CHAPTER 5

The Undifferentiated Boundary of Time

Presupposes: the structural dependence of content on contrast (Ch. 2); the exhaustiveness of the partition (Ch. 3); equality as the grounding terminus (Ch. 4).

Establishes: the dependence of temporal sequence on distinction, and the dissolution of the temporal regress; the eternal-switch model and a realist resolution of Kant's first antinomy; the convergence of the grounding and temporal hierarchies.

In brief. What came before the Big Bang? At the boundary it aims at, the question is not unanswered but unaskable. Time is an ordering of distinguishable states, so wherever "before" applies, there are distinctions; a state with no distinctions — equality — is one at which "before" has nothing to order. The chain of moments can therefore end without ending *at a moment*: like the interval between 0 and 1 that gets ever closer to 0 without containing it, the temporal series can be bounded by something that is not a member of it. That third option resolves Kant's famous antinomy without his idealism, shows that the temporal chain and the grounding chain of Chapter 4 end at one and the same state, and leaves the framework owing one unexplained fact — that the bounded series obtains at all — stated openly. On every scenario, something has always existed.

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1 Introduction

What came before the Big Bang? The question feels irresistible, and this chapter argues that the feeling is misleading. The question presupposes that "before" is a concept that must apply at every point in the regress, and the presupposition is false. The question is not unanswerable; it is structurally ill-formed at the boundary it purports to interrogate.

The temporal regress — the demand for a prior state at every stage of the causal-temporal chain — has driven philosophy from Aristotle's unmoved mover (*Physics* VIII; *Metaphysics* XII) through the kalām tradition and Kant's (1781/1998) first antinomy to the most recent literature: Malpass (2022) on time and the infinite past, Schmid (2024) on Grim Reapers and endless futures, Linford (2024) on a modal condition for the beginning of the universe.

This chapter dissolves the regress by showing that the question "what came before?" has nowhere to land, where the dissolution proceeds from a single structural observation. Every possible state of reality is either diverse or equal, and the partition is exhaustive (Chapter 3). Any answer to "what came before this state?" therefore delivers either another state of diversity, in which case the chain extends, or a state of equality, at which "before" loses application, because temporal sequence requires the distinctions equality lacks. There is no third answer.

The dissolution has three consequences, developed in turn: a third option for Kant's first antinomy that neither the thesis nor the antithesis recognises (§3), the convergence of the grounding and temporal hierarchies at one and the same state (§4), and a disjunctive result — either diversity is infinite or the temporal chain terminates at equality, its foreclosing boundary — on neither branch of which was there ever a state of outright non-existence from which diversity temporally emerged. Something has always existed.

A word on scope: the argument is ecumenical between an infinitely extended past and a terminating one, delivering a substantive result on each branch. Its conditional form, "if there is a temporal boundary, equality is its only foreclosing form", is one horn of that disjunction rather than a qualification of the result. The chapter develops the dissolution (§2), applies it to Kant (§3), establishes the convergence (§4), engages the philosophy of physics (§5), and addresses objections (§6).

2 The Dissolution of Temporal Regress

2.1 Temporal sequence requires distinction

Temporal sequence is the ordering of states by the relation "earlier than". For this relation to obtain, there must be at least two distinguishable states, one earlier and one later, differing in some respect. If they were entirely indistinguishable, no relation of precedence could obtain between them, since an ordering relation needs

relata it can take in one order rather than the other, and indistinguishable relata supply no such asymmetry. The argument needs no identity of indiscernibles and takes on none, since the claim concerns what an ordering requires rather than how many things there are. Temporal sequence therefore presupposes at minimum one distinction.

The dependence holds across competing philosophies of time, and the framework is strictly neutral among them.

Even presentism (D. W. Zimmerman, 2011), on which only the present moment exists, requires the distinction between the present and other moments to give the position its content. On a B-theoretic, tenseless account the ordering relation still requires distinguishable relata (Mellor, 1998), while the A-theoretic requirement of past, present, and future is richer still. McTaggart (1908), whose distinction between the two series frames the modern debate, denied the reality of time for reasons of his own; the argument here takes no side in that dispute, since even his unreality verdict concerns an ordered C-series of distinguishable terms. Presentism, eternalism, and the growing block therefore disagree about which temporal distinctions exist, while the argument here requires only what every party supplies in its own idiom: temporal sequence, however construed, is a structure of distinctions, and equality has none for any of the three readings to find. Time, on any standard analysis, is a structure of differences.

One asymmetry must be noted, because the argument depends on getting its direction right. Temporal sequence requires distinction, but distinction does not require temporal sequence. A frozen photograph has spatial distinctions without temporal change; a mathematical structure has formal distinctions without duration. Diversity is therefore compatible with timelessness. This means the chapter cannot infer from “the prior state is timeless” to “the prior state has no distinctions”. The inference runs only in the other direction, from “no distinctions” to “timeless.” The distinction matters for the convergence argument in §4.

2.2 Two forms of eternity

The exhaustiveness principle, applied to temporal structure, yields two structurally opposite forms of eternity.

Infinite diversity is endless extension with internal structure preserved. An infinite temporal series is composed of finite intervals: each individually limited, the series as a whole without outer boundary. An infinite past is one in which, for every moment, there is always an earlier moment; the regress question "what came before this moment?" always receives an answer within the same temporal series. The mathematical tradition's infinities all live on this side of the line. Cantorian infinities presuppose distinguishable elements (Rucker, 1995).

Infinite equality is a state in which limits are absent not merely externally but internally: no parts, no boundaries, no identities, no components. Here there is no series to extend, since the conditions for extension are themselves absent.

A state of equality is therefore one at which temporal sequence cannot obtain, since there are no distinguishable states to order and no before and after to separate. This is a structural entailment of what it is for a state to lack all distinction rather than a contingent feature of our physics. Equality is not "in time" as events in our universe are; it is at the boundary of temporality, the condition at which the temporal ordering relation has nothing to order. Its standing at this boundary is not a further temporal feature but a consequence of its having only obtaining-determination (Chapter 3, §3.5): the existential determinateness of being rather than not, which offers an ordering relation no distinction on which to operate.

The standard definition of infinity, "without limits", is ambiguous between these two conditions. Infinite diversity is without outer limits while retaining inner limits, the boundaries between elements that constitute each member's identity, whereas infinite equality is without limits of any kind. Both satisfy the definition in full, and neither is a degenerate case of the other. Chapter 8 develops this ambiguity and its

consequences at length, while the present chapter requires only the distinction itself.

