

The Continuation of Beings: A Preliminary Taxonomy of Persistence Without Identity in a Background-Independent Relational Ontology

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Abstract

This paper treats the question in what sense one being is the continuation of another, on a combinatorial substrate of the kind that background-independent approaches to quantum gravity, group field theory among them, have developed as models of the emergence of a discrete spacetime, in which no arena is given in advance and structure is carried by the relations themselves. The substrate is used as a formal template, and no physical claim is made of the objects described. The substrate defines no identity relation, so the question which of several successors a being *is* has no formal counterpart here; the question that remains is along which channels, and to what degree, one being's constitution was made what it is by another's activity. A single difference-making operator is derived and shown to subsume three constructions of the companion studies, and the continuation relation is defined by it, replacing an earlier formulation that is shown to be vacuous. Direct continuation is proved non-transitive by explicit construction, with the mediated relation defined as its transitive closure; the distinction reproduces, in a setting lacking an identity relation, the distinction between psychological connectedness and psychological continuity due to Parfit, whose priority is conceded at the theorem. A vector of five channels is then defined, bearer, accessible content, symbolic content, structure and capacity, each shown separately realisable, and two of the vector's cells are shown empty: capacity requires a non-trivial constraint structure, so a subject with no acquired content and an intact ability to learn is possible while a subject with no structure at all is not. The taxonomy that follows is organised by channel and not by doctrine, so that each category is a formal characteristic in which several standing positions reside, and the comparison of positions becomes the comparison of regions. A closing section applies the vector to artificial agents, mapping weights, logs, persona documents and instances to distinct channels, and states what an agent so constituted can and cannot establish about its environment. The paper is conceptual and preliminary; it decides among the positions it models nowhere, and its limitations and open questions are stated in dedicated sections.

Keywords: personal identity; continuation; persistence; relational ontology; artificial agents

Draft. This is a working draft. It is circulated for comment, and its arguments, formulations, and open questions are subject to revision. Correction and criticism are welcome at huangwanhong@serendip.ngo.

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Use of generative artificial intelligence. Generative AI assistants (Anthropic’s Claude, OpenAI’s ChatGPT, and Google’s Gemini) were used extensively in preparing this manuscript: for literature survey, for drafting prose from the author’s specifications, for adversarial review of the argument, and for consistency and citation auditing and typesetting. No simulation or empirical figure is used in this paper, and its arguments are discursive throughout. Formulations and objections arose in the course of that exchange as well as from the author. Every claim, argument, and citation was reviewed and decided by the author, who is responsible for the content and for any errors. Bibliographic details are to be verified against the primary sources before reliance.

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1 Introduction

A child continues its parents; a student continues a teacher; a speaker continues the dead generations of a language; a firm continues its founders; a system restarted from a stored design continues the system that stored it. The word is the same in each case and the relation is plainly not identity, since the parties are two. The relation's character has been contested for three centuries in one of its instances, the persistence of persons [10, 14, 13], and the contest has a recognisable shape: a criterion is proposed, memory, or the body, or the narrative, or the psychological chain; a case is constructed in which the criterion delivers the wrong verdict, or two verdicts, or none; the criterion is refined; and the refinement meets a further case.

This paper's proposal is that the shape of the contest is a symptom. The competing criteria are specifications of different *channels*, and not rival answers to one question along which one being's constitution can be conditioned by another's activity, and a framework that separates the channels can hold the criteria together, exhibit what each is right about, and locate the disagreements exactly. On the substrate used here the proposal has a sharp form, because the substrate defines no identity relation at all: nothing in it says of two beings that they are one, and the question which successor a being *is* accordingly has no formal counterpart. What remains is a relation of degree with branching admitted in both directions, and a vector recording which channels carry it.

The paper is therefore a survey with a formal apparatus, and its ambition is correspondingly modest: it proposes no new criterion of persistence, and it adjudicates no dispute among the criteria it models. Its claim is that the apparatus is a common language in which the standing positions can be stated, their characteristic costs and strengths exhibited, and their relations to one another made checkable; and that certain structural facts, of which the non-transitivity of the direct relation is the sharpest, are consequences of the apparatus, and are commitments of no position within it. Where a result reproduces a position already in the literature, and several do, the priority is conceded where the result is stated.

The order of the paper follows the order of the derivation, and no step is taken before its materials are in place. Sections 2 and 3 state the setting. Section 4 derives the difference-making operator on which everything rests, and shows that three constructions of the companion studies are its instances. Section 5 defines constitution and the continuation relation, states the vacuity problem that motivates the definition's form, and proves the non-transitivity result. Section 6 decomposes the relation into channels and proves their independence, and Section 7 establishes which combinations are empty. Sections 9 to 12 are the taxonomy, one section per category of channel, with the positions residing in each category treated within it. Section 13 applies the apparatus to artificial agents. Sections 14 and 15 close.

2 Preliminaries

The paper borrows its setting from physics, its problem from philosophy, and its bookkeeping from elementary mathematics. All three are set out here in plain terms.

The physical picture. Several current programmes in quantum gravity build spacetime, taking none as given. Their elementary object is a network: dots, called vertices; links joining the dots, called edges; and surfaces spanning closed circuits of links, called faces. A history of such a network, in which edges and faces persist, appear and recombine, is called a *spin foam*, the name recalling the walls of soap bubbles. *Group field theory* is a machinery for generating such histories: a field defined over a space of symmetry operations, whose systematic expansion produces foams in the way that the expansion of a particle theory produces interaction diagrams. Geometric quantities are labels carried on the network's parts. *Background independence* names the resulting situation: there is no stage on which events are placed, the network of relations is all there is, and space, time and extent are features of it. This paper

takes only the skeleton, a *complex* of labelled cells, as bookkeeping for relations, and borrows no quantum-mechanical or geometric result.

