, offer profound insights into continuity and formal generation, they are engaged here primarily at those junctures where their work directly intersects with or counters the specific trajectory leading to the Mnēmaic framework. A comprehensive history encompassing the full range of phenomenological and process-relational approaches to mathematics remains beyond the scope of the present study.

I begin with Fichte, whose theory of self-positing marks the first rigorous attempt to conceive genesis not as an empirical event, but as a logical structure in which identity emerges from the very act of differentiation.

2 Fichte's Self-Positing as the First Ontogenesis of Difference

Fichte's *Wissenschaftslehre* emerges in the turbulent intellectual decade of the 1790s, in the immediate wake of Kant's critical philosophy and amidst the debates sparked by Reinhold regarding the first principle of philosophy. While Fichte does not offer a philosophy of mathematics in the modern foundational sense, his work constitutes a pivotal moment in the history of logic: it attempts to derive the very form of objectivity from a recursive act of construction rather than from static axioms. This move—grounding identity in a generative act—anticipates the intuitionist and constructivist turns that would emerge over a century later.

Rather than beginning, as other Kantians, from the given primacy of subjectivity, Fichte advances the more radical thesis that subjectivity is itself constituted as an act—indeed, as genesis itself. The *Grundlage der gesamten Wissenschaftslehre* (1794) introduces this with the well-known claim:

“Das Ich setzt sich selbst schlechthin.”¹

¹Johann Gottlieb Fichte, *Grundlage der gesamten Wissenschaftslehre* (1794), §1; see the critical edition in *Gesamtausgabe der Bayerischen Akademie der Wissenschaften*, ed. Reinhard Lauth and Hans Gliwitzky,

On closer analysis, this statement is neither an empirical self-description nor a metaphysical axiom. As Stolzenberg emphasizes, it should be read as a systematic response to Reinhold's *Tatsache des Bewusstseins*, transforming passive givenness into *Tathandlung*, a term that names the originary act of positing itself as constitutive of subjectivity.² The "I" is no longer a datum, but comes into being through the very act of positing; doing and being are inseparable at the origin.

The implications are immediate and far-reaching. The act by which the *Ich* posits itself simultaneously generates its own boundary: a *Nicht-Ich*. Selfhood emerges with its limit, as constraint or alterity. In Fichte's triadic schema:

The *Ich* posits itself.

The *Ich* posits a *Nicht-Ich*.

The *Ich* posits the mutual limitation of *Ich* and *Nicht-Ich*³.

This triad, often construed as a linear dialectic, is far subtler: as Neuhouser³ and Schmid⁴ argue, Fichte's method is not a temporal sequence but a constructive deduction of necessary conditions for self-consciousness.

As Stolzenberg and Gabriel argue, this logic resists linearity: the positing of a boundary (*Nicht-Ich*) is not secondary, but *co-originary* with the positing of self. The third moment—*Wechselseitige Begrenzung*—is not a temporal result but a structural necessity. Hence, the triad forms a recursive structure of self-relation.⁵

To formalize this, let I_0 denote the act of original positing, and $\neg I_0$ the simultaneously posited boundary. We define a recursive operation:

$$I_1 = \text{Posit}(I_0, \neg I_0)$$

and subsequently:

$$I_2 = \text{Posit}(I_1, \delta(I_1, \neg I_0))$$

Here δ models the modulation of constraint. While not computable recursion, this expresses a structural retention of prior conditions—a logic of layered genesis. This schematism echoes Klein's "reflexive recoding of spontaneity" as the hallmark of German Idealism.⁶

vol. 1/2 (Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1971), 96.

² Jürgen Stolzenberg, "Fichtes Satz 'Ich bin': Argumentanalytische Überlegungen zu Paragraph 1 der Grundlage der gesamten Wissenschaftslehre von 1794/95," *Fichte-Studien* 6 (1994): 1–34, <https://doi.org/10.5840/fichte199464>.

³ Frederick Neuhouser, *Fichte's Theory of Subjectivity* (Cambridge: Cambridge University Press, 1990).

⁴ Sebastian Schmid, "Triadic Grounding in der Wissenschaftslehre," forthcoming in *Archiv für Begriffsgeschichte* 66 (2024).

⁵ Markus Gabriel, "Fichtes transzendente Ontologie," in *Der Mensch im Zentrum der Wissenschaftslehre*, ed. R. Kremer and J. Stolzenberg (Berlin: de Gruyter, 2019), 71–89.

⁶ Jacob Klein, "Reflexive Recoding and the Fate of Spontaneity in German Idealism," *Kant-Studien* 97, no. 2 (2006): 211–229.

This reading becomes explicit in Fichte's *Wissenschaftslehre nova methodo* (1796–1799), where he describes the triad as “drei Seiten derselben Tatsache”.⁷ Differentiation does not threaten identity; it constitutes it. The *Nicht-Ich* is not external negation, but internal condition.

Hence, being for Fichte is not static unity or scattered plurality, but recursive auto-differentiation retaining its path within itself. The earliest form of what might be called a proto-recursive ontology is thus articulated—not as formal logic, but as generative structure.⁸

Each act of positing retains the structure of its genesis—not by temporal succession, but by *immanent retention*. As Bykova notes, Fichte's conception of identity entails preservation not through recollection, but through the very structure of re-generation.⁹

A crucial ambiguity emerges: is this structure constitutive of *subjectivity*, or is subjectivity merely the aperture for a more fundamental logic of being? While older readings emphasized subjective primacy (“Das Ich ist das Erste und Unbedingte”), recent scholarship by Stolzenberg and Gabriel treats the *Tathandlung* as a transcendental ontological principle—an immanent articulation of being's generativity.¹⁰

This view gains support from Fichte's description of the *Ich* as a “sich-selbst-produzierende Tätigkeit”—a self-producing activity that reveals ontology through phenomenological subjectivity.¹¹

Kim deepens this reading, arguing that the primal act is not only epistemic but also ethical and existential—what he terms a “Willensentschluss,” or act of volitional resolution. This anticipates existentialist themes in which genesis encompasses intersubjective and practical modalities.¹²

Martin sharpens this by showing that the *Ich* is not a metaphysical substance, but a formal *index* of determinacy—less an entity than a structural function of posited difference.¹³

Stevenson complements this by contrasting Fichte and Heidegger: while both view spontaneity as constitutive, Heidegger detaches it from reason or subjectivity, rooting it instead in the ontological structure of Being.¹⁴

Thus, the *Tathandlung* is best read not only as the genesis of subjectivity, but as the first rigorous expression of an ontology in which difference stabilizes identity. It marks the inaugural articulation of an ontological recursion—where selfhood is nothing but the structured persistence of generated difference.

⁷ Johann Gottlieb Fichte, *Wissenschaftslehre nova methodo* (1796–1799), ed. Erich Fuchs, in *Gesamtausgabe*, vol. II/4 (Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1971), 246ff.

⁸ Marina Bykova, “Kant's ‘I Think’ and Fichte's Principle of Self-Positing,” *Anuario Filosófico* 52, no. 1 (2019): 145–165.

⁹ Jürgen Stolzenberg, “Fichtes Satz ‘Ich bin’: Argumentanalytische Überlegungen zu Paragraph 1 der Grundlage der gesamten Wissenschaftslehre von 1794/95,” *Fichte-Studien* 6 (1994): 1–34, <https://doi.org/10.5840/fichte199464>.

¹⁰ Markus Gabriel, “Fichtes transzendente Ontologie,” in *Der Mensch im Zentrum der Wissenschaftslehre*, ed. R. Kremer and J. Stolzenberg (Berlin: de Gruyter, 2019), 71–89.

¹¹ Johann Gottlieb Fichte, *Wissenschaftslehre 1804*, ed. Reinhard Lauth, in *Gesamtausgabe*, vol. II/8 (Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1988), 124.

¹² Miyoung Kim, “The Ethical Genesis in Fichte's *Wissenschaftslehre*,” *Acta Fichteana* 7 (2018): 133–157.

¹³ Wayne Martin, *Idealism and Objectivity: Understanding Fichte's Jena Project* (Stanford: Stanford University Press, 1997), especially chap. 3.

¹⁴ David Stevenson, “Fichte's Ontology of Spontaneity and Heidegger's Critique,” *Archiv für Begriffsgeschichte* 61 (2019): 87–109.

3 Hegel: Contradiction, Mediation, and the Dialectical Retention of Difference

Writing in the early nineteenth century, Hegel operates in a mathematical landscape pre-dating the rigorous formalization of the infinite by Cantor or the logicist project of Frege. His engagement with mathematics in the *Science of Logic*—particularly his critique of the calculus and his dialectical treatment of Quantity and Measure—reflects a period where the status of the infinite was philosophically volatile. Hegel's intervention is crucial because it attempts to internalize the dynamic of becoming into the logical concept itself, a challenge that remains central to post-Cantorian foundations.

