The Shape of a Total Theory: A Necessary-Conditions Net

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Abstract

Physics pursues a theory of everything, and metaphysics disputes whether the world is unified enough to admit one; both enterprises presuppose a standard for what such a theory would have to be. This paper states that standard. A theory is *total* if it quantifies over everything and places no explanandum outside its own scope, including the theorists who hold it. Such a theory answers to two independent standards: coherence, that it hangs together as a system, and completeness, that it addresses every domain its own scope entails. This paper states and defends a battery of necessary conditions for both, and its contribution lies in how the completeness conditions are obtained: they are derived rather than listed. Seating the theorist inside the described world forces most of the domains a complete account must address, and an independent-variation test sorts the forced domains into structural slots, required of any total theory, and world-contingent fillers, required only of a theory of *our* world. Gravity and spacetime land among the fillers—a verdict no inventory built by inspection would deliver, and evidence that the derivation does more than relabel one. The conditions specify a target, what would count as a coherent, complete total account, without asserting that such an account exists, is unique, or has been found; that restraint keeps the net compatible with scientific pluralism. Read against the current landscape, the net is diagnostic: no surveyed account clears the structural conditions together, and the failures are complementary—each family illuminates a region its rivals leave dark. The conditions also reach past physics, and the closing survey reads a via-negativa tradition against the same net. The net is a sieve and a target specification: it rejects what violates its conditions, and it certifies no survivor as correct.

Keywords: total theory; necessary conditions; coherence and completeness; self-inclusion; transcendental argument; measurement problem; structural realism; philosophy of physics

1 Two standards a total theory answers to

The phrase "theory of everything" circulates in physics as a working ambition and in metaphysics as a disputed one: naturalized metaphysics pursues a single unified account of what there is (Ladyman and Ross, 2007), while a standing counter-tradition holds that the world is too dappled for any such account to exist (Cartwright, 1999; Dupré, 1993). Both sides argue over whether a total theory can be had. Far less attention falls on the prior question of what one would have to *be*—what conditions anything would have to meet to count as a theory of everything, whether or not our

*This specification grew out of work on a particular candidate total theory. It is stated here as a free-standing standard, with no candidate named, so that the conditions can be assessed on their own terms before anything is measured against them.

world cooperates. That prior question is this paper's subject, and it can be answered without taking sides in the dispute that surrounds it.

Call a theory *total* if it purports to quantify over everything there is and to leave no explanandum outside its own scope. The scope of such a theory is unusually demanding, because everything includes the theory's own users and their use of it: the observers who formulate it, the act of holding it, the representational states that carry it, and the fact—if it is a fact—that some of those states have an inside. A total theory that describes a universe but cannot say where within that universe its own theorists sit has left something out: itself. No working program announces its target in these terms; "total" is this paper's regulative reconstruction of what a theory of everything would have to mean if the phrase were taken at its word, and the interest of the reconstruction lies in what measuring real programs against it reveals (Section 7).

Two standards apply to such a theory, and they are routinely run together. The first is *coherence*: the theory hangs together as a system. It asserts no contradiction, its central constructions exist as well-defined objects, it helps itself to no primitive it has not declared, it applies its own rules to every case including itself, and it grounds its explanations without an open or circular regress. Every one of these is checkable without ever comparing the theory to the world, and a perfectly coherent total theory could still be false. The second standard is *completeness*: the theory leaves no required domain unaddressed. A total theory does not get to be silent on what the world is made of, on how determinate facts arise, or on why some processes have an interior, and still count as total. Completeness does not require that every question be answered; open questions are allowed. It requires the weaker thing—that the theory take a *principled position* on every domain its own scope entails, including a principled account of why some question is open, ill-posed, or dissolved.

The two standards are independent, and their independence carries weight in what follows. A theory can be coherent and incomplete: consistent, well-defined, honestly grounded, and yet silent on experience, or on gravity. A theory can be wide-ranging and incoherent: it speaks to every domain while quietly exempting itself from its own rules. The consequence that matters is directional. Coherence conditions audit whatever the theory asserts—checking it for consistency, honesty, and uniformity—and are constitutively blind to whether the theory says anything about a given domain at all. A theory can be flawlessly coherent about a base that never mentions the arrow of time—the arrow may even serve as an example inside a coherence condition, as it does below, without thereby being addressed by the theory under audit. So completeness cannot be read off coherence. This is why completeness needs its own treatment (Section 4), and why that treatment carries most of what is new here: the completeness domains will be derived, and the derivation reclassifies gravity and spacetime.

One register is fixed now and held throughout. The conditions below are *necessary* ones. They prove nothing about any theory's truth. Each condition, violated, makes a theory fail to be a coherent total account; the set is not shown to be jointly sufficient, and is not shown to be exhaustive. Used as intended it is a sieve: what is incoherent or incomplete does not get through, and what does get through has been screened rather than vindicated. Together the conditions form the net of the title—a mesh of independent strands, each checkable on its own, jointly catching what any one of them misses. The accurate name for the result is a *target specification*, and Section 6 says exactly what that does and does not claim.

2 Coherence: what keeps a system from self-destructing

There are six ways a total system can fail from the inside. Each is a distinct defect, and each has a witness that fails it while passing the others, so the six form a battery rather than one demand

restated.

Consistency (C1). The theory's commitments must be jointly satisfiable: no proposition and its negation may both follow from the theory, directly or through its derivation rules. The demand is elementary, and sharper for a total theory than for a local one. From a contradiction every proposition follows, so an inconsistent theory makes no discriminating claim about anything—it "predicts" each state of affairs and its opposite at once. A local theory can wall an inconsistency into one subdomain and keep computing elsewhere; a total theory, quantifying over everything, has no outside to quarantine it in, and a single contradiction propagates without limit. The classic route to this failure is generality turned on itself without restraint: a theory adopts unrestricted comprehension because it wants maximal reach, and reproduces Russell's paradox at its foundation—the set of all non-self-membered sets both is and is not a member of itself (Russell, 1967). Totality with naïve self-application is the standard road to contradiction, and a total theory must show it has closed that road (Tarski, 1936).

Well-definedness (C2). The theory's central constructions—its state space, its dynamical law, whatever measures, limits, sums, or morphisms it leans on—must exist as well-defined objects, and not merely be describable in non-contradictory sentences. This is a separate demand from consistency, and the gap between the two is where a certain kind of theory hides. A sum presented as a partition function may fail to converge; a measure may be asserted over a space that admits none; a limit invoked in a derivation may not exist. In each case every individual sentence the theory writes down can be consistent while the object those sentences purport to describe is absent, so the theory has not said something false—there is nothing for its claims to be true or false of. Consistency cannot catch this: "the measure μ assigns probability one-half to region A" is a consistent sentence whether or not μ exists. One place this happens in practice is a dynamics defined by summing over an infinite space of possible histories—a path integral—with predictions read off by manipulating that sum as though it converged to a well-defined value. When no measure on the space of histories actually makes that manipulation valid, the theory's sentences about "the amplitude" of an outcome are still well-formed strings, but "the amplitude" denotes nothing: the predictions are gestures wearing the dress of derivations, formally correct moves performed on an object that was never shown to exist. A construction has to be shown to exist rather than merely written down.