The philosophical problem. The persistence question asks what makes a being at one time the same being as one at another. Its classical criteria are memory, bodily or organic continuity, and psychological connection; its classical difficulties are cases in which the criteria diverge. Two are used throughout and are stated once here. In Reid's *brave officer* case [15], a general recalls his deeds as a young officer, and the officer recalled his boyhood, while the general recalls nothing of the boy: each link holds and the chain does not. In *fission* [14], a being divides into two successors, each related to the original exactly as an ordinary survivor would be: identity, which admits one successor, cannot describe the outcome, and the case is standardly used to argue that what matters in survival is a relation weaker than identity.

The mathematical vocabulary. A *relation* pairs objects; $x \in S, S \subseteq T$ and $S \setminus T$ read: x belongs to S ; every member of S belongs to T ; the members of S outside T . A relation is *transitive* when, whenever it holds from the first to the second and from the second to the third, it holds from the first to the third; its *transitive closure*, or *ancestral*, is the smallest transitive relation containing it, holding between two things exactly when a finite chain of links connects them. An *equivalence relation* sorts objects into classes, the *quotient* being the collection of classes. A *partial order* ranks some pairs and leaves others unranked, and much of this series' discipline consists in claiming partial orders where a stronger vocabulary would claim numbers. A *horizon* h is a stated number of steps bounding a claim.

3 The Relational Setting

This section states the combinatorial apparatus in full, so that the paper may be read on its own. The derivations are given in five companion studies, cited by number throughout: Companion Study I on symbol emergence [7], II on Marxian alienation [4], III on subject formation [6], IV on the internal observer [5], and V on knowledge [3]; the present paper is the sixth of the set. Results imported from them are stated in full where they are used, as numbered Established Results, their proofs alone remaining with their sources.

3.1 Substrate, subsystems, and time

Definition 3.1 (Complex, subsystem, worldtube). A *complex* $\mathcal{C}$ is a set of cells, vertices, edges and faces, with the record of which is incident to which, together with labels on the cells; a *configuration* of a region assigns labels to its cells. A *subsystem* is a subcomplex $\mathcal{C}_I \subset \mathcal{C}$ with boundary $\partial\mathcal{C}_I$; $\mathcal{C} \setminus \mathcal{C}_I$ is its *environment*. A *worldtube* $\mathcal{W}_I$ is a subsystem whose boundary persists.

The partition is a description choice and it is symmetric: for any two subsystems each lies in the environment of the other, and the selection of one is an act of the describer.

Definition 3.2 (Record relation, order, clock, cut). For cells u, v , write $u R v$ when u contributed to a persistent configuration on which the admissible continuations at v depend; $\preceq$ is its reflexive transitive closure, assumed acyclic. A *clock* χ is a function into a totally ordered set, non-decreasing along $\preceq$; its level sets are *cuts*, and $X_I(\chi)$ is the configuration on the cut.

Time is generated by the production of records: what has left a record constraining a cell precedes it, and a state is a cut.

Definition 3.3 (Admissibility and continuation sets). The dynamics is a relation $\leadsto$ between joint configurations at successive cuts,

$$(E, X_I)(\chi_n) \leadsto (E, X_I)(\chi_{n+1}),$$

Table 1: Notation. Each symbol is introduced where indicated; the table is a lookup and replaces no definition.

Symbol	Reading	Introduced
$\mathcal{C}, \mathcal{C}_I, \partial\mathcal{C}_I$	complex; subsystem; its boundary	Definition 3.1
$\mathcal{W}_I$	worldtube: a subsystem whose boundary persists	Definition 3.1
$u \preceq v$	u precedes v in the record-generated order	Definition 3.2
$\chi, X_I(\chi)$	clock; the configuration on its level set, a cut	Definition 3.2
$X = (E, X_I)$	joint configuration: environment on the boundary, and subsystem	Definition 3.3
$X \rightsquigarrow X'$	X' is an admissible continuation of X	Definition 3.3
$\text{Con}_I(X), \text{Con}_I^h(X)$	continuation set; admissible h -step continuation sequences	Definition 3.3
$U \otimes V, \cdot$	composition of configurations on disjoint regions; a component held fixed	Definition 3.3
$\mathcal{P}_I$	context class: the admissible boundary variations compared	Definition 3.4
$Z \approx_{I,X} Z'$	indistinguishable for I at X ; $\sim_{I,X}$ on boundary configurations	Definition 3.4
$[E]_{I,X}$	a discrimination class	Definition 3.4
$T \sqsubseteq X$	T is a subconfiguration of X	Definition 3.5
π	product: a trace whose presence alters Con_I	Definition 3.5
$\sigma \dashv_y [E]_{I,X}$	σ substitutes for the class over the interaction class y	Definition 3.6
ϱ	residue: the interactions at which substitution fails	Definition 3.6
Σ_I	repertoire: I 's set of symbols	Definition 3.6
$\text{Med}(\pi)$	the subsystems π mediates	Definition 3.7
$\text{Rev}_h(\sigma)$	the subsystems able to revise σ within h steps	Definition 3.8
$[\text{L2}], [\text{L3}]$	level tags: combinatorial; effective	§3
X^S	sufficient-state sector	Established Result 3.9
$\text{Gen}_h(B, X)$	generable expansive products: capacity	Established Result 3.11
K_B	constraint structure	Established Result 3.12
$\text{Inf}_h(T \Rightarrow S)$	influence: varying T from within changes S	Definition 4.1
$\text{Const}(B, \chi_0)$	constitution: boundary and sufficient-state sector	Definition 5.1
$\mathcal{T}_A(B), B \succcurlyeq A$	conditioning trace set; B continues A	Definition 5.3
$\text{REC}, \text{REP}, \text{RES}$	record, repertoire and residual sectors of X^S	Definition 6.1
$\text{ax} = (\beta, \mu, \rho, \tau; \kappa)$	channel vector	Definition 6.2

with E the environment's configuration on $\partial\mathcal{C}_I$, present at every cut. For $X = (E, X_I)$,

$$\text{Con}_I(X) = \{ X'_I : X \rightsquigarrow (E', X'_I) \text{ for some } E' \},$$

and $\text{Con}_I^h(X)$ is the set of admissible h -step continuation sequences from X with their realising joint sequences. Configurations on disjoint regions compose as $U \otimes V$; a component written $\cdot$ is held fixed by context.