The question guiding this section is not whether Hegel inherits something from Fichte—this is evident—but whether his transformation of Fichte's model of differentiation-with-preservation intensifies, displaces, or reconfigures its ontological role. In particular, we must ask: does Hegel's dialectical logic, centered on *Aufhebung* (sublation), truly retain the structure of difference-that-preserves—that is, a generative process in which opposition sustains a continuity of genesis—or does it transform this structure into something fundamentally new?¹⁵

We begin at the point of departure. As developed in the preceding analysis, Fichte conceives genesis as a recursive act of self-positing: the I posits itself, posits its own limit (the not-I), and through this encounter recursively constructs a world. Crucially, each act of positing preserves what preceded it—not merely as historical content, but as the very structural conditions of its unfolding. The I does not leap from stage to stage; it builds and remembers, embedding earlier determinations within later ones through reflective recursion. Here, “difference-that-preserves” is not an accident, but the constitutive logic of genesis itself.¹⁶

Hegel, however, begins from a different starting point: not from a subject or standpoint of positing, but from Being—a purely abstract thought-determination. As he writes at the outset of the *Science of Logic*: “Being, pure Being, without any further determination.”¹⁷

Yet this pure Being immediately reveals itself to be unstable. Lacking any determinacy, it collapses into Nothing. Hegel's first movement—Being, Nothing, Becoming—is not a sequence of additions, but an immanent disintegration and reconstitution. Becoming is not what follows from contradiction; it is the internal dynamic that the contradiction names.¹⁸

In this structure, the fate of “difference-that-preserves” is reconfigured. Fichte's differentiation is driven by posited externality (the not-I), whose limit is recursive and open. Hegel's differentiation is driven by internal contradiction—the failure of any identity to maintain

¹⁵ On the concept of *Aufhebung* in Hegel's dialectic, see G. W. F. Hegel, *Wissenschaft der Logik*, §81. See also John W. Burbidge, “Aufhebung,” in *The Palgrave Hegel Handbook*, ed. K. R. Westphal (London: Palgrave Macmillan, 2020), 223–239; and Miglena Nikolchina, “Between Irony and Revolution,” *Parallax* 14, no. 1 (2008): 53–67.

¹⁶ This sentence illustrates a key difference between Fichtean and Hegelian logic: genealogical memory (Fichte) vs. structural memory (Hegel). Fichte's model reenacts genesis explicitly; in Hegel, past stages are preserved only in the structure of the present concept. See J. Stolzenberg, “Fichte's Proposition ‘I am’,” *Sententiae* 31 (2014): 52–74; Ryan Krahn, *The Sublation of Dialectics*, Diss. Guelph, 2014.

¹⁷ G. W. F. Hegel, *Wissenschaft der Logik*, ed. Georg Lasson, vol. I (Hamburg: Felix Meiner, 1985 [1812–1816]), 83.

¹⁸ The triad Sein – Nichts – Werden is not temporal but dialectical. Being collapses into Nothing due to its indeterminacy, giving rise to Becoming as their immanent unity. See Hegel, *Wissenschaft der Logik*, I, §87ff.

itself without negating itself.¹⁹ Difference is no longer introduced by the I; it is already embedded in the categories themselves. The logical system does not proceed by construction, but by internal failure and reformation.

The engine of Hegel's system is *Aufhebung*, a term that, as is well known, carries a three-fold semantic: to cancel, to preserve, and to elevate. This ambiguity is not accidental but structurally essential. Each new determination in Hegel's logic both negates and preserves its predecessor. It does not remain alongside it, as in a dualistic tension, but incorporates it into a higher form. "Difference-that-preserved" thus becomes "difference-that-is-overcome"—preserved only in and through its own sublation.²⁰

The logic of *Aufhebung* thus constitutes a kind of retention, but not in the Fichtean sense of iterative re-possession. Rather, what is preserved is retained only in and through its transformation. As Hegel writes in the *Science of Logic*: "The result is not something entirely new and foreign... it contains its origin within itself."²¹

This is a pivotal moment: Hegelian logic preserves genesis not by repetition or reflective memory, but by negation and integration. The earlier term is not repeated; it is internalized as a sublated moment of the higher concept. The new category, while emergent, includes within it the tension that gave rise to it.²²

Hence, the dialectic preserves, but not genealogically. It does not maintain a visible trail of differentiation, but embeds the traces of its own genesis structurally, as internal necessity. This is not memory as reflective retention; it is memory as inherent contradiction.²³

Each new identity bears the weight of what it overcomes, not as a remembered act, but as an enduring instability. The "difference-that-preserved" persists only as contradiction resolved—or, perhaps, domesticated.

But this model introduces a new kind of tension. If contradiction is the motor of development, and if every contradiction is ultimately resolved through sublation, then does the Hegelian system allow any form of irreducible difference to persist? Or must all difference be rendered intelligible through integration?²⁴

Scholarly positions diverge. Some, like John Burbidge and Catherine Malabou, argue that Hegel's logic does not eliminate difference, but rather sustains it at every level.²⁵ Each concept is unstable; each synthesis provisional. The dialectic is historical in its very structure: preservation occurs as temporal sedimentation of unresolved tensions.

¹⁹The contrast here is between Fichte's external difference (via the posited *Nicht-Ich*) and Hegel's internal differentiation through the *Begriff*. Hegel's categories destabilize themselves immanently, generating development from within.

²⁰Hegel's *Aufhebung* integrates preservation with negation. Each step of the dialectic preserves its origin only through transformation. This triadic function is what makes dialectic productive—but also controversial in later critiques.

²¹G.W.F. Hegel, *Wissenschaft der Logik*, Bd. I, S. 83.

²²In contrast to Fichte's repeated reactivation of genesis, Hegel internalizes these tensions as sublated moments. The past is not re-enacted, but persists structurally as negated contradiction. See Ryan Krahn, *The Sublation of Dialectics* (PhD diss., University of Guelph, 2014).

²³This reformulates memory not as reflection or reiteration (Fichte), but as unresolved contradiction embedded in conceptual structure. Hence Hegel's system retains through structural necessity, not procedural reenactment.

²⁴This question anticipates the critiques by Derrida and Deleuze, who argue that Hegel reduces difference to a teleological process. They see in Hegel a repression of irreducibility in favor of systematic coherence.

²⁵Catherine Malabou, *L'avenir de Hegel* (Paris: Vrin, 1996).

Others, however—especially in the post-Hegelian tradition—are more skeptical. Derrida, for instance, sees *Aufhebung* as subordinating spacing and irreducibility to the teleology of resolution.²⁶ Difference, in this view, is always processed, always domesticated within the movement toward the Absolute.

Deleuze takes the critique further. For him, Hegelian difference is too closely tied to negation; it is derived from identity and dependent on contradiction. In *Difference and Repetition*, Deleuze insists that genuine difference must be positive, generative, and non-dialectical—not a moment to be mediated, but a force to be affirmed.²⁷

Thus, while Hegel retains difference, he retains it only on the condition that it be structurally mediable. The dialectic includes everything, but it includes only that which can be rendered dialectically intelligible. What Fichte preserves by recursive construction, Hegel absorbs through mediated contradiction.

This distinction has consequences. In Fichte, each new structure refers back to its origin through an explicit act of re-constitution. The structure is open-ended; there is no closure beyond the act of construction itself. Memory is embedded in the form of construction—to construct is to preserve. The “difference-that-preserves” is active, reiterative, and procedurally open.²⁸

Hegel, by contrast, builds a system. Not in the sense of closure as stasis, but as a structure in which the meaning of any term derives from its place in the whole movement. The logic retains what it negates, but always as moment, not as autonomous remainder. The dialectic is integrative by design. Every differentiation is ultimately framed as a station along a total path.

This, then, is not a question of whether difference is preserved in Hegel. It is. The question is how, and whether the form of its preservation presupposes or transforms the very meaning of preservation itself. Is “difference-that-preserves” retained only as difference-that-is-overcome? Or is there a deeper possibility of difference that persists without resolution?

Hegel preserves difference, but as contradiction resolved. Fichte preserves difference as origin retained. In Hegel, the trace remains, but only after being negated; in Fichte, the trace is reiterated, preserved through re-entry. This is the first major fork in our genealogy of preservation. Thus, the divergence is not about whether preservation occurs, but about the mode of preservation. Does preservation operate through construction or through mediation? Through remembrance, or through integration?

Only once this fork is clear can we understand in a new light the interventions of later thinkers who challenge the Hegelian form of preservation as too system-bound, too teleologically intelligible, too synthetic.

²⁶ Jacques Derrida, *Glas* (Paris: Galilée, 1974).

²⁷ Gilles Deleuze, *Différence et répétition* (Paris: PUF, 1968), chaps. 1–2.

²⁸ This sentence underlines the genealogical openness of Fichte’s model versus the systemic closure in Hegel. Fichte’s construction is iterative; Hegel’s is integrative. This sets the stage for theories of preservation that resist mediation.

4 Logic, Subjectivity, and the Psychologismusstreit: Reframing Genesis Between Hegel and Bergson

To interpret the interval between Hegel and Bergson as conceptually barren is to overlook a decisive episode in the transformation of philosophical ontology. This period does not mark the disappearance of the problem of genesis, but its transposition into new theoretical registers: formal logic, mathematical epistemology, early scientific psychology, and transcendental phenomenology. Rather than dissolving, the tension between genesis and preservation—central to both Fichte’s logic of self-positing and Hegel’s dialectical mediation—reemerges in a newly objectivized idiom: the status of logical laws, the meaning of inference, and the ontology of idealities.