2.3 The dissolution

The temporal regress is the iterated demand: for any state S, what came before S? The demand presupposes that "before" applies to S. The exhaustiveness principle guarantees that S is either diverse or equal, and two cases exhaust the space.

Case 1: S is diverse. S contains at least one internal distinction, so temporal sequence can obtain within or prior to it. The question "what came before S?" is therefore well-formed, and the answer is either another state of diversity, in which case the regress continues, and if diversity extends infinitely backward it never terminates, there being no first moment to ask about, or a state of equality, in which case Case 2 is reached.

Case 2: S is equality. S contains no internal distinction. Temporal sequence requires distinction (§2.1). The question "what came before S?" therefore presupposes a condition — temporal precedence — that S's structural character excludes. The question is not unanswered; it is structurally ill-formed at S. "Before" is a temporal concept, and equality is the condition at which temporal concepts lose application.

The decisive step: there is no Case 3. The exhaustiveness of the partition guarantees that every possible state falls into Case 1 or Case 2, and the constitutive instantiation thesis (Chapter 3, §2.3) explains why no third could be produced, since any proposed third state must be distinguished from both diversity and equality in order to be identified, where the act of distinguishing is an instance of diversity.

The regress question therefore has two landing sites, both structurally eternal — diversity as infinite presence of time, equality as infinite absence of time — and neither leaves the regress unresolved. Case 1, iterated, either continues indefinitely or eventually yields Case 2, and on neither path does the regress encounter a state at which the question remains well-formed but unanswerable. The question either

continues to receive answers or reaches a point at which it ceases to be a question.

This is what distinguishes the dissolution from a brute refusal to answer. A brute stopping point — "the universe began, and that's that" — accepts the question's legitimacy and declines to answer. The dissolution shows that the question's legitimacy expires at the boundary. The silence at the boundary is not evasion but the structural absence of the conditions under which the question could be posed.

A further observation sharpens the point. The regress-driving vocabulary — "before", "beyond", "prior to" — is itself distinction-dependent. "Beyond" is a spatial metaphor, since it presupposes the very distinctions equality lacks: extension, position, directionality. To ask "what is beyond equality?" is therefore to apply a category that requires distinction to a state defined by its absence, in the same way that asking "what colour is silence?" applies a visual category to a state outside the visual domain's conditions of application. The question is not profound; it is structurally self-undermining.

2.4 The eternal switch

The possible temporal structures of reality can be formalised through a simple device: the eternal switch. One position represents the presence of diversity (ON — space, time, limits, and identity are present). The other represents equality (OFF — all internal distinctions are absent, temporal sequence dissolves). The exhaustiveness principle guarantees no third position exists. The possible temporal structures of reality are therefore all and only the possible sequences of ON and OFF.

The principal scenarios:

Scenario	**Picture**	**What it coherently describes**
(a) Always ON	Diversity infinite in both temporal directions	No terminus; the non-termination branch
(b) OFF–ON–OFF	A diversity phase bounded at both ends	A self-bounded phase, opening and closing at equality
(c) Infinite cycles	Endless alternation of ON and OFF	On the correction below: a plurality of self-bounded phases, with no fact ordering or numbering them
(d) OFF then permanently ON	Diversity bounded below, unbounded above	A phase with one boundary and an endless future

Every scenario yields eternity through one mechanism or another. There is no scenario in which reality is finite in every respect, no scenario in which the switch is ON for a finite period and then ceases to be anything at all. Either diversity continues (ON), or equality obtains (OFF). The eternal switch has no "broken" position, so reality does not turn off.

Throughout, the switch's sequential vocabulary — "before", "after", "then" — is a picture whose connotations the correction below spells out: OFF names the boundary of an ON phase rather than a member of a sequence containing it, and the scenarios are claims about the topology of diversity (unbounded, bounded at both ends, bounded below) rather than sequences with equality as a term.

A clarification: both positions of the switch can be infinite, but in the two opposed senses of §2.2. ON-infinity is the endless extension of

internal structure; OFF is "without limits" in the internal sense — and the picture of an endless expanse of emptiness projects diversity (spatial extension, temporal duration) onto a state defined by their absence. Equality is the condition at which the distinctions that make extension and duration possible do not obtain. It is not "very large" or "very long."

A correction to scenario (c). One scenario in the list requires a correction that the switch's own vocabulary invites; it is better made here than discovered by a critic. Scenario (c) as pictured, an ordered alternation, ON–OFF–ON, without end, silently re-temporalises the OFF position twice over. An equality "between" two diversity phases would have to stand in ordering relations, later than the first and earlier than the second, that a state without internal distinction cannot bear (§2.1). And an infinity of cycles would require one cycle to be distinguishable from the next, an individuation that nothing undifferentiated can carry and that neither bounded phase supplies for its successors.

What (c) can coherently describe is therefore weaker than the picture suggests. It is not a single temporal super-sequence threading through successive equalities, but a plurality of self-bounded diversity phases, each opening and closing at equality — at equality, not at equalities, since the count of boundaries is settled in §4 — with no fact, because no distinction, ordering the phases or numbering them. Each phase has its boundary, so no series of phases exists to be infinite.

The scenario is retained as the case in which the boundary of scenario (b) is instantiated other than uniquely, with the caution that "again", "alternation", and "succession of cycles" are diversity-side projections with no purchase at OFF. Nothing downstream leans on the stronger reading, since the disjunctive result of §2.5 uses the scenarios only through the property they share, that each yields eternity in one of the two forms, and the corrected reading preserves it.

The eternal switch is a direct consequence of the exhaustiveness principle, not an independent postulate. The dissolution of the regress is visible in the switch's architecture: at ON, the question "what came

before?" receives an answer (another ON or an OFF); at OFF, the question has no temporal purchase. The switch formalises what the dissolution demonstrates: the regress terminates not in an answer but in the expiration of the question.

2.5 The disjunctive result

The dissolution yields a disjunctive result. Either the causal-temporal chain extends infinitely backward as infinite diversity, scenario (a), in which case no temporal origin exists, or it terminates, scenarios (b) to (d).