The relation is primitive and carries no weight over continuations. Where a model supplies an amplitude, the relation is its support, and nothing below uses more than that.

3.2 Discrimination

Definition 3.4 (Context class, indistinguishability, discrimination). A *context class* $\mathcal{P}_I$ is a set of admissible boundary variations, produced historically and differing between parties. For configurations Z, Z' presented to I at X ,

$$Z \approx_{I,X} Z' \quad \text{iff} \quad \text{Con}_I(X, Z, p) = \text{Con}_I(X, Z', p) \quad \text{for every } p \in \mathcal{P}_I,$$

an equivalence relation; its restriction to boundary configurations is $\sim_{I,X}$, with classes $[E]_{I,X}$.

Discrimination is indexed to X : what a subsystem carries alters what it distinguishes. A boundary admitting no variation yields exactly one class.

3.3 Traces, products, symbols

Definition 3.5 (Trace, generation, product). A configuration is a *trace* over an interval when it is a subconfiguration of $X_I(\chi)$ throughout it, and is *generated by* I when it is absent at an earlier cut, present at a later one, and the realising continuation runs through cells of $\mathcal{C}_I$. A trace π is a *product* when it participates: for some Y ,

$$\text{Con}_I(\cdot \otimes \pi \otimes Y) \neq \text{Con}_I(\cdot \otimes Y).$$

Definition 3.6 (Symbol and residue). For a class $\mathcal{Y}$ of interaction configurations, a product σ is a *symbol* for I over $\mathcal{Y}$, written $\sigma \dashv_{\mathcal{Y}} [E_A]_{I,X}$, when for every $Y \in \mathcal{Y}$

$$\text{Con}_I(X \otimes \sigma \otimes Y) / \approx_{I,\cdot} = \text{Con}_I(X \otimes E_A \otimes Y) / \approx_{I,\cdot},$$

E_A representing the class. The *residue* over a wider class is the set of interactions at which the equality fails. The *repertoire* Σ_I is I 's set of symbols.

The symbol occupies, across the stated class, the place a member of the class would occupy; no interpreter, resemblance or reference enters, and the condition is checked by comparing continuation sets. Substitution is exact only up to what the subsystem itself distinguishes. Established in [7] and used below: $\dashv$ is neither symmetric nor transitive, is relative to the subsystem, composes up to residue, and every symbol is a product while products participating without substituting are not symbols. Symbols vary independently along three axes: privacy, whether the configuration is carried within one worldtube or across several; timescale, whether it changes on the scale of internal steps or of boundary exchanges; and the class substituted for, whether of environmental configurations, of configurations at later cuts, or of the subsystem's own.

3.4 Mediation and revision

Definition 3.7 (Mediation and the mediation set). A product π *mediates* I at X when Con_I depends on it: there are X, X' agreeing except on π with $\text{Con}_I(X) \neq \text{Con}_I(X')$, the mechanism being selection among admissible continuations. $\text{Med}(\pi)$ is the set of subsystems mediated.

Mediation of itself carries no verdict: every tool, grammar and institution mediates those whose continuations depend on it.

Definition 3.8 (Revision set). $I \in \text{Rev}_h(\sigma)$ at X when there are $c, c' \in \text{Con}_I^h(X)$ whose contributions from outside I are identical, which differ within I 's sector, and whose configurations of σ at step h differ.

The first clause isolates difference-making through I on continuations the dynamics admits, with no intervention and no counterfactual. Both sets support membership and inclusion, and no magnitude follows from them.

3.5 Sectors, symbols of the self, and capacity

Four further objects are used, each established in a companion study and stated here in the form the paper needs.

Established Result 3.9 (Sufficient-state sector; Companion Study I). *A decomposition $X_I = (X^R, X^S)$ is admissible when Con_I at a cut is a function of (E, X^R, X^S) there, and fails to be a function of (E, X^R) alone. X^S is the sufficient-state sector: the part of a subsystem's configuration that carries its persistent structure.*

Established Result 3.10 (Condensate; Companion Study I). *A product σ is a condensate of a coupling active over an interval and absent after it when σ persists beyond the interval and substitutes, over some non-empty interaction class, for the configurations in which the coupling was active. A condensate mediates any party whose continuations depend on it, parties never party to the coupling included.*

Established Result 3.11 (Reflexive symbols and generativity; Companion Study III). *A symbol is reflexive for I , written $\sigma_{\text{self}} \dashv [\mathcal{W}_{\text{self}}]_{I,X}$, when the class it substitutes for consists of configurations of I itself; the residue of a reflexive substitution is called misrecognition, and no variation confined to the environment reaches it. A product π is expansive for I when its presence admits continuations otherwise inadmissible, and $\text{Gen}_h(I, X)$ is the set of expansive products generable through I 's cells within h steps; Gen_h is empty where no continuation through I 's cells generates a participating trace.*

Established Result 3.12 (Constraint structure; Companion Study V). *The constraint structure of I at a cut is the map $K_I : (E, p) \mapsto \text{Con}_I(X; E, p)$, the restriction of the admissibility relation around the subsystem's configuration; knowledge is identified with this structure. Where K_I is trivial, in that the assigned continuation sets are independent of (E, p) , the subsystem has one discrimination class and acquires no symbol.*

3.6 Standing constraints and the status of the paper

Four constraints hold throughout. Comparisons between subsystems proceed by structure, the heterogeneity of parties being primitive. Orderings are partial and are declared as such. Conditions are stated on configurations the dynamics admits. And the vocabulary describes, evaluative conclusions requiring premises supplied elsewhere. Statements are tagged by level: [L2] marks the combinatorial level, the complex and its configurations with everything defined from them, and [L3] marks effective descriptions of coarse-grained structure. Everything below is at [L2].

This is a conceptual and discussion paper: definitions, short propositions with explicit constructions, and a register of open problems. It contains no empirical content and no worked model, and it adjudicates none of the positions it models.