At the heart of this shift is the Psychologismusstreit—the dispute over whether logic is reducible to psychological processes or whether it expresses ideal, non-empirical structures. Far from being a technical quarrel over methodological purity, this conflict represents the first formal ontological contestation of the Fichtean-Hegelian model of difference-that-preserves through self-differentiation and mediation. By decisively separating logic from psychology, without regressing into Cartesian dogmatism, this controversy creates the conceptual space for non-subjective accounts of preservation—paths that will later be radicalized by Bergson, Simondon, and Deleuze.²⁹

This rupture does not emerge *ex nihilo*. In the aftermath of German Idealism, dissatisfaction with the closure of dialectical systems (Hegel), and the speculative ambitions of metaphysics, motivates a double movement: (1) the rise of scientific psychology (Herbart, Fechner, Lotze), which seeks to empiricize genesis as process and habit; (2) the ascendancy of neo-Kantian and early formal logicians (Boole, Schröder), who attempt to depersonalize form by rooting it in autonomous structures of validity.³⁰

In figures such as John Stuart Mill and Theodor Lipps, we find the paradigmatic shift toward psychologism. For Mill, as outlined in *A System of Logic* (1843), the laws of logic are inductively abstracted from observed patterns of reasoning. Logical necessity is reduced to empirical regularity: “The laws of thought are simply generalizations from the uniformities of mental phenomena.”³¹ Lipps extends this by claiming logical laws merely codify internal psychological experience—general principles drawn from introspective observation. In this view, genesis becomes contingent process: the production of logical structure is no longer a self-structuring act of thought, but the emergent property of cognitive habit.³²

As J. Meiland notes in his reconstruction of Lipps’ position, this move subordinates logical normativity to “the description of mental life,” ultimately collapsing the distinction between norms and facts.³³ Here, the motif of “difference-that-preserves” is not just reconfigured but threatened: preservation is dissolved into flux, difference into epiphenomenal

²⁹ For an overview of the Psychologismusstreit and its role in 19th-century logic, see Alberto Coffa, *The Semantic Tradition from Kant to Carnap* (Cambridge: Cambridge University Press, 1991), especially chaps. 3–4.

³⁰ On the neo-Kantian reaction and early formal logic, cf. Michael Friedman, *A Parting of the Ways: Carnap, Cassirer, and Heidegger* (Chicago: Open Court, 2000).

³¹ J. S. Mill, *A System of Logic*, Book II, chap. 3.

³² Theodor Lipps, *Grundtatsachen des Seelenlebens* (Leipzig: Engelmann, 1902), 89–103.

³³ J. W. Meiland, “Lipps and the Normativity of Logic,” *The Journal of Philosophy* 73, no. 17 (1976): 525–536.

association. What Fichte preserves through recursive self-relation, and what Hegel retains through contradiction and sublation, is now abandoned to the flux of empirical cognition. Form becomes secondary: a product of process, no longer a principle of retention. Genesis, in this view, is flow without structure, origin without recurrence, difference without durability.

The critique of psychologism begins in earnest with Bernard Bolzano's *Wissenschaftslehre* (1837), where a decisive distinction is drawn between judgments as subjective acts and propositions (*Sätze an sich*) as ideal semantic entities. These propositions do not exist in time, nor do they rely on mental acts for their validity.³⁴ They are not inventions of the mind, but ideal contents, capable of being true or false independently of whether anyone asserts or entertains them. This move enables Bolzano to articulate a conception of preservation that is neither psychological nor reflexive: propositions persist because of their internal structure, not because they are remembered or synthesized. In this way, Bolzano inaugurates a theory of difference-that-preserves in which identity is maintained through semantic stability, not temporal or dialectical mediation.

Bolzano's theory of objectless representations—propositions that refer to nothing yet retain intelligibility—prefigures much of Frege's logic. As Porta emphasizes, Bolzano's realism about semantic content inaugurates the “semantic turn” in logic, establishing a model of objectivity in which difference can be structured and preserved without subjective generation.³⁵ Yet, Bolzano also recognizes that any such semantic theory requires a complementary theory of subjectivity to explain how ideal content becomes accessible to consciousness—an insight that will return in Husserl's later synthesis.

Frege extends and formalizes this model, transforming it into a rigorous, symbolic logic. In *Begriffsschrift* (1879) and *Grundlagen der Arithmetik* (1884), Frege abandons any appeal to subjective mental processes in explaining logical or mathematical knowledge. Thoughts (*Gedanken*) are not mental phenomena but non-empirical, objective sense-structures that bear truth-values.^{36,37} The shift here is not merely from psychology to logic, but from genesis as mental act to inference as structural relation. Logical derivation becomes a movement internal to form, guided by syntactic rules and semantic functions. The inference from a proposition to its consequence does not trace a path of thought; it instantiates a law within an autonomous space of meanings.^{38,39}

This results in a new model of preservation: a proposition is not preserved by recollection or by dialectical reversal, but by formal entailment. Theorems retain their axioms not through recursive return, but through derivability: a structure in which identity is held invariant under transformation.

³⁴ Bernard Bolzano, *Wissenschaftslehre*, 4 vols., ed. R. Berg (Hamburg: Meiner, 1985), especially vol. II, §§93–102.

³⁵ Mario Ariel González Porta, “Platonismo e intencionalidad: A propósito de Bernard Bolzano – I,” *Síntese: Revista de Filosofia* 29, no. 94 (2002): 251–276, <https://doi.org/10.20911/21769389v29n94p251-276/2002>.

³⁶ Gottlob Frege, *Begriffsschrift: A Formula Language, Modeled upon That of Arithmetic, for Pure Thought* (Halle: Nebert, 1879); *The Foundations of Arithmetic: A Logico-Mathematical Enquiry into the Concept of Number*, trans. J. L. Austin (Oxford: Blackwell, 1950; orig. 1884).

³⁷ Richard G. Heck, “Frege and Semantics,” *Grazer Philosophische Studien* 75 (2007): 342–378.

³⁸ Gabriel Makin, “Frege's Distinction Between Sense and Reference,” *Philosophy Compass* 5 (2010): 147–163, <https://doi.org/10.1111/j.1747-9991.2009.00277.x>.

³⁹ Jan Löwenstein, “On the Limits of Frege's Logicism,” *History and Philosophy of Logic* 41, no. 2 (2020): 91–109.

Yet this model has limits. In eliminating the temporal and cognitive dimensions of genesis, Frege also eliminates becoming. There is no temporal genesis in Fregean logic, no transformation through time or experience—only a domain of static, eternal truths. As Löwenstein notes, Frege’s logic secures necessity through abstraction, but at the cost of losing any account of how these structures become accessible or meaningful for finite beings. Preservation becomes pure formalism: exact, reliable, but ontologically minimal.

This drive toward formal abstraction was nowhere more forcefully realized than in the foundational programs of Cantor and Russell. Cantor’s set theory inaugurated a vision of pure being as a completed infinite totality—unfolded not through genesis but through hierarchical stratification of transfinite multiplicities, each defined extensionally, not dynamically.⁴⁰ Russell, following Frege’s logicism, sought to ground all mathematical truth in tautological deduction from axioms, culminating in the *Principia Mathematica* (with Whitehead). There, time, subjectivity, and genesis are methodically excluded from the ontology of mathematics, in favor of absolute logical necessity.⁴¹ The logicist ideal becomes an epistemological mirror of an ontological commitment: being is structure, genesis is noise. As Whitehead would later reflect, the system they built had “strangled” the temporal and creative dimensions of reason itself.⁴²

It is precisely this lack of temporal structure—this exclusion of becoming and lived genesis—that will provoke both Husserl’s re-integration of subjectivity and, even more radically, Bergson’s ontological turn to duration.

5 Divergent Genesis, Converging Temporalities: Bergson, Husserl, and the Topology of Time

The question of genesis—how difference endures, how becoming is preserved, how anything comes to be—remains unresolved in the aftermath of Hegel. The *Psychologismusstreit* exposes a fracture at the heart of modern ontology: the reduction of logic to psychological process threatens to dissolve preservation into flux, while the formalist reaction of Frege and Bolzano severs genesis from becoming, leaving only atemporal structures. It is precisely at this impasse—between the collapse of dialectical mediation and the abstraction of formal logic—that the motif of “difference-that-preserves” becomes the central, unsolved problem. Here, Bergson inaugurates a radically new approach, and Husserl’s response begins the great phenomenological relay.⁴³

Bergson’s intervention directly confronts the failures of both German Idealism (Fichte’s *Tathandlung*, Hegel’s *Aufhebung*) and the reductionism of psychologism. Fichte and Hegel sought to preserve difference through recursive self-differentiation or sublation, while the *Psychologismusstreit* dissolves even minimal structures of preservation. Against both, Bergson offers duration (*la durée*) as the ontological principle: time is not succession or

⁴⁰ Joseph W. Dauben, *Georg Cantor: His Mathematics and Philosophy of the Infinite* (Princeton: Princeton University Press, 1979).