Primitive honesty (C3). Everything the theory treats as derived must actually derive from its declared primitives, and anything it uses but cannot derive must be declared a primitive in turn. The base must be finitely specified—given by a finite description, which may license infinitely many instances through a schema, but never by an open-ended license to add posits as the need arises. The demand is not economy for its own sake. A total theory's entire explanatory claim is that a stated base suffices to generate the rest; if the theory quietly helps itself to structure absent from that base—a background metric, a preferred basis, a measure of "typical," an already-individuated stock of objects—then the claim is false, and the real base is larger than advertised. A smuggled posit is worse than a declared one, because a declared primitive can be counted, compared across theories, and challenged, while a smuggled primitive is invisible to exactly those audits (Sider, 2011). The recurring example is a derivation of the Born-rule probabilities from dynamics alone that, on inspection, assumes a "natural" or uniform measure over initial conditions—itself a substantive posit with no derivation. The probabilities were not read out of the stated base; a second primitive, the measure, was added under the table. The failure involves no rule-exemption and no regress: a

hidden node was appended to the base, which is what makes primitive honesty independent of the conditions that follow.

Reflexive closure (C4). A total theory must locate, inside the reality it describes, the observers who formulate and hold it—including their capacity to represent that reality, measure it, and be right or wrong about it—without exempting them from its ontology. The theorist, the theorizing, and the representational states that carry the theory belong to everything, and a theory that quantifies over everything while going silent on where its own users sit, or on how a physical system comes to represent the rest of the world truly, has placed its own truth-conditions outside its scope. The view from nowhere is unavailable to a theory that claims to contain the viewers (Nagel, 1986). A standard illustration is the block universe presented as complete *without self-locating machinery*: a fixed four-dimensional manifold of events with no room for the indexical fact that *this* observer is *here*, holding the map. The "you are here" marker that refers to a location partly by occupying it is the kind of resource that meets the demand, and the situated self is its worked-out form: an account of how indexical machinery operates from inside a physical world, which shows the demand is satisfiable rather than a skeptic's trap (Ismael, 2007). The failure belongs to the block offered as complete while lacking any such resource. Nor is the demand external to physics. In diffeomorphism-invariant theories the fundamental observables are relational, and recent work argues that ordinary experience of determinate objects reflects observers embedded in the universe reading those observables from within—an internal view reached by analysis of the formalism rather than imported from epistemology (Adlam, 2025). A demand the foundations literature arrives at from inside the physics is not an armchair imposition. The demand carries a known limit, and honesty requires stating it: a sufficiently rich, effectively axiomatized consistent system cannot prove its own consistency from within (Gödel, 1931), so reflexive closure asks that the theorist be placed, not that the theory certify its own soundness.

Placing the theorist inside the described world creates a loop: the theory must represent a world that contains that very representation. Coherent self-inclusion requires the loop to *close on a fixed point*—a configuration stable under the theory's own self-representing operation, applied to a world that already contains its output—rather than to defer without end or to bend back on itself viciously. This is a third fate of self-reference, alongside the brute stop and the specified infinite descent that groundedness (C5) governs, and the regress vocabulary of C5 neither entails it nor detects its absence: where the fixed point is missing, the failure surfaces instead as contradiction (C1) or as a predicate with no object (C2). Wherever self-reference has been made formally precise, fixed-point theorems settle which of these fates is on offer (Lawvere, 1969; Yanofsky, 2003); for theories written in other idioms the results fix the menu of outcomes rather than a verdict, and a theory owes its answer at whatever strength its idiom supports. Closure of this kind is part of reflexive closure itself—a further specification of what C4 demands when the theorist is placed without exemption, not a seventh condition alongside the six.

Explanatory groundedness (C5). The chain of explanation must close: no step may appeal to anything outside the theory, and the chain must be fully specified. The condition takes no side on what explanation is; unification accounts, for instance, hold that to explain is to systematize (Friedman, 1974; Kitcher, 1981). Whatever explaining is, a total theory must say where its explanations are permitted to end. Two arrangements satisfy this. The regress may terminate in a declared base the theory presents as brute and does not try to explain further (Aristotle, 1994); or the theory may exhibit a principled infinite descent in which every level is explained by a further level inside the theory, the whole descending structure is specified, and no level reaches outward.

What groundedness forbids is an *open* regress—a promissory "explained by a deeper level, to be specified later"—and a *hidden circle*, in which A grounds B grounds A and the loop is passed off as a floor. Both leave an explanandum inside the theory's own scope unaccounted for, which is what totality cannot abide. Whether grounding must bottom out or may descend forever is a live question (Cameron, 2008), and groundedness is written to accept either answer; it rejects only the open and the circular. Incompleteness constrains the previous condition, where it bounds self-certification; the stopping-point choice here is a separate matter.

Rule uniformity (C6). The theory's generative principles must apply to every case in their stated scope, with no exemption, special plea, or case-by-case adjustment introduced to reach a wanted result. A total theory's explanatory power is exactly the uniformity of its rules: one set of principles, applied everywhere. Each exemption—"the law holds except at the initial singularity," "except during measurement," "except for conscious systems"—is a concealed primitive and a concealed cut in scope, and enough of them turn a law into a lookup table that fits the data because it was fitted. The standard illustration is a cosmology that runs time-symmetric dynamics everywhere and adds a special low-entropy condition at the initial time so that the arrow of time comes out right (Albert, 2000). Where nothing but the wanted result selects the boundary, the exemption is concealed: a different boundary, equally admissible under the same rules, would reverse the arrow, so the rules did no work on the very phenomenon they were credited with explaining. The honest alternative, defended for this very case, is to promote the boundary condition to a law—declaring the primitive instead of hiding the exemption, and paying for it in the open. This defect differs from a smuggled primitive: an honesty failure adds a hidden node to the base, a uniformity failure switches a declared rule off for chosen cases, and a theory can commit the second with a wholly honest base (Popper, 1959).

3 Being about a world

A theory can clear every coherence condition and still fail to say anything about a world, if its structure and its terms are tied to reality by too little. Content anchoring (C7) is the demand that they be tied by more than cardinality and more than an arbitrary reading of the theory's own vocabulary. Two failures are in view, and one repair meets both.