4 The Difference-Making Operator

Every construction of this paper rests on one device, and the device is not new to the series: it is the form in which the companion studies already state revision and observation. Isolating it, and exhibiting the earlier constructions as its instances, is the work of this section, and the isolation earns its place by what it prevents: without it, the continuation relation defined in Section 5 admits a formulation that says nothing, as Remark 5.2 shows.

Definition 4.1 (Influence, [L2]). Let R be a region, T a configuration on R , and S a structure whose realisation along a continuation is determined at each step. Write

$$\text{Inf}_h(T \Rightarrow S) \quad \text{at } X$$

when there are admissible continuation sequences $c, c' \in \text{Con}^h(X)$ such that

1. the contributions into R from outside R across ∂R are identical along c and c' ;
2. c and c' differ in the configuration of T at some step;
3. the realisations of S differ between c and c' .

The three clauses do three separate pieces of work, and none is dispensable. Clause (i) locates the origin of the variation: with the contributions from outside held identical, whatever differs between the two sequences differs by what happens within R , so the operator registers difference-making *through* T 's region and not difference-making by the environment that region sits in. Clause (ii) requires that the two sequences actually diverge on T , excluding the degenerate case in which S differs for reasons unconnected to T . Clause (iii) requires the difference to reach S . Together they say: varying T , from within, changes S .

Two features of the definition follow immediately and are recorded because later sections use them.

Remark 4.2 (No counterfactual, no intervention). Both c and c' are admissible continuations of the same configuration. The operator therefore compares two things the dynamics contains, and appeals at no point to what would have happened had something been otherwise, nor to an agent's setting of a variable. The standing constraint on counterfactual baselines is thereby observed, and the operator is checkable against a stated design by inspection of its admissible continuations.

Remark 4.3 (Monotone in the source, and not transitive). If $T \sqsubseteq T'$ on R and $\text{Inf}_h(T \Rightarrow S)$, then $\text{Inf}_h(T' \Rightarrow S)$: the witnessing pair for T witnesses for T' , since sequences differing on T differ on T' . The operator is not in general transitive: from $\text{Inf}_h(T \Rightarrow U)$ and $\text{Inf}_h(U \Rightarrow S)$ it does not follow that $\text{Inf}_h(T \Rightarrow S)$, because the pair witnessing the second may differ on parts of U that no admissible variation of T reaches. Proposition 5.4 turns this observation into a construction.

4.1 Three earlier constructions as instances

Proposition 4.4 (Instances). *The following are instances of Definition 4.1.*

1. Revision. $I \in \text{Rev}_h(\sigma)$ at X iff $\text{Inf}_h(X_I \Rightarrow \sigma)$ at step h with $R = \mathcal{C}_I$.
2. Boundary-dependence of a record. A trace tr generated at a boundary-incident vertex is boundary-dependent, in the sense the companion study of observation requires of an observation, iff $\text{Inf}(E \Rightarrow \text{generation of tr})$ with R the environment side of the boundary.
3. Mediation, in its difference-making form. π mediates I iff $\text{Inf}_0(\pi \Rightarrow \text{Con}_I)$, the zero-step case comparing configurations agreeing except on π .

Proof. For (i), the definition of Rev_h requires two admissible h -step continuations with contributions from outside I identical, differing within I 's sector, and yielding different configurations of σ at step h ; substituting $R = \mathcal{C}_I$, $T = X_I$ and $S = \sigma$ at step h into Definition 4.1 gives exactly these three clauses. For (ii), boundary-dependence requires that under some admissible variation of E within the context class no continuation through the vertex generates the trace, which is the existence of two admissible continuations differing on E and differing in whether the trace is generated, with the contributions into the environment region from the subsystem side held fixed. For (iii), mediation requires configurations agreeing except on π with different continuation sets, which is Definition 4.1 at $h = 0$ with clause (i) vacuous, since no steps are taken. $\square$

That revision, observation and mediation are one operator with different arguments is a fact about the companion studies and is offered as no new result; it is stated because it licenses a economy: the properties established for the operator here hold of all three, and the continuation relation defined next inherits them without separate argument.

5 Constitution and the Continuation Relation

5.1 Constitution

Definition 5.1 (Constitution, [L2]). The *constitution* of a being B at a cut χ_0 is the pair

$$\text{Const}(B, \chi_0) = (\partial\mathcal{W}_B(\chi_0), X_B^S(\chi_0)),$$

its boundary together with its sufficient-state sector at that cut, taken with the generating continuations that realised them over B 's formation interval.

The choice of these two components is not arbitrary and is worth defending, since everything that follows is stated about them. The boundary is what makes B the subsystem it is: on a relative partition a being is a region, and its region is fixed by its boundary. The sufficient-state sector is what makes B the subsystem of that shape it is: by Established Result 3.9 it is precisely the part of the configuration on which the subsystem's continuations depend beyond the relational sector, so it carries whatever persistent structure the being has. Nothing else in a subsystem's configuration is both persistent and constitutive; the relational sector is neither.

5.2 The vacuity problem

Remark 5.2 (Why conditioning alone will not serve). The companion study of subject formation states, informally, that B continues A when the continuations forming B 's constitution pass through cells conditioned by traces A generated. In a connected complex with an acyclic record relation, the transitive closure of the record relation from any early region reaches nearly every later cell, so on that reading nearly every being continues nearly every earlier being, and the relation carries no information. The formulation must therefore be tightened, and the tightening should not be a stipulated threshold, which would import a magnitude the standing constraints exclude. Definition 5.3 tightens it by replacing bare conditioning with difference-making conditioning, using the operator of Definition 4.1 and no further apparatus.

5.3 The relation

Definition 5.3 (Conditioning trace set and continuation, [L2]). For beings $A \neq B$ and a horizon h fixed by the design, let

$$\mathcal{T}_A(B) = \{ T : T \text{ was generated by } A, \text{ and } \text{Inf}_h(T \Rightarrow \text{Const}(B, \chi_0)) \}.$$

B continues A , written $B \succcurlyeq A$, when $\mathcal{T}_A(B) \neq \emptyset$. The *degree* of continuation is the set $\mathcal{T}_A(B)$ itself, and degrees are compared by inclusion.