⁴¹ Alfred North Whitehead and Bertrand Russell, *Principia Mathematica*, 3 vols. (Cambridge: Cambridge University Press, 1910–1913).

⁴² Alfred North Whitehead, *Process and Reality: An Essay in Cosmology*, edited by David Ray Griffin and Donald W. Sherburne, Corrected ed. (New York: Free Press, 1978), part IV, chap. II.

⁴³ Henri Bergson, *Matière et mémoire*, critical ed. (Paris: PUF, 2009), coll. Quadrige/Grand Textes.

representation, but a virtual field of becoming in which the past endures as a non-localized, ontological condition of actuality.⁴⁴

Memory, in this schema, is not a trace or act of retention but “the past that survives under the form of memory, prolonging its existence into the present and even determining it.”⁴⁵ Preservation here is ontological rather than phenomenological; memory is not a mental state but a dimension of being—a “difference-that-preserves” which is immanent, virtual, and real.⁴⁶ As Deleuze clarifies, duration is not memory itself, but the condition for the actualization of the virtual; it is time as pure heterogeneity, not as linear measure.⁴⁷

Piatti captures this precisely: “Pure memory is an atopic reservoir... not situated in any kind of physical or mental space.”⁴⁸ Bergson’s virtual is not absent from consciousness, but ontologically prior to it—pre-individual and real. In his framework, the past does not return; it never left. Genesis is not structured or remembered; it is the ontogenetic unfolding of difference itself.

In contrast, Husserl’s engagement with genesis is explicitly mathematical from the start. In *Philosophie der Arithmetik* (1891), he attempted to ground the concept of number in the psychological acts of collecting, a position he would later refine into a rigorous formal ontology. By *Zur Phänomenologie des inneren Zeitbewusstseins* (1905), Husserl reinscribes genesis within the structures of transcendental subjectivity. Here, preservation is not a virtual coexistence, but a passive synthesis: the temporal flow of consciousness articulated through impression, retention, and protention. Genesis is thus eidetic, emerging not through empirical choice but within the structural unity of the living present.

Moving beyond the phenomenological horizon, this philosophical reconfiguration of time finds a distinct but parallel articulation in the work of A.N. Whitehead. Bridging the gap between the logicism of *Principia Mathematica* and the process metaphysics of his later work, Whitehead develops a “logic of continuity” that rivals the continental tradition. His concept of “prehension” describes how an actual entity includes its own past as a constituent of its becoming—a form of objective preservation that does not rely on a conscious subject. Similarly, Josiah Royce’s work on the logic of relations and the “self-representative system” offers an alternative idealist lineage for thinking infinite structures.⁴⁹ However, it is Whitehead’s critique of “simple location” that most directly anticipates the need for a topology of time where difference is structurally preserved.

Thus, preservation is not secured by temporal intuition or noetic synthesis, but by the inherent rhythmicity of process: each actuality embodies its past, transforms it, and propagates new differences. In doing so, Whitehead prefigures Deleuze’s reinterpretation of Bergson, offering a process ontology in which difference is preserved by its own unfolding—not by a subject, but by the cosmos itself.

⁴⁴ Henri Bergson, *La pensée et le mouvant*, critical ed., ed. Frédéric Worms (Paris: PUF, 2021), 187.

⁴⁵ Ibid.

⁴⁶ Giulio Piatti, *Cosmogenesi dell’esperienza: Il campo trascendentale impersonale da Bergson a Deleuze* (Milan: Mimesis, 2021).

⁴⁷ Gilles Deleuze, *Le Bergsonisme* (Paris: PUF, 1966).

⁴⁸ Giulio Piatti, *Cosmogenesi dell’esperienza: Il campo trascendentale impersonale da Bergson a Deleuze* (Milan: Mimesis, 2021).

⁴⁹ Royce’s concept of the map contained within the map is a precursor to the recursive structures discussed later in the context of category theory, though his distinct semiotic idealism lies outside the primary genealogy traced here. See Josiah Royce, *The World and the Individual* (New York: Dover Publications, 1959).

Yet this strict opposition between process philosophy and phenomenology begins to soften in Husserl's late work. In the *Analysen zur passiven Synthesis* (1920s), Husserl moves toward a model where time is no longer entirely structure-bound.⁵⁰ Genetic phenomenology opens Husserl's thought to the affective, pre-personal dynamics of experience.⁵¹

Donnelly articulates the stakes: "Husserl's passive synthesis, especially in its later development, seems to offer a structural resolution to Bergson's metaphysical tightness."⁵² Time begins to appear not as a correlate of constitution, but as a proto-intentional horizon—non-chronometric, non-spatialized, structurally open. This convergence does not erase the difference, but reframes it as topological: two sides of the same curvature of genesis.

Here, "topological" is used not in the strict sense of metric or open-set topology, but in alignment with the internal logics of category and topos theory. In a topos, morphisms are not only mappings but rules of structured preservation; they can be thought of as modeling continuity of transformation, where the identity of an object is retained across local variations. For example, consider the standard categorical commutative square:

$$\begin{array}{ccc} A & \rightarrow & B \\ \downarrow & & \downarrow \\ C & \rightarrow & D \end{array}$$

Please delete this equation.

Please delete this equation.

This diagram commutes if the two paths from A to D (via B or via C) yield the same result.⁵³

This expresses a logic of preservation across transformation: identity is not fixed by internal content but by relational invariance under change. Such diagrams mirror the structure of passive synthesis or temporal duration: a difference may unfold, but its form of unfolding is retained.

This proximity deepens in the next generation of phenomenology. Heidegger's *Sein und Zeit* (1927) critiques both Bergson and Husserl explicitly, yet retains deep affinities with both. In his 1920–23 lectures, Heidegger acknowledged that Bergson's notion of original time surpassed Husserl's in depth and intuition.⁵⁴ Though later distancing himself, Heidegger's notion of *Zeitigung* (temporalization) clearly bears traces of Bergson's *durée*, even as it transforms it into the existential structure of *Dasein*.⁵⁵ Heidegger inherits Berg-

⁵⁰ Edmund Husserl, *Analysen zur passiven Synthesis*, *Husserliana* vol. XI (The Hague: Martinus Nijhoff, 1973).

⁵¹ Dan Zahavi, *Self-Awareness and Alterity* (Evanston: Northwestern University Press, 2003).

⁵² Leonard Lawlor, *The Implication of Immanence: Toward a New Concept of Life* (New York: Fordham University Press, 2006), especially chap. 2, "Husserl and Bergson."

⁵³ Commutative diagrams in category theory visually express that two distinct paths yield the same morphism—this abstractly models structural consistency under transformation. The analogy with passive synthesis lies in how difference unfolds without loss of structural identity: the order of operations doesn't matter, only their relational invariance. See Steve Awodey, *Category Theory*, 2nd ed. (Oxford: Oxford University Press, 2010), chaps. 1–3.

⁵⁴ Jon B. Crocker, "Heidegger's Debt to Bergson," *Man and World* 30 (1997): 1–15.

⁵⁵ Heidegger's notion of *Zeitigung* is not equivalent to either retention or *durée* but signifies the eventual unfolding of time from the horizon of *Dasein*'s thrownness. It emphasizes temporalization as ontological event rather than internal synthesis.

son's ontological rhythm while rearticulating it as a thrown-open horizon of Being.⁵⁶ Time becomes ecstatic—not retention, not flow, but event: a historical articulation of difference.

Merleau-Ponty goes further still. In *The Visible and the Invisible* and *The Prose of the World*, he fuses Bergson's ontology of memory with Husserl's temporality to arrive at the "immemorial"—a past that was never present, yet structures all appearing.⁵⁷ This is not memory, nor retention. It is what Al-Saji calls a "vertical time"—not flowing from past to future, but folding being into its own visibility.⁵⁸ Here, time is flesh, a *chiasm*.⁵⁹ Passive synthesis becomes not merely structural, but the mode by which difference endures materially, sensibly, bodily.

Merleau-Ponty's "ontological chiasm" thus completes the trajectory: Bergson radicalizes immanence, Husserl formalizes it, Heidegger temporalizes it, and Merleau-Ponty incarnates it. Their philosophies no longer oppose, but cross—each unfolding a layer of "difference-that-preserves." What began as a strict opposition between Bergson's ontological duration and Husserl's passive synthesis evolves, across their late work and their successors, into a shared topology of time. The logic of "difference-that-preserves" survives not as a choice between two systems, but as a recursive relay: a dynamic tension between structure and flow, between eidetic coherence and ontological immanence.

This relay sets the stage for Simondon's theory of individuation, where memory becomes metastability, and for Deleuze's ontology of difference, where synthesis and duration are no longer opposed, but modulated. The question remains open: Can difference endure without synthesis? Can genesis be both structured and immanent?

Bergson and Husserl do not answer these questions definitively. But they create the conditions under which a new logic of time—and a new ontology of difference—can begin.