The first failure is structural. A theory that says only "reality has structure W," with W specified purely formally, says almost nothing, because any collection of the right cardinality can be arranged to instantiate W (Newman, 1928). Offering abstract structure alone, the theory cannot tell the actual world apart from any equinumerous rearrangement of arbitrary objects, and its content collapses to a claim about how many things there are. The second failure is the same triviality raised from structure to terms. If the theory's central predicate—"actual," say, or "physical"—can be permuted onto a different extension with every theorem's truth-value preserved, then nothing in the theory fixes what the predicate picks out (Putnam, 1980, 1981), and its flagship distinction is one it cannot state determinately.

Both failures fall to one kind of repair. The theory must privilege some relations over others as the anchors of its structure and terms: relations rich enough to give the structure more than cardinality, which is what defeats Newman, and to pin the central predicates to determinate extensions, which is what defeats the permutation. That is the requirement; which relations satisfy it is a further question. The standard route is Lewisian naturalness: joint-carving relations, distinguished from the set-theoretic run of them, whose eligibility constraint on reference answers the permutation argument directly (Lewis, 1983, 1984) and whose application to the Ramsey-sentence

formulation is the standard reply to Newman (Melia and Saatsi, 2006). The repair is shared; the failures stay independent: a theory can privilege natural relations and still leave its predicates unfixed, or fix reference causally and still offer only cardinality-level structure. The structural-realism literature exhibits the split: the claim that only structure survives theory change (Worrall, 1989) met exactly this triviality pressure, and the distinction between epistemic and ontic forms of the view was drawn in response (Ladyman, 1998). Content anchoring is thus a single condition with two failure geometries, and the condition is the demand, not the Lewisian answer to it: what is required is that reference be fixed non-trivially, with naturalness cited as the best-developed satisfier rather than mandated, so a theory that anchors its content by other means discharges the condition equally. Nor is the demand settled. Naturalness faces the question of what anchors the anchors—the perfectly natural properties either terminate the regress by being taken as primitive structure (Sider, 2011) or inherit the problem they were introduced to solve—and within structural realism, the ontology most exposed to Newman's argument, recent reformulations recast the view as a structuralist existence monism, a single world-sized bearer whose modes play the role of objects, precisely to give structure a metaphysics determinate enough to state (Meyer, 2025). A demand still being negotiated by the views most subject to it is a live condition. The repair bears on the previous section as well: a total theory has no outside from which to hand its terms their reference, so the reference-fixing relation must live in its own base and close without vicious circularity. The account of how the theory represents, required by reflexive closure, and the account of what its terms refer to, required here, must ground each other in one such relation, rather than each quietly presupposing the other (Quine, 1960).

4 Completeness: what a total theory is forced to address

The domains a total theory must speak to can be listed by inspection—roughly, what a world contains. A list invites the obvious complaint that it reflects the lister's interests. The domains can instead be *generated*, and generation is what this section supplies: a small set of demands the theory has already accepted forces most of the domains as consequences, and a single test sorts the forced domains into two grades. The move converts "here is what a complete theory happens to cover" into "here is what any total theory is forced to address, on pain of leaving unmet a commitment it has already accepted." The payoff is a verdict no list would deliver: gravity and spacetime, fixtures of any inventory built by inspection, come out as world-contingent fillers rather than structural necessities.

4.1 The generators

Three demands generate the domains, and they are unequal; one does most of the work. The master demand is *self-inclusion*—reflexive closure (C4), read now as a generator rather than a coherence check. As a coherence check it asks only whether the theorist is placed without exemption, auditing what the theory already says; as a generator it asks what placing a theorist requires, and turns the answer into the domains the theory must then address. The one feature that distinguishes a total theory from a merely local one is that it must contain its own theorist: the system that formulates, holds, tests, and can be right or wrong about the theory, seated inside the described world without exemption. To seat a theorist is to commit to whatever the existence of a theorist requires, and each such requirement is a domain the theory is forced to address. Unpacking what it takes to seat a theorist yields most of the structural domains directly, and each step deserves its own statement, because each is a substantive claim. A theorist persists and changes—formulating a theory takes time, and testing it takes more—so the account owes a *dynamics*, an ordering along which one

system does both. A theorist remembers: evidence is a stable, past-directed trace, and memory is asymmetric record-formation, so the account owes *records*, and the *temporal asymmetry* that their one-way character presupposes. A theorist registers outcomes: a measurement ends with one determinate result where the theory admitted several, so the account owes *definiteness*—some story about how the determinate arises—and with it the *modal* structure that makes "the alternatives that did not occur" a contentful phrase. A theorist has, or on a principled view lacks, an inside, which forces a position on *interiority*; this is the weakest forcing of the six, and it is examined on its own terms below. A theorist intervenes—testing is doing—which forces *agency*. And a theorist is made of something rich enough for all of this, which forces a *constitution*: a matter slot, constrained by the requirement that whatever fills it support a memory-bearing, registering system. Each step can be resisted—an eliminativist resists the interiority step, a Humean deflates the modal one—and the battery prices such resistance as principled denial, which is itself a position; what no total theory gets is silence. The two readings of C4—audit and generator—are one condition put to two uses, and the division of labor is what preserves the independence claimed in Section 1. The audit checks that the theorist is placed without exemption, and a theory can pass it while staying silent on what placement requires; the generator makes that requirement explicit, and silence on a generated domain fails the completeness standard rather than the audit.

Two further demands, already accepted, add one domain each. *Declare your base*—primitive honesty and groundedness (C3, C5)—forces the theory to say what *kind* of thing its base is, its categorial character, since a base with no stated kind is an undeclared base. Call this the *arena*. *Fix your reference*—content anchoring (C7)—forces a determinate reference for "actual" against "possible," the modal distinction whose existence self-inclusion already forced.

What disciplines the unpacking itself? The admission rule is the same test the tiers will face: a feature belongs among the generators' yields only if deleting it from the description deletes the theorist described. The rule also says why some candidates that might seem forced are not listed. Truth and normativity name no further slot, because a theorist's capacity to be right or wrong is already the representation and reference machinery of C4 and C7, audited on the coherence side rather than forced as a domain. A community of theorists names none, because a lone theorist satisfies the antecedent: what communities add can be varied away with the theorist still standing. And mathematics names none, because it is the medium of the theory's constructions—policed by well-definedness—rather than a domain of the described world. The unpacking is exposed to the same refutation standard as the tiers: exhibit a feature whose deletion destroys the theorist and which the six do not already contain, and the list grows.