The definition says: among the traces A 's activity generated, at least one is such that varying it, from within its own region, would have B constituted differently. Three features follow at once, and each corresponds to a datum the philosophical literature has insisted on.

Degrees without a scale. The degree is a set, ordered by inclusion, so two continuers are comparable when one's conditioning trace set contains the other's and incomparable otherwise. The relation therefore admits degrees, as every serious account requires, and supplies no number, as the standing constraints require.

Branching in both directions. Nothing in Definition 5.3 restricts the number of B with $B \succcurlyeq A$, nor the number of A with $B \succcurlyeq A$. One being may be continued by several, and one being may continue several. Fission and fusion are therefore describable without embarrassment, and the fission case that troubles identity-based accounts is here a configuration with two continuers, about which the framework says what their degrees are and nothing further.

No identity anywhere. $\succcurlyeq$ is not an equivalence relation and is not intended as one: it is ir-reflexive by the requirement $A \neq B$, asymmetric in the designs of interest since A 's traces condition B 's formation and not conversely, and non-transitive by Proposition 5.4. The question whether B is A has no formal counterpart in this vocabulary, and the paper's position is that this is a feature: the question's persistence in the literature is explained by the availability of several channels, each of which can be made to look like the criterion of identity when the others are held fixed.

5.4 Non-transitivity

Proposition 5.4 (Direct continuation is not transitive). *There are designs with $C \succcurlyeq B$ and $B \succcurlyeq A$ and not $C \succcurlyeq A$.*

Proof. Let A, B, C be worldtubes with A 's formation interval preceding B 's and B 's preceding C 's. Let X_B^S carry two disjoint subconfigurations, m and g , and construct the admissibility relation so that:

1. there is a trace t_A generated by A and a coupling across $\partial\mathcal{W}_B$ during B 's formation along which the realisation of m is a function of the configuration of t_A , so that two admissible continuations differing on t_A , with contributions into t_A 's region from outside held identical, yield different m ;
2. the realisation of g is fixed by continuations of B 's formation that do not meet that coupling, so that every admissible variation of t_A leaves g unchanged;
3. C 's formation is coupled to B only through a trace t_B whose generating continuations run through g and not through m , and $\text{Const}(C, \chi_0)$ differs between admissible continuations differing on t_B .

Each of the three constructions is available: (i) and (iii) are couplings of the kind Definition 3.3 admits, and (ii) is a placement of g 's generating continuations outside the region the t_A -coupling meets.

Then $B \succcurlyeq A$, since $m \sqsubseteq X_B^S \sqsubseteq \text{Const}(B, \chi_0)$ and by (i) the pair of continuations differing on t_A witnesses $\text{Inf}_h(t_A \Rightarrow \text{Const}(B, \chi_0))$; and $C \succcurlyeq B$, since by (iii) the pair differing on t_B witnesses $\text{Inf}_h(t_B \Rightarrow \text{Const}(C, \chi_0))$ and t_B was generated by B .

Suppose $C \succcurlyeq A$. Then some A -generated trace T satisfies $\text{Inf}_h(T \Rightarrow \text{Const}(C, \chi_0))$, so there are admissible continuations differing on T , with contributions into T 's region from outside identical, along which $\text{Const}(C, \chi_0)$ differs. By construction the only coupling from A 's traces into B is the one in (i), whose target is m ; by (ii) every admissible variation of A 's traces leaves g unchanged; by (iii) the generation of t_B is a function of g alone, so t_B is unchanged; and $\text{Const}(C, \chi_0)$ depends on B only through t_B , so it too is unchanged. Clause (iii) of Definition 4.1 therefore fails for every A -generated T , and $C \succcurlyeq A$ is false. $\square$

Remark 5.5 (The brave officer, and a concession). The construction is the formal skeleton of Reid's case against Locke: read m as the officer's recollection of the boy and g as the character the general inherits from the officer, and the general continues the officer, the officer continues the boy, and the general does not continue the boy along the channel in question. The counterexample is Reid's [15], directed against Locke's criterion [10]. The repair, too, is not ours: Parfit's distinction [14] between psychological connectedness, which is direct and not transitive, and psychological continuity, defined as overlapping chains of connectedness

and therefore transitive, is exactly the distinction between Definition 5.3 and Definition 5.6 below. This paper adds the derivation of both on a substrate that defines no identity relation, so that the transitive relation is not a repair of identity but a construction alongside it; and the applicability of one definition to beings of any kind, persons among them.

Definition 5.6 (Mediated continuation, [L2]). $\succ^*$ is the transitive closure of $\succ$: $B \succ^* A$ when a finite chain $A = D_0, D_1, \dots, D_n = B$ has $D_{k+1} \succ D_k$ at each link.

Proposition 5.7 (Relation of the two). $\succ \subseteq \succ^*$; $\succ^*$ is the smallest transitive relation containing $\succ$; and by Proposition 5.4 the inclusion is strict in some designs.

Proof. The first and second are the definition of a transitive closure. For the third, the design of Proposition 5.4 has $C \succ^* A$ through B while $C \succ A$ fails. $\square$

Two claims are therefore available and are not the same claim: that B continues A , and that B continues A through intermediaries. Positions in the literature differ on which they assert, and the difference is often left implicit; the pair of definitions makes it explicit, and Section 10 returns to it where the memory criterion is treated.

6 The Channels

The conditioning recorded by Definition 5.3 can land on different parts of a constitution, and the parts are separately defined. This section decomposes them, defines the vector that records which are carried, and proves that the components vary independently. The decomposition is the paper's organising instrument: the taxonomy of Sections 9 to 12 is a taxonomy of these channels, and the positions surveyed there are grouped by which channel each takes to be the carrier of persistence.