6 The Formal Break: Mathematical Architectures of Difference and Sameness

Having traced in section IV how the motif of "difference-that-preserves" is reconfigured by Bergson's duration and Husserl's passive synthesis—each suggesting a topology of time that resists the closure of formal logic—we must now rewind and return to mathematics itself. Mathematics can be seen as far from an inert technical domain; it has been described as a key site of the fracture between genesis and structure, and, ultimately, as a space in which new approaches to the logic of preservation have been constructed. To fully understand contemporary explorations of genesis and memory within mathematics, one must consider how the intellectual drama initiated by Bergson, negotiated by Husserl, radicalized by Brouwer, deepened by Manin and Martin-Löf, and given new formal expression by Law-

⁵⁶ Keith Ansell-Pearson, *Geminal Life: The Difference and Repetition of Deleuze* (London: Routledge, 1999), chap. 2.

⁵⁷ Maurice Merleau-Ponty, *Le visible et l'invisible*, ed. Claude Lefort (Paris: Gallimard, 1964), 208ff.; and *La prose du monde* (Paris: Gallimard, 1969), 84ff.

⁵⁸ "Vertical time" does not mean a spatialized alternative to linear flow, but rather a **non-sequential depth** through which the past configures the present without ever being fully thematized—similar to how Merleau-Ponty's *flesh* is both presence and non-presence. See Alia Al-Saji, "The Temporality of Life: Merleau-Ponty, Bergson, and the Immemorial Past," *Continental Philosophy Review* 40, no. 2 (2007): 113–139.

⁵⁹ Renaud Barbaras, *La perception: Essai sur le sensible* (Paris: Hatier, 1994), 157–160.

vere, offers a framework for reinterpreting aspects of the history of mathematics through the lens of event, memory, and preservation.

Bergson's inaugural critique in the *Essai sur les données immédiates de la conscience* (1889) is not only directed against psychologism or German Idealism but also at what he perceived as the mathematical reduction of time to space. For Bergson, classical mathematics—by decomposing continuity into discrete units—risked misrecognizing becoming by substituting a static, juxtaposed continuity for the “real” continuity of lived duration (*la durée*). “La science [mathématique] substitue à la continuité réelle des choses une continuité factice, faite de parties juxtaposées, comme celle des points de la ligne ou des nombres sur l'échelle,” he famously writes.⁶⁰ This can be understood not as a wholesale rejection of mathematics, but as a demand to recognize its limits in certain domains: mathematics can formalize succession, but, in Bergson's view, could not fully capture the ontological power of genesis. Duration, for him, is not the sum of instants, but a living, qualitative process whose difference endures as memory rather than as abstract difference.⁶¹

The impact of Bergson's critique on early twentieth-century French mathematical and epistemological culture is considered by some to be both profound and subtle. Édouard Le Roy, in *La philosophie de Bergson* (1899), connected Bergson's thesis to a critique of the “tyranny of number,” arguing that true mathematical invention is a creative, temporal act, irreducible to pure logicism. Poincaré, while far less metaphysical, affirmed in *La Science et l'Hypothèse* (1902) that intuition—rather than mere mechanical rule-following—lies at the heart of mathematical discovery, a view that resonates with Bergson's valorization of temporal genesis.⁶² As Daston and Galison emphasize, Poincaré's pragmatic idealism decisively rejected Bergsonian metaphysics, yet he remained committed to the creative and temporal aspect of mathematical invention.⁶³ Duhem, too, stressed the historicity and context-dependence of scientific systems, implicitly acknowledging that mathematical structure may not be entirely divorced from the memory of its genesis. While Poincaré resisted Bergson's metaphysics, his defense of intuition in mathematical invention unmistakably resonates with Bergson's concern for temporal genesis.⁶⁴

Thus, the French tradition, arguably influenced by Bergson's intervention, developed a persistent suspicion toward attempts to “close” mathematical genesis within static forms or pure symbol manipulation. It is this intellectual climate that some suggest seeded the later French fascination with category theory and structuralism, both of which would return to the question of how difference might be structurally preserved without erasing the temporal event of its genesis.⁶⁵

Parallel to this, Husserl's early mathematical philosophy (*Philosophie der Arithmetik*, 1891) sought to ground mathematical meaning in subjective acts of collecting and unify-

⁶⁰ Henri Bergson, *Essai sur les données immédiates de la conscience*, ed. Frédéric Worms (Paris: PUF, 2008 [orig. 1889]), 99.

⁶¹ M. Čapek, “The Dynamic Continuity of Duration,” in *Bergson and Modern Physics* (Dordrecht: Springer, 1971), 92–98, https://doi.org/10.1007/978-94-010-3096-0_12.

⁶² Henri Poincaré, *La science et l'hypothèse* (Paris: Flammarion, 1917 [1902]), especially chaps. IV–V.

⁶³ Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), chap. 4.

⁶⁴ Justin Bagby, “Reconstructing Bergson's Critique of Intensive Magnitude,” *Journal of the British Society for Phenomenology* 52 (2021): 80–94, <https://doi.org/10.1080/00071773.2020.1806688>.

⁶⁵ Miguel Betti, “Henri Bergson y la continuidad indivisible de lo real,” *Episteme: Revista de Estudios Socio-territoriales* 11, no. 1 (2019): 97–113.

ing, thus attempting to anchor number in genesis. Yet the *Psychologismusstreit*—especially under Frege’s withering critique—revealed the risk: without a criterion of objectivity, mathematical necessity could seem to collapse into the flux of habit and empirical association.⁶⁶ Husserl’s epoch-making response in the *Logische Untersuchungen* (1900) was to suspend psychological genesis and postulate ideal, intersubjectively accessible contents—meanings “constituted in and through temporally flowing intentional acts,” but not reducible to them. Temporality, rather than being eliminated, was then systematized as the flow of intentional life.⁶⁷ In *Zur Phänomenologie des inneren Zeitbewusstseins* (1905), Husserl investigated the structure of passive synthesis, the way retention, protention, and impression articulate an eidetic flow within consciousness. Yet this was presented as neither a pure structure nor a pure genesis, but an unstable suspension, a bracketing that held the question of preservation open rather than definitively resolving it.^{68,69}

It is against this background that Brouwer’s intuitionism emerged, not as a simple return to psychological genesis, but as a radical reassertion that mathematical truth can be understood as a temporal, constructive event. “There are no non-experienced truths in mathematics”⁷⁰: mathematics, for Brouwer, was not a set of eternal objects nor a system of atemporal entailments, but a field of acts—each new truth must be constructed, and each construction could be said to preserve its genesis as memory. Brouwer’s concept of choice sequences crystallized this position: the continuum was conceived not as a completed infinite but as an ever-unfolding, temporally indexed process in which every choice, every difference, is preserved as the historical horizon for new acts.⁷¹ Although not directly influenced by Bergson, Brouwer’s notion of temporal construction unmistakably echoes the ontological concerns of duration; his approach can be seen as radicalizing Husserl’s “passive synthesis” by insisting that mathematical existence is linked to the performance of memory—a genesis that endures within and as construction. This, in turn, resonated with the French intuitionist tradition: while Poincaré did not embrace intuitionism, he too saw mathematical invention as irreducibly temporal. The intuitionist project thus sought to actualize the Bergsonian demand for a logic that does not abolish time but internalizes it as a ground of mathematical being.⁷²

As mathematics in the early twentieth century became ever more professionalized and formalized—especially under the influence of Hilbert and the formalist program—there was a determined effort to secure mathematics as a timeless calculus, reducing preservation to the entailment of static symbols. Gödel’s incompleteness theorems had a devastating impact on this ambition: no purely formal system can exhaust the space of mathematical

⁶⁶ Gottlob Frege, “Kritische Beleuchtung einiger Punkte in E. Husserls *Philosophie der Arithmetik*,” *Zeitschrift für Philosophie und philosophische Kritik* 103 (1894): 313–332.

⁶⁷ Leonard Lawlor, *The Implication of Immanence: Toward a New Concept of Life* (New York: Fordham University Press, 2006).

⁶⁸ Dan Zahavi, *Husserl’s Phenomenology* (Stanford: Stanford University Press, 2003), chap. 5.

⁶⁹ Edmund Husserl, *Philosophie der Arithmetik: Mit ergänzenden Texten (1891)*, ed. Lothar Eley, *Husserliana*, vol. XII (The Hague: Nijhoff, 1970); idem, *Logische Untersuchungen*, vols. I–II (Tübingen: Niemeyer, 1984 [orig. 1900/01]); idem, *Zur Phänomenologie des inneren Zeitbewusstseins (1893–1917)*, ed. Rudolf Boehm, *Husserliana*, vol. X (The Hague: Nijhoff, 1966).

⁷⁰ L. E. J. Brouwer, *Over de Grondslagen der Wiskunde* (1907), in *Collected Works*, vol. 1, ed. A. Heyting (Amsterdam: North-Holland, 1975), 17.

⁷¹ Casper Storm Hansen, “Intuitionism and Choice Sequences,” in *Synthese Library* (2021).