A terminating chain may end at a brute first state, a structured initial moment for which the question "what was before this?" is intelligible but unanswered, or at equality, the structural boundary of temporality rather than a moment within it. Equality is therefore the unique terminus at which that question does not merely go unanswered but dissolves, since it has no temporal identity, because temporal sequence requires distinctions that equality excludes.

The result parallels Chapter 4's finding for the grounding hierarchy without being identical with it. Chapter 4 answered "what is the ground?" by eliminating candidates, whereas the present chapter dissolves "what came before?" by showing that the question expires at equality, its presuppositions absent there. The conclusions converge — on neither branch was there ever a state of outright non-existence from which diversity emerged — while the arguments are structurally independent, so the shared conclusion that something has always existed is overdetermined: it follows from either argument alone.

What the mind instinctively pictures as "nothing" before the universe may be equality, standing at the series' lower boundary rather than before it: undifferentiated being that, lacking all identity, is indistinguishable from non-being while retaining ontological presence (Chapter 3, §3.5). This is the illusion of equality, developed at length in Chapter 8, since a mind constituted by distinctions cannot form a positive image of a state without them, and the representational substitution of "dark empty space" for "the absence of the conditions for

space" is what sustains the illusion; Appendix A assembles the whole answer in one place.

A further consequence concerns the possibility of a series bounded by equality. The picture of a transition from equality to diversity is sequential; §2.4 has withdrawn the sequence: equality is earlier than no state, so no change from equality ever occurred. What obtains on the termination branch is a diverse series with equality as its bound, which is enough for the modal point a critic needs answered. A series bounded by equality obtains; whatever obtains is possible, by the axiom T; so a series can be bounded by equality, whatever a critic makes of the boundary's inability to act. The possibility is established retrospectively and by no speculation about what equality can do.

Two questions, two verdicts. Why the transition occurred must now be handled with a care the framework's own distinctions make possible, because two questions travel under that phrase and they receive different verdicts.

The first is the grounding question: what feature of equality produced, caused, or explains the population of the diverse side? This question is structurally foreclosed, in the full sense Chapter 4 (§5) gave the term. Equality has no determination — no dispositions, no capacities, no "because" for a causal or explanatory demand to latch onto — and the relational corollary (Chapter 3, §2.3) adds that nothing can stand in a working relation to equality at all, so "equality produced diversity" is a form of words the theory renders ungrammatical rather than a false hypothesis. Foreclosure here is claimed at full strength and is earned.

The second is the obtaining question: why is the diverse side of the boundary populated at all? Here the framework must not overclaim, and the difference between the two questions is sharp. A question is ill-formed when there is nothing it could be asking about, whereas the obtaining question asks about an actual, contingent fact — diversity obtains (Chapter 1); it could have failed to, since the OFF condition is coherent (Chapter 1, §6.4; Chapter 3) — so the question is well-formed.

What the no-features argument proves about it is that its answer cannot exist, because any answer would have to cite features of the boundary state and there are none. A well-formed question about a contingent fact whose answer provably cannot exist has a name in Chapter 4's vocabulary — brute — since necessary unanswerability is a discovery about the answer rather than about the question. On the termination branch, therefore, the framework accepts one brute fact: that the switch is ON.

The obtaining residue. The concession should be measured, because measured it becomes an asset. Call the result the obtaining residue: on the termination branch, the framework's total unexplained remainder is a single structureless fact, that the bounded hierarchy obtains at all.

The bookkeeping can be pictured. A rival terminus with features is a ledger with an open query on every line — why this mass, why this law, why this constant. The obtaining residue is a ledger with one line, and the line reads only: on.

The boundary's topology fixes the measure (§3.3). The series has a limit without a first term, the non-member bound of Chapter 4's Appendix, so every member is preceded by earlier members and every specific diverse fact has its predecessors and its grounds within the chain, while the terminus, having no features, supplies nothing further to ask about.

One question the residue leaves open should be named, because the accounting does not claim it: why this series obtains rather than another. That question stands on every account of a bounded or beginningless series, since the brute-diversity foundationalist's terminus could equally have been otherwise, so it discriminates between none of them and is set aside as shared.

What does discriminate is the shape of what remains. The brute-diversity foundationalist's terminus is a maximally specific differentiated state with one unanswered question per feature, so her residue is the entire specific structure of a world, each item of it a site where explanation is declined. A featureless brute fact against a featured

one. The foreclosed/declined distinction of Chapter 4 accordingly holds at its true strength: foreclosure for every question about contents and grounds, with bruteness confined to the bare obtaining, against a rival whose bruteness has as many sites as her terminus has features. This is the accounting Chapter 4's ledger (§4) anticipated. A framework that claimed zero contingency at the boundary would in any case sit poorly beside its own concessions — the coherence of the OFF condition (Chapter 1, §6.4) and the open disjunction of Chapter 4 — and one brute obtaining is the contingency those passages imply.

3 The First Antinomy and the Third Option

3.1 The antinomy stated

Kant's first antinomy (*Critique of Pure Reason*, A426–434/B454–462) presents two arguments that appear equally compelling:

Thesis: The world has a beginning in time.

Antithesis: The world has no beginning in time; it is infinite as regards time.

The thesis argues by reductio. If the world had no beginning, then up to every given moment an eternity has elapsed: an infinite series of successive states has passed away. But the infinity of a series consists in the impossibility of its ever being completed by successive synthesis. An infinite elapsed series is therefore impossible; hence the world has a beginning.

The antithesis argues also by reductio. Suppose the world has a beginning. Then there was a time before the world, empty time, in which nothing existed. But in empty time there is no sufficient reason for the world to begin at one moment rather than another, since nothing distinguishes one moment of empty time from any other. Therefore the world cannot have begun, and the series of past states is infinite.

3.2 Kant's resolution

Kant's resolution is that the antinomy reveals the limits of reason applied beyond possible experience. Both arguments attempt to determine the absolute extent of the temporal series, and this determination exceeds what experience can warrant. The resolution is transcendental idealism: time is a form of intuition rather than a feature of things in themselves. Questions about the absolute extent of the temporal series therefore treat the series as a thing in itself.