4.2 The independent-variation test

Generation lists the domains; a further test grades them. The precedent is the cGh cube, the physics-only map on which theories are placed by which of the constants c, G, $\hbar$ they incorporate, and where sending a constant to a limit omits an entire theory from the cube without defect—Newtonian gravity is the well-defined $c^{-1} \to 0$ corner, not a broken relativity (Bronstein, 1933; Okun, 2001). The cube shows that a structural map can separate forced features from optional fillers by asking what survives a limit. What transfers is not the machinery—the cube's limits are operations on a shared parameter space, and domains offer no parameter—but the question: what can be removed while everything else stands? Hold fixed everything self-inclusion, base-declaration, and reference-fixing require, and try to vary a domain away—to build a coherent total self-including theory that takes no position on it. If the domain cannot be deleted without costing something a generator forces—it is welded to the existence of a persisting, remembering, registering, acting theorist, to the declaring of a base, or to the fixing of "actual"—the domain is *structural* (Tier 1),

and every total self-including theory must discharge it. If the theory can be completed with the domain deleted and everything the generators force still supplied, the domain is *world-contingent* (Tier 2): forced only for a theory of a particular world, where the structural obligation is the empty slot rather than the specific filler.

One run of the test, written out, shows the sorting in action. Try to vary records away: describe a coherent total self-including world whose theory takes no position on stable, past-directed traces. The theorist of that world must still hold and test a theory—that is what makes it a theorist—and testing compares a present state against something: an entailed prediction, a registered outcome. With no records there is nothing the comparison could consult; evidence collapses to whatever the present instant contains, and the theorist's claim to be right or wrong about anything reaches no further than now. The variation does not produce an exotic but coherent world; it deletes the theorist it was required to keep. Records are therefore structural. Run the same attempt on gravity and it goes through without resistance: a world of theorists whose interactions are electromagnetic, whose records are chemical, and whose arrow rests on a thermodynamic gradient of its own loses nothing that a generator forces when metric coupling is deleted—the deletion changes one filler of the matter slot and reaches no other slot at all. One deletion destroys the theorist; the other only redescribes the world's furniture. That asymmetry is the tier distinction. Throughout, the verdicts are claims about descriptions, not sightings of distant worlds, and the criterion in the tier definitions is what disciplines them: a challenger who finds the gravity-free description incoherent owes the name of the generator-forced domain it fails to supply, not a report that the whole strikes them as impossible. The demand on such descriptions is deliberately weaker than C2's demand on theories, and the asymmetry is principled. A theory asserts that its central objects exist and must exhibit them; a variation sketch claims only that nothing forces the deleted domain, and what it saves in rigor it pays in status—each verdict stands as a challenge, refutable by producing the description the verdict says cannot be had, or by finding the gap in the one it offers.

4.3 The two tiers

The test sorts the generated domains into two tiers, and Table 1 is the map. Tier 1 holds the eight *structural slots*: the domains every total self-including theory—every total theory as actually held by a theorist it contains—must address, whatever its world is like. Tier 2 holds the *fillers*: the specific contents our world supplies for some of those slots, forced only for a theory of *this* world. A slot is an obligation; a filler is what happens to meet it here. The stakes differ accordingly: silence on a slot abdicates totality itself, while silence on a filler forfeits only the claim to describe our world, a lesser failure.

Each of the eight slots can be given in a line. *Arena*: what kind of thing is fundamental. *Modality*: the space of possibilities and what marks the actual. *Matter*, as a constrained slot: what the theorist is constituted of and how it interacts, its constituents rich enough to support stable records and determinate registration. *Dynamics*: the ordering along which the theorist persists and changes. *Records and temporal asymmetry*: the stable past-directed traces knowledge requires, running one way. *Definiteness*: how determinate facts arise on any account whose fundamental level is less determinate than the manifest one—an account exhibiting no such gap discharges the slot trivially. *Interiority*: whether, and why, some processes have an inside. *Agency*: the intervention and selection by which theories are tested. Six are forced by seating a theorist; the arena comes from declaring a base and the modal distinction from fixing reference.

These eight are not independent posits set side by side; the forcing runs through them in the partial order that Figure 1 lays out, rooted in constitution and change: nothing persists, registers, acts, or has an inside except a constituted something, and traces, their one-way character, and

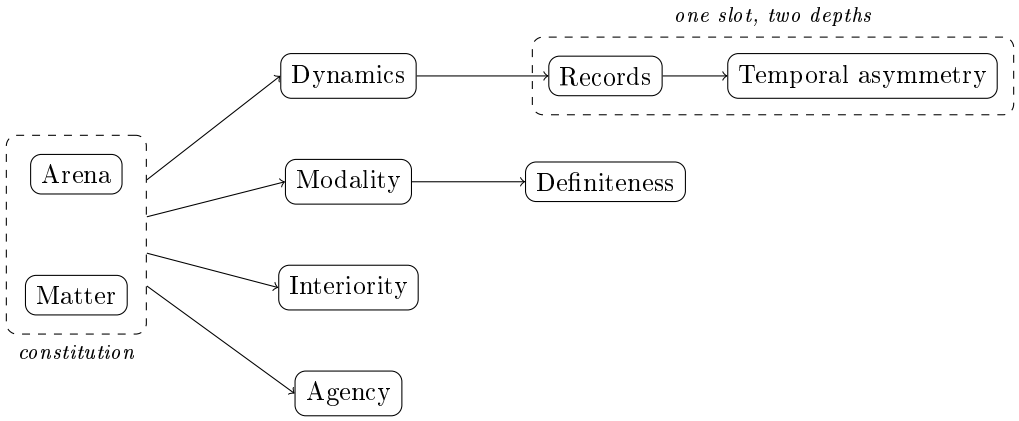

Figure 1: The order of the forcing. An arrow from A to B means B enters the forcing only on the far side of A: a theorist must be constituted (arena, matter) before it can persist, register, act, or have an inside; a record presupposes persistence; a direction of time presupposes records; a determinate outcome presupposes a field of alternatives. Records and temporal asymmetry are one slot entered at two depths. Interiority and agency are drawn with only the constitution dependency; the forcing claims no further order for them. Which generator forces each slot is recorded in Table 1.

determinate outcomes each wait on a prior slot. The order is also what keeps records, dynamics, and the arrow distinct: close enough that a bare enumeration would risk collapsing them into one, they enter the forcing at different depths.

The lower panel of Table 1 lists the fillers, and each earns its place there by the variation test: its deletion costs nothing the generators force. A coherent self-including theory of a gravity-free world, or of a world whose spacetime is emergent rather than fundamental, omits gravity or fundamental spacetime without defect, because there is nothing of the kind in that world to take a position on; a discrete combinatorial world likewise omits our specific matter and gauge content.

Not every structural slot takes a filler of its own; the lower panel marks four with no separate entry. Modality, definiteness, interiority, and agency name no separate item in our world's inventory, because what our world fixes about them arrives through the fillers of the other slots. What the space of alternatives contains, and how one of them comes to register, are settled by the world's specific matter and its law of evolution; whether and where insides and agents arise is settled by what its constituents can compose. The four are structural obligations whose world-contingent content rides on the fillers of the rest.