⁷² Michael Dummett, *Elements of Intuitionism*, 2nd ed. (Oxford: Oxford University Press, 2000), especially chaps. 1–2.

truth. It has been argued that Gödel's theorem can be seen as marking the return of event and temporality into mathematical ontology, suggesting the system cannot fully encode its own genesis, and that “difference-that-preserved” might then be understood as either trivial, in the form of invariance, or threatening, as paradox.⁷³ Gödel's theorem, in this light, could be interpreted as revealing the challenge of reducing genesis to static symbol manipulation, and as pointing towards the need for an architecture capable of modeling its own becoming. Mathematics thus faced an impasse, suggesting a need for new formalisms that could better accommodate genesis as memory, and structure as ongoing event.

It is here that Lawvere's category theory has been described by figures like Król (2017) and Healy & Caudell (2006) as a candidate for the “meta-ontology” of the twentieth century. Drawing on intuitionism, the French critique of spatialized logic, and continental philosophies of relation, Lawvere sought to redefine mathematical objects not primarily by their substance but by their place in a network of morphisms—that is, by their relations, transformations, and capacity to record their own history.⁷⁴ In category theory, morphisms can be understood not merely as mappings but as expressions of transformation whose compositionality provides a structure for modeling a form of memory.⁷⁵ Topos theory extended this further: logic could become local and variable, not necessarily static and universal. Every topos has its own internal logic, and preservation is reflected in the rules by which morphisms compose and diagrams commute.⁷⁶ Category theory is considered by some authors as offering a more ontologically generative framework than set theory, with the claim that it models becoming through relational structures and memory through organized forms.⁷⁷ This has been seen as a point of intersection with Simondon's metaphysics of individuation, where individuation is not the arrival at a state, but the ongoing maintenance of tension and metastability across phases; Lawvere's morphisms have been interpreted as offering a way to model aspects of genesis akin to Simondon's concept of a tension-preserving transformation.⁷⁸

The convergence of category theory with Martin-Löf's constructive type theory and the Curry–Howard correspondence illustrates the correspondence of proof to program and verification to execution, with recursion offering a formal means to construct and represent aspects of genesis.⁷⁹ Here, Martin-Löf's intuitionistic type theory, in particular, provides an architecture in which mathematical objects and proofs are generated together, each arguably inhabiting a temporal logic of construction and verification.

To make this structure more vivid, consider a simple type definition:

⁷³ Jan M. Mikki, “Gödel, Memory, and the Mathematical Event,” *History and Philosophy of Logic* 43, no. 1 (2022): 53–75.

⁷⁴ William Lawvere, “Functorial Semantics of Algebraic Theories,” *Proceedings of the National Academy of Sciences* (1963); William Lawvere and Robert Rosebrugh, *Sets for Mathematics* (Cambridge: Cambridge University Press, 2003).

⁷⁵ Thomas Healy, “Memory as Structure in Lawvere's Functorial Logic,” *Topoi* 29 (2010): 77–92.

⁷⁶ Colin McLarty, “The Uses and Abuses of the History of Topos Theory,” *British Journal for the Philosophy of Science* 56 (2005): 681–702.

⁷⁷ Zbigniew Król, “Category Theory and Philosophy,” in *Springer Proceedings in Physics* (2017), https://doi.org/10.1007/978-3-030-30896-4_2.

⁷⁸ *Ibid.*

⁷⁹ Per Martin-Löf, *Constructive Mathematics and Computer Programming* (Oxford: Oxford Logic Guides, 1982).

$$\text{Nat} ::= 0 \mid \text{Succ}(\text{Nat})$$

This inductively defines the natural numbers, where each new element ($\text{Succ}(n)$) depends on the prior one. In **Curry–Howard logic**, this definition mirrors a proof: constructing $\text{Succ}(\text{Succ}(0))$ corresponds to proving a proposition P , whose justification includes each prior step as its structure. Thus, proof becomes **recursive retention**: to verify P , one must traverse and reconstruct its generative history.

As Wadler (2015) explains, “proofs are programs” — and **execution is memory reactivated**. Each function call retains context; each recursion replays history.⁸⁰ Philosophically, this aligns with Bergson’s duration (where the past is ontologically present) and with Husserlian retention (where the now holds the trace of the before). It also offers a mathematical grounding for Simondon’s idea of individuation as the structured passage of inherited tension.

Proofs are not only performative; they can be seen to reinstate aspects of genesis and memory into verification itself, echoing Bergson’s idea of knowledge as action, and connecting to Manin’s insistence that mathematical reasoning is always an eventful, historically layered activity. In this synthesis, mathematical reasoning can be conceptualized less as a series of static entailments and more as a recursive architecture of executable memory.

As Joyal & Street and Mikki demonstrate, diagrammatic reasoning can be viewed as representing a non-linear memory of paths.^{81,82} This has been connected to the ‘enactive logic’ of Varela, with some interpretations suggesting that aspects of it are mathematically reflected in homotopical structures; within such a framework, the idea of “laying down a path in walking” might serve as an analogy for how, in certain categorical logics, processes can be understood as constructing a history and a topological space where difference is preserved.⁸³

Thus, it has been argued that category theory, particularly in Lawvere’s development, offers a mathematical topology relevant to the concept of “difference-that-preserves”. Within this perspective, memory finds its model in structure, genesis can be conceptualized through architecture, and logic may be understood as facilitating the dynamic preservation of event and possibility. As authors like Badiou and Bhattacharyya have observed, the shift from sets to categories can be interpreted as a shift from a focus on inert being to one on structured eventhood—suggesting a convergence of the mathematical, ontological, and phenomenological genealogies after their long detour.^{84,85} What began as a tension between structure and genesis, between the spatialization of becoming and the memory of duration, now finds potent means for its rigorous exploration within a developing mathematical ontology, one in which difference, memory, and event can be structurally modeled and preserved.

⁸⁰ Philip Wadler, “Propositions as Types,” *Communications of the ACM* 58, no. 12 (2015): 75–84.

⁸¹ André Joyal and Ross Street, “The Geometry of Tensor Calculus,” *Advances in Mathematics* 88 (1991): 55–112.

⁸² Jan M. Mikki, “Gödel, Memory, and the Mathematical Event,” *History and Philosophy of Logic* 43.1 (2022): 53–75.

⁸³ L. H. Kauffman, “Enaction and the Mathematical Work of Francisco Varela,” *Cybernetics and Human Knowing* 24, no. 1 (2017): 9–38.

⁸⁴ Alain Badiou, *Logics of Worlds* (London: Continuum, 2009).

⁸⁵ Anindya Bhattacharyya, “Sets, Categories and Topoi: Approaches to Ontology in Badiou’s Later Work,” in *Badiou and Philosophy*, ed. Sean Bowden (Edinburgh: Edinburgh University Press, 2012), 79–96, <https://doi.org/10.1515/9780748643530-007>.

Here, the role of Yuri Manin has been considered decisive by some as a bridge between the “French” and “constructive” traditions and the contemporary structural turn. Manin, both a first-rate mathematician and a philosopher of mathematics, drew attention to the irreducibly historical and creative dimensions of mathematics, and to the way in which mathematical concepts themselves might possess an inner temporality. In works such as *A Course in Mathematical Logic for Mathematicians* and *Mathematics as Metaphor*, Manin explicitly foregrounded how mathematical practices can be seen to bear the traces of their own genesis—how proof, invention, and construction are arguably never mere formal entailments but the sedimented memory of acts of conceptual innovation. For Manin, mathematics is always an articulation of difference that endures: a living tradition, not entirely reducible to mere axiomatics, and always marked by the recursive interplay between historical invention and structural preservation. Manin’s reflections, often neglected in the philosophical literature, thus serve as a vital link between the ontological thematics of duration, the epistemic structure of intuition, and the logic of memory as enacted in mathematics.^{86,87}

We have seen how Fichte and Hegel ground preservation in subjectivity, how the *Psychologismusstreit* reframed it in logic, and how phenomenologists refracted it through time. In the next act, we will trace how Simondon’s individuation and Deleuze’s ontology of difference radicalize these motifs—before finally bringing them to bear on a new Mnēmaic foundation for mathematics.

7 Individuation, Virtuality, and the Event: Preservation Without Substrate

As the motif of “difference-that-preserved” advances into the late twentieth century, its classical supports—subjectivity, dialectical mediation, and the temporality of lived consciousness—begin to dissolve. What initially functioned as the trace of genesis (Fichte’s Tathandlung), the structural resolution of contradiction (Hegel’s Aufhebung), or the memory of duration (Bergson’s durée) no longer provides adequate ground. In thinkers like Simondon, Deleuze, and Badiou, preservation is reconfigured in ontologies where no stable substrate—neither form, structure, nor temporality—is available. What then does it mean to preserve difference, when preservation itself must operate without recourse to memory, identity, or mediation?