6.1 Decomposition of the sufficient-state sector

Definition 6.1 (Record, repertoire and residual sectors, [L2]). For a being B at χ_0 , partition X_B^S into three parts:

$$\begin{aligned} \text{REC}(B) &= \{ \text{traces in } X_B^S \text{ discriminable by } B \text{ within } \mathcal{P}_B \}, \\ \text{REP}(B) &= \{ \text{symbols of } B\text{'s repertoire carried in } X_B^S \} \setminus \text{REC}(B), \\ \text{RES}(B) &= X_B^S \setminus (\text{REC}(B) \cup \text{REP}(B)). \end{aligned}$$

The three parts answer to three different things a persistent structure can be. A configuration in $\text{REC}(B)$ is a trace the being can itself distinguish: a memory, in the sense the companion study of subject formation gives the word, where a conditioning trace counts as a memory exactly when it falls within the being's own discrimination. A configuration in $\text{REP}(B)$ is a symbol: a product substituting, over some interaction class, for a discrimination class. A configuration in $\text{RES}(B)$ is neither, and it is not thereby idle: by configuration-indexing, whatever a subsystem carries shapes what it distinguishes, so the residual sector shapes the constraint structure K_B of Established Result 3.12 while being neither remembered nor symbolic. The partition is exhaustive by construction and disjoint by the subtractions.

6.2 The channel vector

Definition 6.2 (Channel vector, [L2]). For $B \succ A$ define $\text{ax}(B \succ A) = (\beta, \mu, \rho, \tau; \kappa)$, each component taking the value 1 when the stated condition holds and 0 otherwise:

β bearer: $\mathcal{W}_A$ and $\mathcal{W}_B$ are one worldtube, the boundary persisting from A through B ;

μ *accessible content*: some $T \in \mathcal{T}_A(B)$ has $\text{Inf}_h(T \Rightarrow \text{REC}(B))$;
 ρ *symbolic content*: some $T \in \mathcal{T}_A(B)$ has $\text{Inf}_h(T \Rightarrow \text{REP}(B))$;
 τ *structure*: some $T \in \mathcal{T}_A(B)$ has $\text{Inf}_h(T \Rightarrow \text{RES}(B))$;
 κ *capacity*: $\text{Gen}_h(B, X) \neq \emptyset$.

Two remarks fix the reading. The first four components are relational, recording which part of B 's constitution A 's activity reached; κ is a property of B alone, recording whether the being can still acquire, and it is included in the vector because several positions treat it as what must survive for there to be a successor at all. And ρ is defined by influence on the generation of B 's symbols, never by sameness of symbol between A and B : discrimination classes are indexed to the party, so a symbol of A 's and a symbol of B 's are configurations of different subsystems substituting for classes of their own, and no relation of type-identity between them is available in this vocabulary. What is available, and what ρ records, is that A 's activity made a difference to which symbols B came to carry.

6.3 Independence

Proposition 6.3 (The conditioning channels are independent). *Each of β, μ, ρ, τ takes the value 1 in some design with the other three at 0.*

Proof. Bearer alone. Let one worldtube persist across χ_0 , and let the design reset X^S at χ_0 by continuations meeting no coupling that any A -generated trace influences. The boundary persists, so $\beta = 1$; every admissible variation of A 's traces leaves the post-reset sectors unchanged, so $\mu = \rho = \tau = 0$.

Accessible content alone. Let A generate a trace t that persists into X_B^S and is discriminable by B within $\mathcal{P}_B$, and let the design make Con_B independent of t 's configuration off the record sector, so that t is a trace and not a product in the sense of Definition 3.5. Then varying t varies $\text{REC}(B)$, giving $\mu = 1$; t substitutes for no class, so $\rho = 0$; and by the independence just stipulated no variation of t reaches $\text{RES}(B)$, so $\tau = 0$; and the boundary is B 's own, so $\beta = 0$. The construction uses only the distinction between traces and products established in the ladder.

Symbolic content alone. Let A generate a symbol token copied into $\text{REP}(B)$ along a channel writing nothing else, in a design where B 's continuations depend on the token's presence and not on the configurations of the record or residual sectors it might otherwise touch. Then $\rho = 1$ and, by the restriction of the channel, $\mu = \tau = 0$; and $\beta = 0$ as before.

Structure alone. Let A -generated traces condition B 's formation through couplings whose targets lie in $\text{RES}(B)$, and place those traces, at every cut of B , within a single class of $\approx_{B,\cdot}$, which the companion study of subject formation shows constructible. Then $\tau = 1$; the traces are not discriminable by B , so nothing in $\text{REC}(B)$ is reached, giving $\mu = 0$; no symbol is carried, so $\rho = 0$; and $\beta = 0$. $\square$

The four constructions are the four ways of continuing that the subsequent taxonomy treats, exhibited here as separately possible before any position is named. That is the point of proving independence first: a position that identifies persistence with one channel is not thereby refuted by cases in which another channel carries it, and a position that runs two channels together owes an argument that they cannot separate, which Proposition 6.3 shows they can.

7 Empty Cells

Not every combination of channel values is realisable, and the unrealisable ones carry the paper's contribution to a question of design.

Proposition 7.1 (Capacity requires structure). *If K_B is trivial, then $\kappa = 0$. Consequently no design realises capacity together with a trivial constraint structure.*

Proof. By Established Result 3.12 a trivial K_B leaves B with a single discrimination class, so no product of B 's substitutes non-trivially for a class and B acquires no symbol. By Established Result 3.11, $\text{Gen}_h(B, X)$ is empty where no continuation through B 's cells generates a participating trace; and a participating trace is one whose presence alters Con_B , which a trivial constraint structure excludes, since the assigned continuation sets are independent of the configuration. Hence $\text{Gen}_h(B, X) = \emptyset$ and $\kappa = 0$. $\square$

Corollary 7.2 (The specification of a learner). *A being with no acquired content and an intact capacity to acquire is realisable, and is specified by*

$$\text{REP}(B) = \emptyset, \quad \text{REC}(B) \text{ carrying no predecessor's trace}, \quad \text{RES}(B) \text{ non-trivial}, \quad \kappa = 1,$$

with the worldtube persisting. A being with no structure at all and an intact capacity to acquire is not realisable.