The resolution is elegant and costly. It requires transcendental idealism: the view that the spatiotemporal world is appearance rather than reality in itself. Allison (2004) provides the standard defence, reading the doctrine as an epistemic distinction between standpoints rather than a two-worlds metaphysics; Allais (2015) reads it as a qualified realism that honours Kant's idealism and his realism together. Al-Azm (1972) traces all four antinomies to the Leibniz–Clarke correspondence, which lowers their standing as products of pure reason. Guyer (1987) argues they do not compel the idealist conclusion, charging Kant with assuming what they are meant to establish.

Philosophers who reject transcendental idealism, holding that time is a real feature of reality, therefore cannot avail themselves of Kant's resolution and must confront the antinomy on its own terms. And Kant's resolution treats the antinomy as showing that reason has reached its limits, rather than that the options have been incompletely specified. It does not consider the possibility that the two arguments share an assumption which, if rejected, dissolves the opposition.

3.3 The third option

The dissolution of §2 offers a resolution that does not require transcendental idealism, turning on a shared assumption different from the one Kant identifies. The shared assumption is that a temporal terminus, if it exists, must be a first moment: a moment in time at which the temporal series begins. The thesis argues that such a moment must exist, and the antithesis that it cannot, so both assume that the only alternative to an infinite past is a beginning within time.

A third option emerges from the dissolution. A state of equality falls outside time, because temporal sequence requires distinction and equality excludes all distinction. Such a state is the condition at which temporality itself is absent — the structural boundary of time, not a moment that precedes the first moment, and not a position within time's structure.

The thesis's argument is addressed. The temporal series does not extend infinitely backward, on the termination branch, and neither does it begin at a first moment, since it terminates at a structural boundary: a state that is not a member of the temporal series at all. The series therefore has a limit without having a first term, structurally analogous to the way the open interval (0, 1) is bounded by 0 without containing 0.

The thesis assumes that "beginning" means the first event in a temporal sequence, whereas equality is not a moment preceded by nothing but the condition at which the temporal ordering relation has nothing to order. The thesis's concept of beginning therefore presupposes the very temporal structure whose origin it attempts to explain.

Smith and Grünbaum. The open-interval structure has a distinguished ancestry in the philosophy of cosmology, and the relation should be stated with care, because the positions are close enough to be confused and different enough that the difference is the point.

Newton-Smith (1980) laid out the topological options for a time with a beginning, among them a past that is finite without containing a first moment, as an open interval has a bound it does not contain. Q. Smith (1988) and Grünbaum (1989) argued, against the demand for a cause of the beginning, that a universe with a finite past need not contain a first instant, since on the open topology every moment is preceded by earlier moments. On that topology there is then no first event of which a cause could be demanded. Their move operates inside the temporal series, since the boundary is missing and the interior does all the work.

The present position is differently shaped: the boundary is not missing but non-temporal. Equality is not an absent first instant but the

structural limit at which the ordering relation itself runs out of material — a limit-ground of the series (Chapter 4, §3) rather than an earliest member of it. What Smith and Grünbaum deflate, the demand for a cause of the first event, this analysis forecloses. It explains in addition why the open topology is the right description: a series bounded by a state with no internal distinctions can only approach its boundary, because there is nothing at the boundary for a member of the series to be. Convergent conclusions, distinct mechanisms.

The antithesis's argument is also addressed: there is no empty time before the world's beginning, because the terminus is not in time. The antithesis's objection, that empty time provides no sufficient reason for the world's beginning at one moment rather than another, presupposes that the terminus is a temporal state, and since equality is the boundary of temporality, the objection does not arise.

Its underlying concern, that nothing could explain why the world began when it did, receives the division of §2.5. The demand for a sufficient reason at the boundary is structurally foreclosed, since equality has no determination from which a reason could be constructed. The residual, well-formed question of why the bounded series obtains at all is the obtaining residue, which the framework owns as brute rather than dissolves. The world began, if it began, at the boundary at which the conditions for temporal selection are absent rather than at a moment selected from among alternatives.

And if Maudlin (2007) is right that the passage of time is a fundamental feature of physical reality, the third option acquires additional physical motivation. Passage itself has a boundary at which it ceases, because the condition for passage, distinction between successive states, is absent, rather than because the B-series runs out of members.

3.4 Comparison with Kant

The resolution shares one feature with Kant's, since both diagnose the antinomy as resting on a shared assumption that, once exposed, dissolves the opposition. But the assumptions and the costs differ. Kant

diagnoses the assumption that the temporal series has a determinate absolute extent, whereas the present analysis diagnoses the assumption that a temporal terminus must be a first moment. The two halves of the antinomy are met by different features of the same topology. The antithesis half, which concerns a first moment, is met by the boundary: there is no first moment for empty time to precede. The thesis half, which concerns the count of successive states, is met by the measure. On the termination branch the series has infinitely many members before any given moment and a finite duration, since a bounded series with no first term is the shape of an open interval. The thesis's premise, that an infinite series of successive states cannot have elapsed, forbids this only if it forbids the elapsing of every continuous interval, each of which contains infinitely many instants between any two of its members and is completed whenever an hour passes. The premise therefore holds only where a finite interval contains no actual infinity of instants — a discrete time, or a continuum divided only as far as it is divided in thought — a commitment the thesis never argued for and would need to (Puryear, 2014). "The series does not extend infinitely backward" is accordingly true of its duration and false of its count; the thesis half needs the count.

Kant's resolution requires transcendental idealism, while the present resolution requires only the exhaustiveness principle and the dependence of temporal sequence on distinction. It does not relativise time to human cognition and does not deny that the temporal series is a real feature of reality, so the analysis resolves the first antinomy on realist terms — terms Kant himself did not consider available. Whether this refutes Kant's claim that the antinomy demonstrates the limits of reason is left open; what it demonstrates is that the antinomy does not compel transcendental idealism.

The third option — a boundary of time that falls outside time — is arguably the chapter's most distinctive contribution. The literature on the beginning of the universe has largely operated within Kant's binary: either a first moment or an infinite past. Where it has stepped outside the binary, in the open-topology models of §3.3, it removed the first

moment without saying what bounds the series. The third option says: a state, and a member of no series.

Augustine. One qualification keeps the novelty claim in bounds. Within the modern debate the third option appears under-explored, while the deeper move — refusing the question "what came before?" at the boundary itself — has a distinguished theological ancestor. Augustine, asked what God was doing before he made heaven and earth, answered that there was no "before": time was created with the world rather than within a pre-existing time, so the question lacks any interval in which to arise (*Confessions* XI; *City of God* XI.6). The structural form is the one defended here, since the regress expires because "before" has no application at the boundary rather than because the boundary is a first moment with empty time stretching behind it.