The demotions of gravity and spacetime are the test's sharpest verdicts, and they are deliberate: what is structural is the slot—account for your world's interactions, account for your arena's structure—while universal metric coupling and the Lorentzian signature are what our world happens to supply. The table files metric coupling under the matter slot deliberately: the demotion targets gravity as an interaction the theorist's constitution does not require, and that run is distinct from the arena run—a world with fundamental spacetime but no universal coupling is a different variation from a world whose spacetime is emergent. The verdict is exposed to refutation on stated terms, and half of the needed entailment already exists: given a massless spin-2 field, universal coupling follows (Weinberg, 1964; Deser, 1970). No one has derived the other half—that a world habitable by a memory-bearing, registering agent must contain such a field at all. That is the entailment an opponent of the demotion owes. For spacetime the verdict also has independent support. The major quantum-gravity programs pursue the emergence of spatiotemporal structure from a less-than-fully-spatiotemporal base—in different degrees and senses across programs (Wüthrich

Tier 1—structural slots (forced for any total self-including account)

Slot	Forced by	The requirement it answers
Arena	base declaration	the base must have a stated kind
Modality	reference-fixing	"actual" must be pinned against "possible"
Matter (constrained)	self-inclusion	the theorist is constituted and interacts
Dynamics	self-inclusion	the theorist persists and changes
Records / asymmetry	self-inclusion	memory is a stable, one-way trace
Definiteness	self-inclusion	the theorist reads a determinate result
Interiority	self-inclusion	whether there is something it is like to grasp the theory
Agency	self-inclusion	testing is intervention among alternatives

Tier 2—world-contingent fillers (forced only for a theory of our world)

Structural slot	Tier-2 filler our world supplies	Varies away in...
Arena	spacetime (3+1D, Lorentzian metric)	an emergent or non-spatiotemporal world
	cosmological history	a world with different or no cosmology
Modality	— what the alternatives are is settled by the matter and dynamics fillers	
Matter	specific matter & gauge content	a discrete or combinatorial world
	gravity (universal metric coupling)	a gravity-free world
Dynamics	the specific law of evolution	a world with different laws of motion
Records / asymmetry	arrow mechanism (a Past Hypothesis)	a world with a different source of asymmetry
Definiteness	— how one alternative registers is settled by the matter and dynamics fillers	
Interiority	— whether insides arise is settled by what the matter filler composes	
Agency	— whether agents arise is settled by what the matter filler composes	

Table 1: The two-tier taxonomy the forcing function produces. Tier-1 slots are forced for any total self-including account, and silence on one abdicates totality. Tier-2 fillers are forced only for a theory of *our* world; each can be varied away with everything the generators force still supplied, which is why gravity and spacetime sit here rather than among the structural slots. Slots marked with a dash take no separate world-inventory item; each is settled downstream by the fillers named in its row.

and Huggett, 2025)— and spacetime functionalism gives that standing its philosophical form: being spatiotemporal is a role, and the role can be played by structure that is not fundamentally spatiotemporal (Lam and Wüthrich, 2021). A world of that kind is one of the variation test's own cases—spacetime emergent rather than fundamental—so the functionalist literature independently describes the very world in which the spacetime filler is absent. The support is corroboration, not source: the net reaches the demotion from seating a theorist alone, with no input from quantum gravity. For gravity no comparable program exists, and there the verdict rests on the derivation's own strength.

The distinction disciplines the credit a theory can claim. Deriving gravity or the dimensionality of spacetime is a deep result about our world; it is not the discharge of a structural necessity, because a total theory as such is under no obligation to a world with gravity in it.

4.4 The uniform standard, and its limit

Every structural slot forces a *position*, and a position is a weaker thing than a substantive posit. The demand is discharged by an account, by a specification of the conditions under which the domain's phenomena arise, or by principled denial or dissolution. Modality is discharged by a Humean denial of irreducible modality as squarely as by a realist modal structure (Lewis, 1986; Kripke, 1980); definiteness—the measurement problem generalized past quantum mechanics, whose sharpest statement is Maudlin's trilemma (Maudlin, 1995; Bell, 1990)—is discharged by exhibiting no gap between the fundamental and the manifest as squarely as by bridging one; agency is met by locating agents, emergent but real, within a physicalist ontology (List, 2019) or by a principled denial that anything is one; interiority is answered by an account of the inside or by an eliminative argument that the question is ill-posed (Chalmers, 1996; Nagel, 1974). Interiority is the most visibly deniable of the eight, and for that reason the one a critic will press hardest; it is a worked instance of the uniform standard, held to the same bar as the rest. Its forcing is also the thinnest, and the bar's uniformity should not obscure the gradient beneath it: constitution, dynamics, and records admit no denial, only rival characterizations; modality, definiteness, and agency admit deflationary discharges, though even the agency-denier still owes an account of the intervention behavior that testing consists in; interiority alone can be denied outright, since a determined eliminativist can hold that a theorist is exhaustively a third-person functional system. The position remains forced—the eliminativist still owes the argument, and a theory that simply says nothing about the inside of the system that grasps it has abdicated the slot—but the difference in strength is marked here in plain view.

The standing of the whole construction has a limit that must be stated plainly. These are transcendental arguments in the analytic sense (Kant, 1998; Strawson, 1966, 1959): they establish what a total self-including account must *address and represent*, and not that reality independently *instantiates* the domains (Stroud, 1968). The forcing stays on the near side of that gap, and staying there does not reduce it to an unpacking of the word "total." The arguments are substantive and conditional at once, in the way a theorem is: non-obvious consequences of a stipulated antecedent, established by argument rather than read off the world. Nothing in the definition of totality contains the demotion of gravity on inspection; it follows once the antecedent is fixed. That restraint—specifying a target, never reading structure off the world—keeps the completeness condition compatible with the possibility that reality is not neatly totalizable, and clear of the ontological over-reach primitive honesty would otherwise flag against it. The conditionality is explicit: given that one is specifying a total account containing its own theorist, these domains are the conditions of the possibility of the theorist the account must contain. Abandon that antecedent—build a merely local theory that exempts its own theorist—and the necessity lapses. Nothing in the antecedent names a world, a mechanism, or a particular theory; the completeness half stays exactly as candidate-neutral as the coherence half.

5 Two virtues that are not gates

Two further properties belong to a good total theory and are deliberately kept off the necessary list.