Gilbert Simondon articulates the most consequential break. For Simondon, individuation is not the actualization of a pre-given form, nor the synthesis of opposed terms, but a continuous negotiation of tensions within a **metastable field**. Metastability, as developed in his *Individuation in the Light of the Notions of Form and Information*, is not mere disequilibrium, but a structured potential for transformation. As Mill and Bardin emphasize, Simondon’s ontology rejects both hylomorphism and linear causality. In its place, it posits a **preindividual field** charged with energy and potential, wherein individuation emerges through **transduction**—a progressive,

⁸⁶ W. T. Gowers, “Yuri Ivanovich Manin, An Extraordinary Mathematician,” *Bulletin of the American Mathematical Society* 60 (2023): 1–10, <https://doi.org/10.1090/bull/1801>.

⁸⁷ G. Cornelissen, “Late Style – Yuri I. Manin Looking Back on a Life in Mathematics,” *Notices of the American Mathematical Society* 60 (2013): 84–85, <https://doi.org/10.1090/noti932>.

domain-crossing operation in which each new structure is the principle of further individuation.⁸⁸90“Transduction is a process of individuation in which activity propagates from one region to another within a domain, such that each determined region serves as a principle of structuration for the next.”⁹⁰

Transduction is thus neither computation nor deduction: it is a **recursive analogical genesis**, modulating across physical, vital, and psychic domains without closure. Preservation in this framework is neither memorial nor dialectical—it is the continued **structural openness of the field**, the capacity of each individuation to sustain tensions for further becoming.⁹¹923

Let F be a metastable field of preindividual potentials.

Transduction: $\mathcal{F}_n \rightarrow \mathcal{F}_{n+1}$, where each phase maps unresolved tensions into new thresholds.

Preservation: \mathcal{F}_{n+1} is preserved iff it remains open to further transduction; memory is not content, but recursive condition.

This logic of preservation as **tension that persists**, rather than form that returns, becomes more radical in Deleuze. While Simondon grounds individuation in energetic fields, Deleuze makes **difference itself ontologically primary**. The virtual, in Deleuze’s sense, is not an unreal or potential dimension—it is the **real** condition from which actual forms diverge. Preservation occurs through **repetition with a difference**: not the reproduction of sameness, but the ceaseless variation of the virtual in the actual.

“Difference is not what differs from something else, but that by which the given is given.”⁹⁴

⁸⁸This ontological layer—neither formed nor null—recalls Husserl’s hyletic substrate: the affective and sensory givenness that, while not yet intentional, conditions the emergence of meaning through passive synthesis. In *Ideas I* and the *Analyses Concerning Passive and Active Synthesis*, Husserl describes hyletic data as “sensuous materials” that are neither reducible to objects nor to acts, but instead serve as a non-conceptual ground for constitution. See Edmund Husserl, *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy*, trans. F. Kersten (The Hague: Nijhoff, 1982); and *Analyses Concerning Passive and Active Synthesis*, ed. M. Fleischer, trans. A. Steinbock (Dordrecht: Kluwer, 2001). Simondon’s notion of the **preindividual charge** functions analogously: it is not a determinate form nor a null background, but a dynamic field of tensions and potentials that becomes structured through transduction. The philosophical affinity between these two concepts has been explored in detail by Ballús, who argues that Simondon’s theory of individuation—particularly the role of affect and pre-formal intensity—anticipates contemporary **enactive models of cognition**, where meaning emerges from dynamic interaction rather than pre-given forms. Andreu Ballús Santacana, “Simondon, ¿enactivista? Individuación y generación de sentido,” *Astrolabio: Revista Internacional de Filosofía* 15 (2013): 187–203.

⁸⁹Andrea Bardin, “Elements for a Philosophy of Individuation,” in *The Process of Individuation*, ed. D. Scott and S. Voss (Dordrecht: Springer, 2015), 3–19, https://doi.org/10.1007/978-3-319-27410-6_1.

⁹⁰Gilbert Simondon, *L’individuation à la lumière des notions de forme et d’information* (Grenoble: Éditions Jérôme Millon, 2005 [orig. 1964]): 10–15.

⁹¹Gilbert Simondon, *L’individuation à la lumière des notions de forme et d’information* (Grenoble: Éditions Jérôme Millon, 2005 [orig. 1964]).

⁹²Andrea Bardin, “Elements for a Philosophy of Individuation,” in *The Process of Individuation*, ed. D. Scott and S. Voss (Dordrecht: Springer, 2015), 3–19, https://doi.org/10.1007/978-94-017-9831-0_1.

⁹³Stephen Mills, *Gilbert Simondon: Causality, Ontogenesis & Technology*, PhD diss., Middlesex University, 2014, <https://eprints.mdx.ac.uk/14453/>.

⁹⁴Gilles Deleuze, *Différence et répétition* (Paris: PUF, 1968); German translation: *Differenz und Wiederholung* (Munich: Fink, 1992), chaps. 1–2.

Repetition, therefore, is a creative operation, whereby difference unfolds without exhaustion. As Piatti and Alloa & Michalet clarify, the Deleuzian virtual is not a hidden essence or a background condition, but a structurally productive multiplicity: it sustains divergent actualizations precisely by **not being reducible** to any single form.^{95,96}

Let V be a virtual multiplicity

Actualization: $A : \mathcal{V} \rightarrow \mathcal{A}$, $a_i = A(v)$, $v \in \mathcal{V}$; Preservation: $\forall a_i \in \mathcal{A} \exists v \in \mathcal{V} \setminus a_i$

—the virtual is inexhaustible. Preservation occurs by maintaining divergence, not identity.

Deleuze thus preserves difference not by returning to origins (Fichte), integrating contradiction (Hegel), or retaining duration (Bergson), but by **affirming the inexhaustibility of divergence itself**. This is a logic in which difference remains not because it is resolved, but because it **resists closure**, constantly re-expressing itself in new actualizations.

Badiou reconfigures the motif entirely. For him, difference appears not as tension or virtuality, but as the **event**—a singular irruption into the order of being that **subtracts itself from structure**. The event is not a transformation within a field; it is a **rupture without precedent**, introducing a truth that cannot be derived or mediated from the situation. Yet, paradoxically, the event **preserves** itself through its **generic trace**—an invariant that persists across all possible extensions of the structure, formalized via **forcing** in set theory.

“The event is what makes truth possible. But it is only by its trace, in the form of a generic set, that it enters into being.”⁹⁷

Preservation, for Badiou, is no longer the memory of genesis, nor the persistence of potentiality. It is the **invariance of the undecidable**—a logic of subtraction, where what is preserved is not a content, but a relation of **generic indiscernibility**.⁹⁸

Let $M \models ZFC$ be a ground model.

Forcing: Let $M[G]$ be a generic extension, with G generic over M .

Preservation: A property p is generic iff $\forall D \in M$ (*denseset*), $G \cap D \neq \emptyset$

Here, truth is preserved as what **cannot** be foreseen—**invariance without memory**.

These three models—Simondon’s metastable individuation, Deleuze’s virtual differentiation, Badiou’s generic trace—transform the motif of “difference-that-preserved” by detaching it from the classical grounds of preservation. No longer is preservation a function of reflection, temporality, or contradiction. It is instead:

the **persistence of transformative potential** (Simondon),
 the **ontological inexhaustibility of difference** (Deleuze),
 or the **formal invariance of the undecidable** (Badiou).

⁹⁵ Emmanuel Alloa and J. Michalet, “Differences in Becoming: Gilbert Simondon and Gilles Deleuze on Individuation,” *Philosophy Today* 61 (2017): 475–502, <https://doi.org/10.5840/philtoday2017918167>.

⁹⁶ Giulio Piatti, *Cosmogeneresi dell’esperienza: Il campo trascendentale impersonale da Bergson a Deleuze* (Milan: Mimesis, 2021).

⁹⁷ Alain Badiou, *L’être et l’événement* (Paris: Seuil, 1988).

⁹⁸ Anindya Bhattacharyya, “Sets, Categories and Topoi: Approaches to Ontology in Badiou’s Later Work,” in *Badiou and Philosophy*, ed. Sean Bowden (Edinburgh: Edinburgh University Press, 2012), 79–96.

Each figure replaces identity with process, memory with recursion, and resolution with divergence. But together, they raise a deeper question: **Can there be a logic that preserves difference without relying on any substrate—neither subject, structure, nor temporality?** Can genesis and preservation coincide without mediation?

This is where mathematics re-enters, not as symbolism, but as **a mode of ontological investigation**. Category theory, topos logic, and homotopy type theory offer frameworks where identity is preserved only via structural mappings, and where diagrams commute by virtue of transformation, not by reidentification. They provide a particularly promising terrain on which **preservation without substrate** can be rigorously modeled. The final task, then, is to determine whether such a formalization can succeed—not merely as a technical system, but as the **contemporary mathematical realization of the motif** of difference-that-preserves.