What separates the present account from Augustine's is not the dissolution but what stands at the boundary. For Augustine it is a maximally determinate being, an eternal and intelligent creator from which time issues, whereas on the present analysis it is equality — zero complexity, with no determination beyond its obtaining — from which nothing issues by agency at all. Augustine dissolves the "before" by placing a timeless person at the origin, while the present analysis places a timeless absence of all structure there. Whether the terminus could nonetheless be what Augustine supposed, whether a state at the boundary of time could think, intend, or create, is the question Chapter 6 takes up, and its answer is not the tradition's.

4 The Convergence of Hierarchies

The grounding hierarchy (Chapter 4) and the temporal hierarchy are structurally distinct. Grounding is a relation of metaphysical dependence, typically taken to be atemporal (Fine, 2012; Rosen, 2010); temporal succession is a relation of causal or chronological ordering, inherently temporal. Despite the difference, the two hierarchies converge at the same point: equality — zero complexity, the condition at which relations that operate on distinctions have nothing to relate — is the foreclosing terminus of both.

Why the hierarchies converge. The convergence has a structural basis. Schaffer (2016) argues that the grounding relation and the causal relation are structurally analogous — in asymmetry, in a form of necessitation, and down to the parallel challenges each faces over transitivity — while differing in their temporal profiles, and structurally similar relations operating on the same domain should reach the same structural limit.

The relational corollary of the constitutive instantiation thesis (Chapter 3, §2.3) explains the convergence at the deeper level. Every relation-instance that does structural work, whether grounding, temporal succession, or any other, has non-identical relata and so instantiates the condition that equality lacks, with reflexive instances excluded from structural work by the corollary's two counts. Any distinction-dependent relation, regardless of its specific character, therefore encounters the same structural limit at undifferentiation, and the convergence of the two hierarchies is a specific instance of this general fact.

The count is one. The convergence is numerical rather than merely structural. The arguments so far establish that both hierarchies reach a terminus of the same kind, a state of zero complexity, while equality comes in neither kinds nor instances.

A second terminus distinct from the first would need some feature setting it apart, and a second kind of terminus would need some feature distinguishing one zero-complexity state from another. Either feature would itself be an internal distinction, and equality just is the absence of all internal distinction (Chapter 4). Diversity is variegated, with endlessly many ways to be differentiated, whereas equality is unique, since there is one way to have no distinctions, which is to have none.

The objection this invites is the denial of the identity of indiscernibles, and the argument does not rest on that principle. A theorist who rejects it holds that two things may be primitively distinct, distinct by a bare thisness with no discerning feature at all. The move is unavailable at the terminus, for the reason Chapter 4 (§2.2) fixed: a haecceity is a way of being, and equality has no way of being beyond its

obtaining. Primitive distinctness needs a primitive property to be distinct by, and the terminus bears none, not even that one. The count is therefore one because there is nothing there to count twice rather than because indiscernibles must be identical. The classification underwriting this argument is itself proof against worldly unsettledness, since by the hard-edge corollary (Chapter 3, §4.1) whether a state is equality cannot be ontically indeterminate. What the argument so far blocks, however, is internal individuation only, and a second route exists.

External individuation. The second route is this, and a multiverse theorist will take it. Two featureless silences are told apart by their surroundings: the silence before the storm, the silence after the concert. Two indistinguishable blank pages are two because they sit in different books. Suppose, then, two universes, each a bounded diversity phase terminating at equality. The theorist grants that Universe A's terminus and Universe B's terminus have no internal differences and individuates them relationally, by what they bound: two equalities, like two silences.

The reply runs on two counts. The first is that the borrowing has no hooks. A silence borrows identity from its surroundings through relations it really stands in — bounded by these sounds, located in this interval, part of this concert — and every analogous hook at the terminus is a working relation with equality as a relatum, which the relational corollary (Chapter 3, §2.3) excludes, since equality offers no feature by which anything relates to it as one relatum rather than another, temporal location included. "The equality that bounds A rather than B" therefore names a relational property, bounding-A-not-B, that nothing undifferentiated can bear.

The second count runs deeper, and uses an assumption Chapter 4's Appendix names as unproven — that a distinction can be carried by more than one state, so that the intervals bounded by two causally disconnected series are comparable at all; the count-is-one result is conditional on it. Boundary individuation points the wrong way. A bilateral boundary is individuated partly by both sides, whereas a unilateral boundary contributes nothing to what it bounds and receives nothing from it (Chapter 4, §5), and the mathematics of limits displays the consequence sharply. The limit 0 of the interval (0, 1] and the limit 0

of the interval (0, 2] are not two zeros: the intervals differ, where the limit is one. Distinctness of the bounded regions therefore individuates the regions and never passes inward to the limit, because passing inward would require the limit to bear a differentiating relational property, and a relational property is a way of standing — something equality determinately lacks and, by the hard-edge corollary, cannot even indeterminately have.

The result can be stated at its clean strength: many bounded phases, many boundings, one boundary. The plurality of the corrected scenario (c) (§2.4) is a plurality of phases, and the multiverse theorist's plurality is a plurality of universes, while in both cases the count of equalities is one, for the same reason the count of zeros bounding different intervals is one. "Two equalities" therefore belongs to the same family of diversity-side projections as scenario (c)'s "again" and "alternation"; it is filed with them.

The silences keep their use as a diagnostic, inverted: a silence is in time, borrowing identity through temporal relations, whereas equality is the boundary of time, with nothing to borrow through, so what makes external individuation work in the analogy is what is absent at the limit. The grounding terminus and the temporal terminus are therefore not two structurally identical states but numerically the same state — not two boundaries that happen to match, but one.

A clarification about the scope of the convergence is needed. Chapter 4 treated the equality–diversity relationship as structural, and the present chapter's treatment is structural too, with one addition: the temporal hierarchy carries a topology, and on the termination branch its series is bounded below by equality, a limit without a first term (§3.3). The switch's sequential vocabulary might suggest a stronger reading, on which equality temporally preceded diversity, while §2.4's correction withdraws it, since "before" and "after" never take equality as a term, where the bounded topology is the whole of what the sequential picture correctly conveys.