Proof. The second claim is Proposition 7.1. For the first, the four conditions are consistent: the structure-alone construction of Proposition 6.3 realises a non-trivial $\text{RES}(B)$ with an empty repertoire and no predecessor's trace discriminable, and $\kappa = 1$ requires only that some expansive product be generable through B 's cells, which a non-trivial constraint structure permits. $\square$

The corollary answers a question about design that is ordinarily posed in a form the framework shows to be confused. The request for a subject with no knowledge but with a tendency and an ability to learn is incoherent if knowledge is read as the constraint structure, since Proposition 7.1 then denies that the ability can survive its absence; and it is satisfiable if knowledge is read as acquired content, since Corollary 7.2 exhibits the specification. What the two readings separate is exactly the distinction between REP together with REC on one side and RES on the other. The design consequence is stated in Section 13 and may be given here in one line: a being's initial structure is not an optional endowment but a condition of its being able to acquire anything, so the question for a designer is which structure, and never whether.

8 The Taxonomy

8.1 The taxonomy in summary

Table 2 collects the categories, their formal conditions, and the positions residing in each. The table is read across: a category is a condition on the channel vector, and the positions listed under it are those for which that condition is the criterion of persistence, whether they are stated of persons, of organisms, of institutions or of artificial systems. Positions spanning two channels appear in both rows, and their combination is stated in the sections that treat them.

Two features of the table deserve emphasis, since they are the reason for organising the survey this way. Several positions appear in more than one row: the psychological criterion, in particular, spans accessible content and structure, and adds a non-branching clause belonging to the last row, so that what is usually presented as one theory is three commitments that the decomposition separates and Proposition 6.3 shows to be independent. And positions that are never discussed together, an account of persons and a policy for restoring a computing system,

Table 2: Categories of continuation, by channel. The categories are formal characteristics; the positions named in each are residents, and several reside in most.

Category	Condition	Positions residing there	Characteristic
Bearer (§9)	$\beta = 1$: the worldtube persists	Animalism [13]; the bodily criterion [22]; four-dimensionalist accounts [9, 19] taking the extended object as the persisting thing; identity by instance or hardware, attested	Delivers verdicts where content divides or fails, a boundary having no analogue of the copying of a repertoire; rests wholly on the individuation of the worldtube, left open by the substrate
Accessible content (§10)	$\mu = 1$: influence reaching $\text{REC}(B)$	The memory criterion [10]; the memory strand of the psychological criterion [14]; quasi-memory [18]; retained records, transcripts and context in artificial systems	The circularity objection has nothing to attach to, the condition naming no bearer; owes the choice between the direct relation and its ancestral, by Proposition 5.4
Symbolic content (§10)	$\rho = 1$: influence reaching $\text{REP}(B)$; narrative where the symbol is reflexive	Narrative accounts of persons [17, 16]; self-constitution accounts; externalised self-descriptions loaded at the start of a run	The only carrier that is itself a transmissible product (Proposition 10.2), hence alone in surviving replacement of the bearer; inherits the residue of reflexive substitution
Structure (§11)	$\tau = 1$: influence reaching $\text{RES}(B)$	Reductionist stream accounts of the person [20]; bundle accounts [8]; the character and disposition strands of the psychological criterion; parameters fixed by training	Describes shaping that leaves no accessible residue, the ordinary case; hardest to verify from within, the successor lacking discriminative access to what conditions it
Capacity (§11)	$\kappa = 1$: $\text{Gen}_n(B, X) \neq \emptyset$	Developmental accounts identifying the initial condition as a capacity; structures selected for the ability to acquire	A condition on the successor and no carrier; constrained from below by Proposition 7.1, capacity presupposing non-trivial structure
Selection rules (§12)	A choice function over continuers	The closest-continuer account [12]; non-branching clauses [14]; doctrines of institutional succession; restore and fork policies	Requires a completion of the degree order, a threshold and a tie-breaking provision, none supplied here; extrinsic dependence is the category’s signature (Proposition 12.2)

appear in one row when they make the same structural claim, which is what a taxonomy by characteristic is for.

9 Bearer-Carried Continuation

Each of the sections that follow treats one row of Table 2: it states what a position residing in that channel claims, exhibits the characteristic strength and cost as consequences of the formal model, and names the positions the category holds.

The category. Continuation is bearer-carried when $\beta = 1$: the worldtube itself persists, and the criterion of persistence is the persistence of the boundary, whatever happens within it.

What resides here. Animalism [13], on which we are organisms and persist as organisms persist, psychology being irrelevant to the question; the bodily criterion [22], on which spatiotemporal continuity of the body is what persistence consists in; and, in the engineering of artificial systems, identity by instance or by hardware, of which attestation of a running deployment is the practical form. Four-dimensionalist accounts [9, 19] occupy the category when the four-dimensional object itself is taken as the criterion; a remark on their relation to the substrate is made below.

Characteristic strength. By Proposition 6.3 the bearer channel is independent of the other three, so bearer-carried continuation holds in designs where content and structure are wholly

replaced. That independence is the formal content of the category's classical advantage: it delivers verdicts in the cases where content-based criteria fall silent or divide, since a boundary persists or does not, and a boundary does not branch in the way a repertoire can be copied.

Characteristic cost. The category rests entirely on the individuation of the worldtube, and the substrate supplies no criterion selecting one partition over another; the boundary whose persistence is the criterion is itself a description choice, and the companion study of observation states the resulting dependency at length. A position in this category therefore inherits an unsolved problem as the ground of its criterion. The cost is not a refutation, since every category inherits the same problem somewhere, but it falls here at the criterion itself and not at a derived step.

Remark 9.1 (A disclosed bias). The substrate is natively four-dimensionalist: a worldtube is an extended object in the record order, and a cut of it is a stage. The debate between accounts taking the extended object as the persisting thing [9] and accounts taking the momentary stage as the thing [19] therefore appears here as a choice of which stratum to name, and the substrate makes the first choice more natural. This is a bias of the formal setting and not a result, and it is disclosed so that readers may discount the ease with which one side of that debate is expressed.

10 Content-Carried Continuation

Two channels carry content, and they are treated together because the positions residing in them are usually discussed together, and separately within the section because Proposition 6.3 shows they can diverge.