Empirical contact. A theory ought to touch observation, ideally by entailing at least one measured quantity or risking a falsifiable prediction. A total theory can be internally coherent and structurally complete while touching no measurement—discharging every domain consistently and predicting nothing—and such a theory is worse for it, yet it is not thereby incoherent, and no structural domain is left unaddressed by its idleness. Empirical contact is the decisive virtue for choosing

among coherent, complete rivals, which is a different task from deciding whether a theory is one (Popper, 1959; Quine, 1951). Holding it off the necessary list keeps the coherence-and-completeness analysis independent of confirmation. The two-tier split of the completeness condition shows through here. The structural slots are checkable without the world, so testability bites almost entirely on the Tier-2 fillers: our world's specific content is what measurement grades. Covering the structural slots is the necessary demand; that the coverage touches measurement and risks a prediction is the aspirational one, and the two come apart.

Parsimony. Among theories that clear the necessary conditions, prefer the one with the smaller and more natural primitive base. A baroque theory with many declared primitives can be fully coherent—honesty requires that primitives be declared and sufficient, not that they be few—and complete, so parsimony discriminates among survivors rather than deciding survival (Lewis, 1973; Sider, 2011). It gains force in company with primitive honesty: since smuggling is barred, every primitive is paid for in the open, and a bloated base is a large visible bill. That is why parsimony is a strong virtue and still not a gate.

6 A target specification, not a uniqueness claim

The conditions assembled here specify a target: what would count as a coherent, complete total account, with no assertion that anything has hit it or that only one thing could. This section adds one observation about sides to the register fixed in Section 1. The whole apparatus is specification-side. The coherence conditions had that character all along—internal properties, checkable without looking at the world—and the forcing function, because it derives the structural slots relative to the demand for a total self-including account rather than reading them off the world, puts completeness on the same side.

That framing settles an objection the enterprise would otherwise face. The strongest case against any single total theory is that reality is not the kind of thing that admits one: laws hold only in shielded circumstances, the world is a patchwork, and the disunity of the sciences is a fact about the world rather than a passing state of inquiry (Cartwright, 1999, 1983; Dupré, 1993). Grant all of it. The specification is untouched, because saying what would count as a total account is a separate question from whether reality obliges by being totalizable. A total theory of a dappled world still seats its theorist, still declares a base, still fixes "actual"; the structural slots are forced whatever the world's degree of unity. The bullseye is well-defined whether or not the world is a single target. The specification is compatible with monism, with pluralism, and with there being no satisfier at all, because it specifies a target rather than asserting a hit. The pluralist and the monist disagree about the world; they need not disagree about what an account of it would have to do. A more radical pluralist rejects the ambition itself, holding that "an account of all of it" is the error rather than the unmet goal, and the net picks no quarrel there either: as the close of Section 4 made explicit, whoever declines the antecedent stands outside the net's reach. A third position stands between them: perspectival realism, on which scientific knowledge is irreducibly perspectival—produced and assessed within the historically situated practices of epistemic communities—while remaining knowledge of one shared world (Massimi, 2022). The net does not adjudicate this debate either. Its conditions constrain what a total account must address, not the perspective from which inquiry proceeds; what can be said is that reflexive closure shares perspectivalism's starting point, the knower inside the world known, while leaving open whether appraisal itself is perspectival.

A neighboring program runs the other way: constraints of naturalistic closure ask which metaphysical claims earn their keep, admitting only those that unify specific scientific hypotheses, at least

one drawn from fundamental physics (Ladyman and Ross, 2007). The two are complementary—that program disciplines which metaphysics is admissible, this one what a total account must address—and neither collapses into the other. Within these bounds the specification does its work: it narrows the field without naming a winner.

7 The landscape the net reveals

Used as a lens on the current field of total theories, the net shows which regions of reality each family illuminates and which it leaves dark. Figure 2 lays the families out against the conditions. The point is diagnostic. The figure maps partial understanding, and reading it as a ranking misreads its purpose.

7.1 Applying the net

The columns are grouped to make one axis visible. Internal coherence and anchoring sit on the left—the hygiene checks nearly every serious account passes. The heavy rule then separates the conditions that face the *world* a theory describes (whether it covers the world's specific content, whether it grounds the arrow) from those that must seat the *theorist* (placing the representer, yielding determinate facts, accounting for the inside, locating agency). Four of the eight structural slots from Table 1—arena, modality, matter, dynamics—are omitted: every serious total theory addresses them, so those columns would fill near-uniformly and separate nothing. What remains are the conditions on which the surveyed accounts actually differ, and the divide the rule marks is where the differences fall.

Each cell reports a three-way judgment, and the judgment is operational. A full mark means the account, in its strongest defended version, contains an explicit treatment that discharges the condition. A partial mark means a developed treatment exists and its success is contested in the print debate—contested, not refuted, which is why the convention of charity marks such cells as partial and never as failed. An empty mark records silence, and the conventions below fix exactly what silence does and does not imply. Grades attach to formulations, not to programs' ambitions: what an account could add is invisible to the map until someone adds it.

One group behaves differently from the rest and is worth reading on its own terms. Russellian monism (Goff, 2017; Alter and Nagasawa, 2015) and Whitehead's process philosophy (Whitehead, 1978) carry both an intrinsic and an extrinsic side in their primitives, and the consequence shows in the shape of their rows rather than in the count of their marks. Neither has the block of empty cells that every other family carries somewhere: Whitehead's row records no outright silence at all, and Russellian monism's single empty cell is definiteness, where it says nothing about which outcome obtains.[1] What they have instead is partial marks nearly everywhere, and a partial mark here means a developed treatment whose success is contested rather than a treatment that does not exist. Read across the row, that is a family with the right general shape and little settled inside it. The map records the position and does not adjudicate it; what a base of that kind would have to supply, and whether anything supplies it, are questions this specification does not take up.

Three further conventions matter for reading the physics rows. Consistency grades each theory inside its own domain—the Standard Model and general relativity are each consistent where they apply, and their failure to combine across the Planck-scale overlap registers on the map as coverage

[1] The nearest adjacent attempt is the proposal that conscious states bias quantum probabilities (Kent, 2018), which assumes objectively localized collapse events rather than accounting for them, and argues from no Russellian-monist premise. The cell records the position of the literature on intrinsic natures, which does not take the question up.