Limit and eternity. A terminological observation illuminates the convergence. Chapter 4 naturally describes equality as a limit, the

unilateral boundary at which the grounding relation's presuppositions are unsatisfiable, whereas the present chapter naturally describes it as eternity, the infinite absence of time. The descriptions are aspects of the same state viewed from within different hierarchies.

The same undifferentiated state therefore looks like a limit when approached from the direction of structure — what is the edge of the explanatory chain? — and like infinity when approached from the direction of time: what obtains when temporal extension dissolves? That the two vocabularies converge on the same state is what makes the convergence substantive rather than verbal, since the hierarchies arrive at the same structural condition through independent routes, where the condition's dual character is a consequence of its having no internal features to differentiate the two descriptions.

5 Engagement with Philosophy of Physics

The chapter's structural analysis identifies boundary conditions that any physical cosmology must respect. The engagement is of the consistency-check kind, and its claims should be read at that strength: the structural analysis neither derives the physics nor is derivable from it. Where a proposal and the analysis meet at the structural floor, the meeting displays shared presuppositions rather than mutual confirmation, in the sense Chapter 6 (§5) gives that distinction.

5.1 Emergent spacetime

Huggett and Wüthrich (2013) argue that spacetime may be emergent, so the fundamental level of physical reality may lack spatiotemporal structure altogether. Two programmes describe fundamental levels at which temporal ordering may be absent: loop quantum gravity replaces the continuous manifold with discrete spin-network states whose combinatorial structure constitutes spatial geometry, and causal set theory posits that spacetime is a discrete partial order of events.

By the asymmetry of §2.1, absence of temporal order does not make either a candidate for the terminus. A spin network is a richly

differentiated combinatorial structure of nodes, links, and labels, and a causal set is a structured order of events, so each is timeless yet diverse: a physical picture of the ON position at minimal complexity rather than of the boundary. The point is the one §5.2 makes against the Euclidean regime, since removing temporal order removes one distinction among many and does not approach the removal of all.

What these programmes contribute is therefore a physical realisation of the claim that temporal sequence is not fundamental, while the terminus at which distinctions cease lies below any of their states. Callender (2017) adds that what makes time special is a cluster of asymmetries — thermodynamic, causal, epistemic — themselves constituted by distinctions between earlier and later states, for which the dissolution provides the structural account of what happens at the boundary where these asymmetries are absent.

5.2 Quantum cosmology

Contemporary quantum cosmological models — the Hartle–Hawking no-boundary proposal (Hartle & Hawking, 1983), quantum vacuum fluctuation models (Vilenkin, 1982), inflationary scenarios — describe states that already contain structure: measurable properties, probabilistic activity, symmetry-breaking potentials, curvature. These are states within diversity, however minimal their complexity, so quantum cosmology describes early diversity rather than its origin, filling in the physical content of the ON position without addressing the boundary at which the switch's positions are defined.

The no-boundary proposal is sometimes read as describing a transition from a regime in which temporal distinctions are absent, the Euclidean regime in which the time coordinate becomes spacelike, to one in which they are present, the Lorentzian regime, and the Euclidean regime is then offered as a physical candidate for the boundary. The analysis declines the reading, and declines it on its own criterion. The Euclidean regime is a four-dimensional Riemannian manifold with a metric, a curvature and a topology, which is a state of considerable internal distinction and therefore a state within diversity. That its time coordinate behaves spacelike removes one distinction among many

without approaching the removal of all. The temporal boundary is therefore not a regime in which time is differently structured but the limit at which the ordering relation has nothing to order, and no manifold is that.

Two pictures physics reaches for at the boundary show the analysis at work from the other side. The classical singularity is infinite density and infinite curvature: not the absence of structure but its maximum, everything crushed to a point, and an account that treats it as the beginning has imaged the boundary through the plenum. Vilenkin's tunnelling "from nothing" (1982) names a quantum state with a wavefunction — a something called nothing — and has imaged the same boundary through the void. Fullness and emptiness are the two surrogates a distinction-built mind has for a condition with no dimension along which to be full or empty (Chapter 8, §3.4), and cosmology's two pictures of what lies before the first structured state are the projections theology reaches by another road (Chapter 12, §5). Cyclic and eternal models (Penrose, 2010; Steinhardt & Turok, 2002) posit no boundary at all and belong to the non-termination branch, where the disjunctive result of §2.5 already stands. The last distinction cannot be removed by a process, because a process is a distinction, so what a calculation can describe is the approach and never the arrival; a probability attaches to a state in a space of alternatives, and the dimensionless is not a point in any such space.

5.3 The structural analysis and empirical cosmology

A clarification about the relationship between the structural analysis and empirical cosmology is essential. The chapter makes a structural claim — about what the temporal boundary must be like — not a cosmological claim about the specific physical processes by which the universe came to exhibit the diversity it does. The two are complementary; they do not compete. The analysis stands to empirical cosmology as the second law of thermodynamics stands to particular chemical reactions: the law constrains what can happen without specifying how it happens.

The constraint is prospective as well, holding for models not yet proposed. A physical account of origin describes its initial state in the theory's own terms — a metric, a field content, an amplitude, laws fixing what the state may do — so the state described carries structure by the form of the description, whatever the model calls it. A state stripped of every feature would leave the laws without a subject, since a law relates features; a state that did not obtain is no state a theory can occupy. Physical cosmology accordingly settles which condition is earliest, never whether one obtains, and the verdict of §5.2 reaches future proposals by their form rather than case by case.

Where the argument stands: temporal regress has been dissolved at equality, where "before" finds no earlier and later to sort (§2); the first antinomy has a third option, with both of its halves met (§3); the temporal and grounding hierarchies have been shown to converge on one boundary (§4); and the structural analysis has been set against the physics (§5). What follows meets the objections.

6 Objections and Replies

6.1 The tenseless time objection

Objection. The chapter assumes temporal sequence requires distinguishable relata. But on a B-theoretic account, the before/after relation is a primitive ordering that does not require the relata to be qualitatively distinguishable — they need only be numerically distinct positions in the temporal manifold. A state of equality could occupy a position in the B-series without any internal qualitative distinction.