8 The Mnēmaic Framework: A Mathematical Logic for Recursive Preservation

This final section seeks to articulate, in precise mathematical and philosophical terms, the ontological trajectory traced from Fichte’s theory of genesis to the concept of *difference-that-preserves* as developed through Simondon and Deleuze. The Mnēmaic framework presented here is not a loose assemblage of technical devices, but a rigorously integrated construction in which all algebraic, categorical, and logical properties arise necessarily from a single primitive operation: recursive differentiation. This operation is conceived not as a symbolic or computational procedure, but as a minimal act of structural emergence that simultaneously introduces distinction and conserves its own generative lineage. What emerges, then, is not a static universe of pre-given forms, but a dynamically unfolding ontology in which every new structure encodes, within itself, the complete history of its production. Preservation and genesis are not reconciled post hoc, but co-constituted from the beginning.

Let DD be a non-empty set of primitive distinctions—marks, gestures, modalities, or categorical differentiators. The null mnēma $M0 := \emptyset M0 := \emptyset$ designates the absolute origin: a point of undifferentiated potential. The set MM of all mnēmata is generated inductively as the smallest collection such that

$$M_0 \in \mathcal{M}, \quad \text{and} \quad \forall M \in \mathcal{M}, \forall d \in \mathcal{D}, (d, M) \in \mathcal{M}.$$

Each mnēma $M \in MM \in \mathcal{M}$ thus admits a unique expression as a finite, nested sequence of distinctions:

$$M = (d_n, (d_{n-1}, \dots, (d_1, M_0) \dots)) \equiv M(d_1, \dots, d_n)$$

where the sequence $(d_1, \dots, d_n)(d_1, \dots, d_n)$ fully determines both the identity and the structure of the mnēma. This recursion is not merely syntactic—it is ontological: the being of a mnēma is constituted entirely by its path of generation. Morphisms within this framework are identified with differentiation paths. A morphism $f: M \rightarrow N: M \rightarrow N$ exists if and only if NN is an extension of MM by a finite sequence

$$(e_1, \dots, e_k) \in \mathcal{D}^k \quad \text{and} \quad N = M(e_1, \dots, e_k)$$

Each such morphism corresponds uniquely to this extension sequence, with the identity morphism represented by the empty path $\epsilon\epsilon$, and composition defined via concatenation:

$$(e_1, \dots, e_k) \circ (d_1, \dots, d_n) = (d_1, \dots, d_n, e_1, \dots, e_k)$$

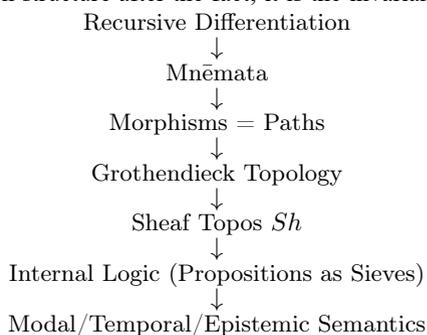
This defines a free category M , whose objects are genealogically constructed $mn\bar{e}mata$ and whose morphisms are recursive differentiation sequences. No further axioms are required. Identity is internal to this structure: two $mn\bar{e}mata$ are the same if and only if their genealogical paths coincide. Logical identity, in this framework, is not posited—it is recursively *achieved*.

The category M possesses a natural Grothendieck topology,⁹⁹ defined via ancestral covers. A sieve S on M covers M if for every morphism $f:N \rightarrow M$, there exists $N \rightarrow M' \in S$ such that $M' \leq M$ in the prefix order. This yields a canonical site whose sheaf topos $Sh(M)$ supports an internal logic in which propositions, implication, conjunction, and subobjects are realized as sieves stable under genealogical extension. Crucially, logical operations are not postulated externally but arise intrinsically from the topology of recursive differentiation.

The philosophical consequence is immediate: preservation becomes a structural invariant of genesis itself. A proposition is said to persist if its realization is stable across all paths of recursive differentiation; truth is not global by assumption but constructed from coherent local extensions. Identity is path-invariance, and objectivity emerges not as correspondence to an external reality, but as the *stability of genealogically preserved structure* within the system. From this emerges a new logic—one capable of internalizing not only propositional reasoning but also modal, temporal, and epistemic dynamics. Modal operators correspond to Lawvere–Tierney topologies on $Sh(M)$; necessity is realized as stability under all extensions, possibility as its dual. Temporal logic is inscribed into the structure of the category itself: each morphism is a time-step, each $mn\bar{e}ma$ a record of generative history. Epistemic modalities, similarly, are defined by accessibility over sieves corresponding to shared or convergent ancestral paths.

The logic of the $Mn\bar{e}maic$ framework thus arises not from arbitrary rules or extrinsic declarations, but from the internal necessity of a single operation: recursive differentiation. This construction realizes, with full formal precision, the philosophical motif of difference-that-preserved. In contrast to classical foundations, where logical primitives are stipulated and ontological commitments remain opaque, the $Mn\bar{e}maic$ system allows one to derive all further structure—categorical, logical, topological, and semantic—from one primitive act. Preservation is not a property imposed upon structure after the fact; it is the invariant

through which structure arises in the first place.



⁹⁹ A **Grothendieck topology** is a categorical generalization of open covers in classical topology. Rather than using spatial points or neighborhoods, it defines covering conditions in terms of morphisms into an object. In the present context, it is defined over the category of $mn\bar{e}mata$ by ancestral truncation: a sieve covers an object if it collectively contains enough morphisms to reconstruct all its genealogical extensions. This induces a logical geometry where preservation is not spatial but structural: each ‘cover’ is a record of compatible ancestral paths. This reconceptualizes topological locality as genealogical coherence, and enables the subsequent construction of an internal logic via sheaf semantics.

This generative process can be summarized diagrammatically as follows:

Recursive Differentiation

↓

Mnēmata (\mathcal{M})

↓

Morphisms = Paths

↓

Grothendieck Topology

↓

Sheaf Topos $\text{Sh}(\mathcal{M})$

↓

Internal Logic (Propositions as Sieves)

↓

Modal/Temporal/Epistemic Semantics

In this sequence, every subsequent layer of mathematical structure emerges as a necessary consequence of the recursive act of differentiation. The framework exhibits a logic that is not superimposed, but internal to the genealogical memory it encodes. What results is a categorical universe in which identity, logic, and modality are unified by a principle of structural recursion—one that operationalizes philosophical notions of genesis, difference, and preservation with full mathematical rigor.

By demonstrating that a complete system of logic and objectivity can arise from the recursive preservation of structural difference, the Mnēmaic framework offers not only a new foundation for mathematics and logic but also a philosophical model of internal realism. In this vision, truth and coherence do not lie outside the system but emerge within it—stabilized through paths of generative differentiation that preserve their own conditions of origin.

9 Conclusion

This paper set out to trace and actualize the motif of “difference-that-preserved,” beginning with Fichte’s account of genesis, moving through the conceptual innovations of Simondon and Deleuze, and culminating in the formal construction of the Mnēmaic framework. By following this philosophical genealogy, the argument exposed the limitations of static ontological paradigms and made explicit the need for a logic in which genesis, memory, and preservation are not external impositions but internal structural features.

The Mnēmaic framework proposed here represents one rigorous attempt to embody this necessity at the level of mathematical logic. By adopting recursive differentiation as its sole primitive and deriving all further structure from it by internal necessity, the framework provides not only a new foundation for understanding preservation and identity, but also demonstrates how a genuinely genealogical logic can be rigorously formalized. Within this system, preservation is not a metaphor but a structural invariant; identity is no longer an abstraction but a concrete, path-dependent construction. The mathematical articulation offered by this work aspires to unite philosophical and formal insights, showing that the motif of difference-that-preserved can serve as a generative principle for both ontology and logic.

While ambitious, this proposal is intended as an opening rather than a final word. The Mnēmaic framework invites further technical development, philosophical critique, and interdisciplinary engagement. It is offered not as a definitive foundation, but as a precise and generative hypothesis—one that seeks to stimulate new ways of thinking about genesis, preservation, and the logic of difference at the intersection of philosophy and mathematics.

In this spirit, the present work submits its claims to the community as a contribution to ongoing dialogue, remaining open to revision, extension, and critique in pursuit of deeper understanding. The reconstruction it presents is necessarily partial; by focusing on the genealogical line from Fichte to category theory, this study has bracketed the rich traditions of neo-Kantianism and the analytic philosophy of mathematics, as well as alternative formalisms such as homotopy type theory, which also address issues of identity and continuity. Furthermore, the roles of key transitional figures like Husserl and Whitehead have been treated selectively to illuminate the specific motif of difference-that-preservation. The Mnēmaic framework is thus offered not as a closed foundational system, but as a conceptual hypothesis requiring further technical development and dialogue with these broader historical and logical traditions.

Author Contribution A.B.S. (Andreu Ballús Santacana) conceived the research, conducted the philosophical and historical analysis, developed the conceptual framework, wrote the manuscript, and prepared references. The author reviewed and approved the final manuscript.

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Declarations

Competing interests The authors declare no competing interests.

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Andreu Ballús Santacana is a philosopher of science at the Department of Philosophy, Universitat Autònoma de Barcelona. His research investigates the relationship between scientific practice, mathematical formalisms and philosophical concepts, with a particular focus on how ideas of genesis, time and structure shape the foundations of mathematics and logic. He works at the intersection of philosophy of science, history of ideas and contemporary structural approaches such as category theory.