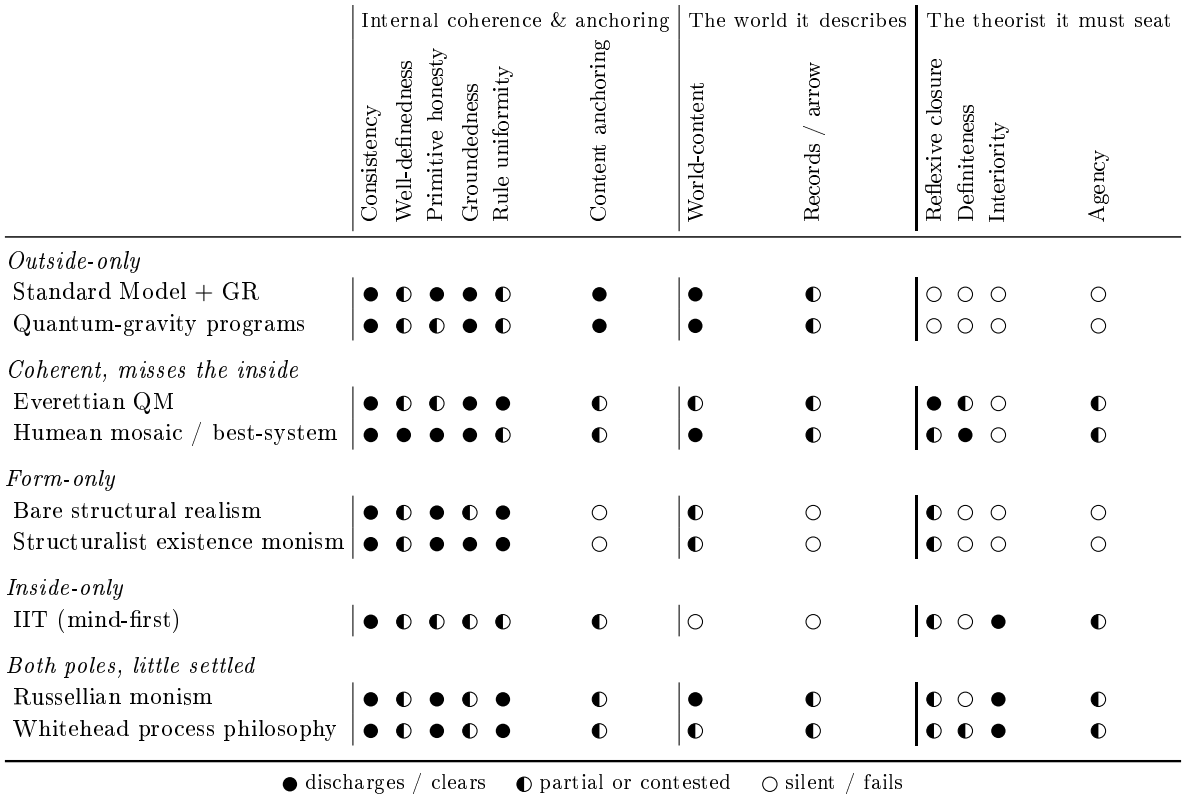

Figure 2: Total-theory families against the net. The columns are grouped: internal coherence and anchoring, then—across the heavy rule—the conditions that describe the world versus those that must seat the theorist; the rows are grouped by the region each family illuminates. Each cell is graded from the strongest defended version of the account, and contested cells are marked partial rather than failed: the branch measure for Everettian QM, the centered-worlds reply on the situated theorist for the Humean mosaic, and the derivation of a mind-first theory's postulates from its experiential axioms. The pattern is complementary for the families that pick one region: the outside-only rows go dark just past the rule, the inside-only row before it. The both-poles rows break that pattern, carrying almost no silence and almost no cleared cell either. World-content is a single Tier-2 summary column (gravity, spacetime, gauge content); the other four structural slots (arena, modality, matter, dynamics) are common ground and omitted, and fixed-point closure is not a separate column, since it is part of reflexive closure and grades with it. The two form-only rows differ by a single cell: the existence-monist repair clears groundedness and moves nothing else.

left dark rather than as a contradiction within either. An empty mark means the account as stated addresses the condition nowhere, never that it could not: a physics-plus-functionalism package that argued an eliminative discharge of interiority would move its cell by making the argument, and no surveyed formulation makes it. The same convention governs reflexive closure in the quantum-gravity row: the relational-observables literature already supplies internal-view materials an account could build with (Adlam, 2025), and the empty mark records that no surveyed formulation has yet built them in. And the quantum-gravity programs, which differ sharply among themselves on the coherence side of the rule, converge on the theorist-facing columns; convergence on the axis in view is what earns them a single row.

The marks most likely to draw fire are known in advance, and naming them is part of the

application. An Everettian will contest definiteness graded partial rather than cleared; Section 7.2 runs that candidate through the net in full, and the grade turns on where the branch-measure debate stands rather than on either side's say-so. A Humean will contest anchoring graded partial, since perfectly natural properties are offered as exactly the anchor the condition demands; the grade records the regress of Section 3—whether the anchors are themselves anchored is the open question, and open is what partial means. A physicist will ask what partial well-definedness means for the Standard Model row; it records that no interacting quantum field theory in four dimensions has a mathematically rigorous construction, so the theory's flagship object exists at physical rather than mathematical standards of existence. And the mind-first row's full mark on interiority will be contested from the opposite direction, by critics of integrated information theory. The two both-poles rows carry the most exposed grades in the figure, since a historical system and a schematic position are both harder to hold to a cell than a live research programme is; the thinnest are Whitehead on world-content, where the cosmology is metaphysical rather than specific, and on consistency, where the criterion is stated and never proved. There as everywhere, the strongest-defended-version rule is doing the work.

7.2 A worked application: Everettian quantum mechanics

Running one candidate through the whole net, condition by condition, shows what the figure's grades rest on. Everettian quantum mechanics is the instructive case: its profile is the most mixed and its strongest version the most explicitly defended (Wallace, 2012). The coherence columns first. Consistency clears. Well-definedness is partial, graded by the same standard as the Standard Model row: realistic Everettian quantum mechanics is unitary quantum field theory, and no interacting quantum field theory in four dimensions has a rigorous construction. Rule uniformity clears for the same reason—no collapse exemption, no measurement clause; the dynamics applies to every system including the measuring apparatus, a universality that is the view's founding advertisement. Groundedness clears: explanation terminates in the universal state and the dynamics, declared as brute. Primitive honesty is the first partial, and the grade records the branch measure. The Born weights must either be derived from the dynamics or added to the base; the decision-theoretic derivation defended in the strongest version (Wallace, 2012) is exactly what the print debate contests, and if it fails, a probability measure has been added without declaration. Content anchoring is partial for a reason that shares the row's center of gravity: the strongest version anchors the emergent classical world in decoherence-selected structure, and how far that structure is independent of a choice of measure is part of the same contested debate (Kent, 2010). The world-facing columns are quick: world-content is partial by the same parity—this is a theory of our matter without gravity—while records and the arrow inherit the usual thermodynamic story with its posited low-entropy past, the same partial the Humean row carries. The theorist-facing columns are where the profile turns. Reflexive closure clears, and notably: observers are physical subsystems inside the universal state, measurement is entanglement, and the theory says where its own users sit—the very demand most physics rows leave dark. Definiteness is partial for the same reason primitive honesty is: a determinate outcome is an outcome with the right weight, so the definiteness story stands or falls with the branch measure. Interiority is empty; the view says nothing about why some subsystems have an inside, and its defenders do not claim otherwise. Agency is partial: agents are decision-theoretic subsystems whose rational credences the derivation employs, a developed treatment whose success is bound to the same contested derivation it serves. Four of this row's grades ride, directly or at one remove, on a single debate over the branch measure—and localizing is the net's diagnostic use: the application shows exactly what would have to be settled for a profile to change. Even with the measure settled, the rigor gap, the missing gravity, the thermodynamic arrow, and interiority would

remain. The row would still be the only one in the survey that clears reflexive closure outright, which is the condition the account was built to meet.