Reply. The objection weakens the requirement from qualitative distinguishability to numerical distinctness — but numerical distinctness is itself a form of distinction, the minimal relational form of Chapter 2 (§2.1). Two positions in the B-series are numerically distinct if and only if they are not identical: if there is at least one respect in which they differ, even if only their position. A state of equality has no internal distinctions of any kind: no qualitative differences, no positional differences, no numerical non-identity among its "parts,"

because it has no parts. The B-theory relocates the distinction from the qualitative (past/present/future) to the structural (earlier/later as primitive ordering), but a primitive ordering still requires at least two ordered items, and two items require non-identity. The chapter's claim is pitched at this minimal level, and the B-theory is not an exception.

6.2 The quantum cosmology objection

Objection. No-boundary models (Hartle & Hawking, 1983; Vilenkin, 1982) describe a universe with no temporal boundary: smooth, closed geometry, no singularity at which time begins. If the universe has no temporal boundary, the notion of a temporal terminus does not apply.

Reply. The analysis is compatible with no-boundary cosmologies. If there is no point at which the temporal series terminates, this is scenario (a): diversity is infinite, the switch is permanently ON, and the non-termination branch is instantiated. The argument does not require that the hierarchy terminates; it derives what follows either way. And as §5.2 noted, quantum cosmological models describe states that already contain structure and therefore belong to diversity; they do not reach back to the boundary at which the temporal ordering relation has nothing to order.

6.3 The causal power objection

Objection. If equality is completely undifferentiated, how can it give rise to diversity? Compatibility is not causation; the chapter owes an account of how the transition occurs.

Reply. Two responses operate at different levels, supplemented by the division of §2.5.

First, the demand's presupposition. "How does equality produce diversity?" presupposes a sequential reading, equality preceding and causing diversity, that Chapter 4 (§6.1) argued at length is misleading. The relationship is structural, so at the boundary of time the demand for temporal causation has no application. Second, the retrospective modal argument of §2.5: a series bounded by equality obtains, whatever

obtains is possible, and so the demand to show that such a series is possible is met by its actuality, while the demand for a passage from equality asks for the sequence §2.4 withdrew. The chapter therefore does not need to explain the mechanism of change to establish the possibility of the bounded series.

The division of §2.5 completes the reply. The grounding question is structurally foreclosed, since equality has no determination — no causal powers, no tendencies, no features from which an explanation could be constructed — while the obtaining question is well-formed and owned as the obtaining residue: brute, necessarily unanswerable from the equality side, and confined to the bare obtaining of the series. The bounded series is therefore actual, possible by the axiom T, unexplainable from the equality side by foreclosure, and contingent in its obtaining alone — a costed concession rather than a deficiency, since the accountings on offer elsewhere leave either an infinite descent or a fully featured brute terminus.

6.4 The scope objection

Objection. The chapter establishes a conditional — if the temporal hierarchy terminates, equality is its foreclosing terminus — but is neutral on whether it terminates. The disjunctive result is too thin to count as a substantive contribution.

Reply. The disjunctive result is substantive because it excludes a possibility that much of the existing literature takes seriously: that reality emerged from non-existence. On neither branch was there ever a state of outright non-existence from which diversity arose, an exclusion that bears on the something-from-nothing question that has driven philosophical and theological cosmology since Leibniz.

And the neutrality on termination is a strength. The debate between an infinite past and a temporal beginning is among the most active in metaphysics and cosmology, and the disjunctive result constrains both branches without requiring either to be correct.

6.5 The mechanism objection

Objection. The retrospective modal argument is logically valid but explanatorily empty: it tells us the transition was possible (because it happened) without saying how it happened. In physics, possibility without mechanism is a placeholder for explanation. Until a bridge to physical process is provided, the analysis is pure metaphysics disconnected from empirical cosmology.

Reply. The objection correctly identifies that the retrospective modal argument is explanatorily thin. But the demand for a mechanism is structurally ill-formed at the boundary, for the reasons of §2.5: equality has no determination from which an explanatory account could be constructed. The mechanism demand is dissolved by structural foreclosure, while the distinct question of why the bounded series obtains at all is owned as the obtaining residue rather than dissolved. The division of labour is the one §5.3 fixed: the chapter's claim is structural, concerning what the temporal terminus must be like; empirical cosmology supplies the detailed mechanism within diversity.

6.6 The Aristotelian objection

Objection. Aristotle (*Physics* VIII) argued that motion is eternal and no first moment of change can be identified without presupposing a prior change. The analysis appears to agree with Aristotle on the non-termination branch. What does it add?

Reply. The termination branch and the third option. Aristotle argued that the past must be infinite because a first moment of change presupposes a prior change; the analysis agrees this is one coherent possibility (scenario (a)). But Aristotle did not consider that the temporal chain might terminate in a state that is not a moment — a boundary at which the conditions for change are absent. The third option is unavailable to Aristotle because his framework does not include the concept of a state without any internal distinction — the concept the exhaustiveness principle makes available.

6.7 The Craig objection

Objection. Craig (1979; Craig & Sinclair, 2009) argues that an actually infinite past is impossible because an actual infinite cannot be formed by successive addition. If the past is not actually infinite, it must have a beginning — and the beginning requires a cause.

Reply. The full response to the kalām argument is developed in Chapter 11, which targets the inference from temporal origination to a necessary cause, so the present chapter addresses the narrower point.

Craig's argument treats a finite past as a beginning that calls for a cause, and he holds that a beginning needs no first instant (Craig & Sinclair, 2009), so the open interval alone does not escape him. What the dissolution adds is the character of the beginning: the temporal chain can terminate in a state that is not a moment, not within time, and not preceded by anything temporal. On this reading Craig is right that the past is not actually infinite, on the termination branch, and wrong that the beginning is a coming-to-be for which a cause can be asked. The beginning is a structural boundary, which is not the kind of thing that requires a temporal cause, because it is not in time. The successive-addition argument, transposed to this branch, meets the dilemma of §3.4: the branch's series has infinitely many members and a finite measure, so the argument forbids it only if it forbids the traversal of every continuous interval; it escapes that consequence only by denying that a finite interval contains an actual infinity of instants, which Puryear (2014) shows the argument needs and has not established; Oppy (2006) surveys the wider case that successive addition can form an infinite. Craig's further argument, that only a personal agent can produce a temporal effect from a timeless state, is addressed in Chapter 11, which grants that the cause may be personal while arguing that it cannot be shown to be necessary, and so cannot be shown to be God.

6.8 The whole-series objection

Objection. On the non-termination branch every event has a predecessor that explains it, so the origin question is dissolved. But a question about the whole remains. Even if each member of the

beginningless series is explained by an earlier member, the series itself — that there is this endless chain rather than none — appears unexplained. Hume's Cleanthes held the question spurious, since explaining every part explains the whole, the whole being nothing over and above its parts (Hume, 1779/2007, pt. IX), a reply Edwards (1959) canonised. Pruss (1998) constructs counterexamples. A chain in which each link's obtaining is explained by the previous link's may leave the obtaining of the chain unexplained, since the internal explanations presuppose what was to be explained. If Pruss is right, the non-termination branch carries an explanatory debt after all.

Reply. The framework declines to rest the branch on the Hume–Edwards principle. The refusal costs it one admission, of a kind already costed.

Grant the objection its distinction: internal explanation of every member is one thing, explanation of the series' obtaining another. Ask then what an explanation of the second kind could cite. On this branch there is no terminus, so no explainer outside the series exists to cite; equality, were it invoked, has no determination from which an explanation could be constructed (§2.5). The demand is thus a demand for what the branch's own structure forecloses. What remains is the division §2.5 drew for the termination branch, transposed: the mechanism question is structurally foreclosed; the obtaining question is owned rather than answered.

The non-termination branch accordingly carries its own obtaining residue: the brute obtaining of the unbounded series, a single structureless fact, symmetric with the bounded series' residue on the other branch. Which series obtains is, as on the other branch, a question every rival shares and none settles (§2.5). The symmetry is worth recording, since it completes the ledger of Chapter 4: on either branch the framework's total unexplained remainder is one structureless fact without content or capacity; no rival position has been found that owes less. In plain words: each branch keeps one brute, structureless fact, while no rival yet found keeps less. What the objection cannot do is convert the residue into an argument for a cause. A cause of the whole series would have to stand outside it, while on the branch's hypothesis

the series has no outside for such a cause to stand in; the demand for one is the termination branch reintroduced under another name.

6.9 The time-without-change objection

Objection. Shoemaker (1969) describes a world of three regions, each of which freezes for a year at regular intervals, the cycles so arranged that every sixtieth year all three freeze together. Its inhabitants have good inductive grounds to hold that a year then passes in which no change occurs anywhere. If time can pass through a changeless year, the moments of that year are indistinguishable states standing as earlier and later, which §2.1 declares impossible. An undifferentiated state could then have had a duration of its own before the first change.

Reply. The case establishes less than the objection needs. What it establishes the argument can grant. The frozen year is an interval inside a differentiated series. Its length is fixed by the regional cycles observed before it and confirmed after it. Each of its moments is distinguished from the others by its distance from the last change before the freeze and from the first change after it. The moments are alike in intrinsic character and differ in their relations to states that differ; §2.1 asks for distinguishable states differing in some respect, a relational respect included. What Shoemaker shows is that time does not require change at every moment. What the ordering requires is difference somewhere in the series, and his own argument for the year's passing runs through the differences that bound it.

The extension to equality fails for the same reason. A freeze with no changes before it has no cycle to measure it and no earlier state to stand at a distance from, so the question how long it lasted has no answer by Shoemaker's method or by any other: a year of equality and an instant of equality mark no contrast. The substantivalist will answer that the moments of an absolute time are distinct in themselves, whatever fills them. Grant it, and the result survives on her side of the dispute as well. A series of distinct moments ordered by an intrinsic relation is a differentiated structure, so an empty time before the first event is a diverse state, one more member of the series whose regress §2.3 dissolves, and no candidate for equality. On the relationist's account

there is no time without difference; on the substantivalist's, time is itself difference. The dissolution needs only the disjunction.

7 Conclusion

The chapter yields three results.

Temporal sequence depends on distinction. A state of equality is one at which temporal sequence cannot obtain, on both A-theoretic and B-theoretic accounts, since both require at least the numerical distinctness of temporal positions. The dissolution of the temporal regress follows: the question "what came before?" either receives an answer within the temporal series or reaches a boundary at which it is ill-formed, with the exhaustiveness of the partition guaranteeing no third case.

The eternal switch and Kant's first antinomy. The eternal-switch model exhausts the possible temporal structures of reality, each yielding eternity by one mechanism or another. On the termination branch the temporal terminus is a boundary of time, not a moment in time — a third option that neither Kant's thesis nor his antithesis recognises, resolving the first antinomy on realist grounds without transcendental idealism. Both of Kant's arguments assumed that a terminus must be temporal; the analysis rejects the assumption.

Convergence of the two hierarchies (conditional on termination). The grounding and temporal hierarchies converge at one and the same state, equality, zero complexity, rather than at merely matching termini, since equality admits neither a second instance nor a second kind.

On the termination branch a series bounded by equality obtains, its possibility established by its actuality, and its obtaining unexplainable from the equality side. The grounding question is foreclosed, while the obtaining question is owned as the obtaining residue of §2.5: a single featureless brute fact, against the featured residue of any brute-diversity terminus. On neither branch was there ever a state of outright non-existence from which diversity emerged. Something has always existed.

If both hierarchies terminate in equality, a state of zero complexity without any internal distinction, a question of enormous consequence arises. Can the terminus think? Can it know, intend, design, or create? The question matters because the entire prime mover tradition, from Aristotle through Aquinas to Leibniz, assumes that the answer is yes — that the ground of all things is a maximally intelligent being. Chapter 6 derives the answer, and the tradition will find it unwelcome.

Grades and Dependencies

1. **Grades.** All three results are graded *established*. The dissolution of the temporal regress and the eternal-switch resolution of the first antinomy hold unconditionally; the numerical convergence of the two hierarchies is conditional on the termination branch. The obtaining residue is conceded on both branches (§2.5 for termination; §6.8 for non-termination) and is a costed commitment, not a defect. The Premise Register records the full chain.
2. **Where the obtaining residue is used.** The residue completes the cost accounting of Chapter 4's ledger (§4: the boundary line), feeds the burden-of-proof analysis of Chapter 11 (which turns on the framework owing one structureless fact while the kalām owes a modal impossibility claim), and pairs with the illusion-of-equality diagnosis of Chapter 8 (why "nothing" is misimagined as dark empty space). An auditor checking the concession's total exposure should read those three sites together with §2.5 and §6.8 here.

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