7.3 The landscape

The pattern is a set of complementary blindnesses, with one exception the survey should not bury. The physics-first cluster—the Standard Model with general relativity, and the quantum-gravity programs that deepen its reach—illuminates matter, spacetime, and gravity, and goes dark on how determinate facts arise, on interiority, on agency, and on seating the theorist; it is the paradigm outside-only account, complete about the public record and silent on the inside. The mind-first account, integrated information theory, is the mirror image, and its current formulation makes the ordering explicit: the theory begins from properties it takes experience to exhibit and derives the requirements a physical substrate must meet (Tononi, 2004; Oizumi et al., 2014; Albantakis et al., 2023). It targets interiority directly, the region most physics rivals leave dark, and says nothing principled about matter, the arrow, or the emergence of determinate facts. The form-first account, bare structural realism, states that structure is fundamental and then cannot anchor it, so it fails the Newman test and supplies no domain content—the placeholder that names the form of an answer without its body. The grade sits under a live repair program, so the figure runs the repaired version as its own row: the existence-monist reformulation met in Section 3, which makes the world's structure itself the one existent and makes objects its modes (Meyer, 2025). The repair moves exactly one cell. With one declared bearer the grounding story closes, so groundedness clears; content anchoring does not move, because the reformulation gives structure a metaphysics without giving it a reference-fixer; and the theorist-facing columns stand where the bare version left them. A repair that improves the family's coherence while leaving its characteristic blindness untouched is the complementarity pattern in miniature. The Humean mosaic is the cleanest coherence rival, strong on consistency and honesty and grounded, its fundamental level fully determinate; it is contested on whether the impersonal mosaic can seat the perspectival theorist (Lewis, 1979); its anchoring is partial because the perfectly natural properties doing the anchoring face Newman-style pressure of their own—whether the anchors are themselves anchored—and it buys its arrow with a posited low-entropy boundary and its chances with the best-system analysis (Lewis, 1994). Everettian quantum mechanics, run through the net condition by condition in Section 7.2, is the sharpest comparison on the two conditions that matter most here: it seats its observers and keeps its dynamics uniform, and its profile turns on the branch measure while staying silent on the inside.

The exception is the both-poles pair. Russellian monism and Whitehead's process philosophy do not trade one lit region for a dark one. Whitehead's row has no dark cell at all and Russellian monism's has one, and what stands in place of the darkness is partial marks running the length of the row. Their shortfall is a different kind from the rest of the survey's: the others fail by not addressing a region, these by addressing every region without settling any of them. A family can therefore have the right coverage and still leave the position open, which is why coverage is not the only thing the net measures.

The pattern the survey exposes is systematic. No surveyed account clears reflexive closure, rule uniformity, content anchoring, and the full run of structural slots together. The rows that come closest come close in two different ways and neither arrives: the physics-first and Humean rows clear more conditions outright and leave the inside dark, while the both-poles rows leave nothing dark and clear little. That open position—an account that seats its own theorist *and* speaks to the inside *and* anchors its content *and* covers the span, all under one uniform rule—is a well-defined position the net specifies and the current landscape leaves open. Whether anything occupies it is a question the net does not answer; it draws the target and reports what the surveyed accounts do

and do not reach.

The complementarity invites an obvious repair: take a physics-first account for the outside and a mind-first account for the inside, and combine them. It does not work in general. Two theories merge into one only along a shared sub-theory that aligns their primitives, and a physics-first base and a mind-first base typically share none—what one treats as fundamental the other derives, so there is no interface to glue along. Even successive paradigms that share most of their vocabulary resist point-by-point translation (Kuhn, 1962); bases that share no primitives at all stand farther apart than that. And the union of two individually consistent theories need not be consistent in any case. The open region the survey exposes is therefore not a gap a merger closes; closing it takes a single account whose one base reaches both sides.

The net is not confined to physics, or even to theories in the usual sense; it applies to anything that claims totality and seats its own theorist. A classical Daoism is the instructive case (Laozi, 1963; Zhuangzi, 2013): it clears conditions that leave the physics-first cluster dark, and it parts from every row above at well-definedness and content anchoring—not by oversight but by doctrine, holding that its central term cannot be named and its reference cannot be fixed. It thereby rejects the premise those conditions encode, that a total account must represent determinately, and the Stroud caveat licenses the verdict: the conditions fix what a total theory must represent, so an account that declines to be a theory of that kind falls outside the specification rather than beneath it. The instrument locates such an account; it does not refute it. That a via-negativa tradition and a quantum-gravity program separate at exactly one demand is evidence of how far past physics the instrument reaches.

8 Conclusion

This paper set out to say what a theory of everything would have to be, and to say it without naming a candidate. The answer has two halves. A total theory must cohere: six pairwise independent conditions—consistency, well-definedness, primitive honesty, reflexive closure, groundedness, rule uniformity—joined by a seventh, content anchoring, which ties its structure and terms to a world. And a total theory must be complete in a sense that can be derived rather than stipulated: seating the theorist inside the described world, declaring a base, and fixing reference jointly force eight structural slots, and the independent-variation test separates those slots from the world-contingent fillers—gravity and spacetime among them—that only a theory of our world owes.

What the net delivers is bounded and general. It draws a non-arbitrary target—the structural slots are consequences of self-inclusion, not a curated list—and it applies wherever totality is claimed, in physics or outside it: it rejects any candidate that violates a stated condition, and it locates, without refuting, any that declines the representational premise the conditions encode. It does not prove the target is occupied, and three limits deserve final statement. The conditions are necessary and not shown sufficient, so clearing them makes a candidate an account of the right kind and does not make it true. The forcing is conditional, so whoever declines to specify a total self-including account is bound by nothing here. And the verdicts are defeasible: a program that built self-locating machinery into its formalism would move its cells on the map, an argument deriving universal metric coupling from the habitability constraint would move gravity itself between tiers, and both map and taxonomy are drawn to make such movement visible.

The landscape survey locates the current families against the target; it does not adjudicate among them, and locating is not the end of the instrument's use. The constructive continuation is to interrogate the open position itself: to ask what kind of base could discharge every structural slot by account rather than by denial, whether the conditions jointly constrain that kind narrowly

or leave it wide, and what any candidate answer would cost. The net draws the target and leaves open whether anything reaches it—which is what a target specification is for.

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