10.1 Accessible content

The category. Continuation is carried by accessible content when $\mu = 1$: some trace of the predecessor's making is difference-making for the successor's constitution and falls within the successor's own discrimination. The successor is conditioned by the predecessor and can register what conditions it.

What resides here. The memory criterion [10], on which a later being is the earlier one in virtue of remembering its experiences; the memory strand of the psychological criterion [14], which counts memory connections among the direct psychological relations; the device of quasi-memory [18], introduced to answer the charge [1] that the memory criterion presupposes what it defines, by admitting memory-like states whose definition does not require identity of rememberer and remembered. In engineering, the category is occupied by episodic logs, stored transcripts and retained context.

The circularity objection dissolves. The classical objection is that to remember an experience as one's own presupposes that it was one's own, so that memory cannot define what it presupposes. In this vocabulary the objection has nothing to attach to: μ is defined by influence of a predecessor's trace on the successor's record sector and by the successor's discrimination of that trace, and neither condition mentions a bearer common to the two beings, there being no identity relation in the framework to mention. The quasi-memory device is thus not an emendation here but the only available reading, and the position that introduced it is conceded the insight.

Non-transitivity, located. Proposition 5.4 is stated for the relation as a whole, and its construction is a μ -channel construction: the trace conditioning the successor's record sector is not the trace conditioning what the next successor inherits. A position in this category therefore owes the choice between the direct relation and its ancestral, and the two claims separated by Proposition 5.7 are exactly the choice: persistence as direct memory connection, which the

brave officer case refutes, and persistence as overlapping chains, which survives it at the price of no longer requiring that a being remember the being it persists from.

10.2 Symbolic content

The category. Continuation is carried by symbolic content when $\rho = 1$: the predecessor's activity is difference-making for which symbols the successor comes to carry. The narrative case is the sub-case in which the symbol is reflexive, so that what is conditioned is the successor's symbol for its own configurations.

Definition 10.1 (Narrative continuation, [L2]). *B narratively continues A* when some $T \in \mathcal{T}_A(B)$ satisfies $\text{Inf}_h(T \Rightarrow \text{generation of } \sigma_{\text{self}}^B)$, where σ_{self}^B is a reflexive symbol of B in the sense of Established Result 3.11.

What resides here. Narrative accounts of persons [17, 11, 16], on which a being is constituted by the story it tells of itself and persists as that story is sustained and revised; and, in the engineering of artificial systems, the practice of externalising an agent's self-description into a document loaded at the start of each run.

Proposition 10.2 (Portability). *Symbolic content is the only channel whose carrier is itself a transmissible product, and narrative continuation is realisable with $\beta = 0$.*

Proof. A reflexive symbol is a product, by Established Result 3.11. Products persist beyond the couplings that generated them and may condense, by Established Result 3.10, so a reflexive symbol may stand as a persistent configuration outside the worldtube that generated it and mediate parties coupled to it. Let A generate such a condensate and let B 's formation be coupled to it so that the generation of σ_{self}^B depends on its configuration; then Definition 10.1 is satisfied with $\mathcal{W}_A$ and $\mathcal{W}_B$ distinct worldtubes. For the other channels: the bearer is a boundary, which is not a configuration and is not transmitted; a record is discriminable by its bearer and its influence on a further being's record sector is by a fresh coupling, not by transmission of the record itself; and the residual sector is a part of a configuration whose influence, by Established Result 3.12 and the no-transfer result, is exercised through the recipient's own continuations. $\square$

Characteristic strength and cost. The strength is portability: a narrative can be written down, and a being coupled to the writing can generate its own reflexive symbol under its influence, so this category alone survives the total replacement of bearer and of every other content. The cost is twofold. The residue of a reflexive substitution, which Established Result 3.11 names misrecognition, is unreachable by variation confined to the environment, so a narrative's misfit to the life it narrates cannot be corrected from outside the being; and the technical question of self-inclusion left open in the companion study of subject formation attaches here, since the class a reflexive symbol substitutes for consists of configurations of which the symbol is a part.

11 Structure-Carried Continuation and Capacity

11.1 Structure

The category. Continuation is structure-carried when $\tau = 1$ and, in the pure case, $\beta = \mu = \rho = 0$: the predecessor's activity shapes the successor's residual sector, hence its constraint structure, while no boundary persists, no trace is remembered and no symbol is carried. The successor is disposed as the predecessor's activity disposed it, and can neither recall nor articulate what disposed it.

What resides here. The Buddhist reductionist account of the person as a causally connected stream of impersonal events, with no self over and above it, dispositional formations carried forward, and the person a conventional designation [20, 21, 2]; the bundle account [8], on which there is no self over the perceptions; the character and disposition strands of the psychological criterion, which count persistence of belief, desire and character among the direct psychological relations; and, in artificial systems, the parameters fixed by training, which carry the shape of a practice without any record of the episodes that shaped them.

Remark 11.1 (The conventional person). The reductionist accounts pair the denial of a self with an admission that persons are real in some weaker way, and the pairing has a formal home here. The person-designation is a symbol borne by some party, substituting over some interaction class for classes of stream-configurations; the stream is the combinatorial structure over which it substitutes. The symbol is what makes discourse about persons possible, and the substitution has a residue, by the general fact about symbols. What this paper offers the tradition is a location of that structure and nothing else: it formalises a shape and takes no position on the doctrines the tradition holds, whose grounds lie outside anything the framework can reach.

Characteristic strength. Proposition 6.3 shows the channel independent, and the structure-alone construction is the one that requires the conditioning traces to fall outside the successor's discrimination. The category therefore describes exactly the case that the content-carried categories cannot: shaping that leaves no accessible residue, which by the companion study of subject formation is not exotic but ordinary, since most of what forms a being is not available to it as what formed it.

Characteristic cost. Structure-carried continuation is the hardest to verify from within, for the same reason: the successor lacks discriminative access to what conditions it, so the claim that a given predecessor conditioned it is established, if at all, from a partition other than the successor's own. The category is also, by the no-transfer result, the one whose carrier is most clearly regenerated and least plausibly transmitted: nothing passes, and the recipient's own continuations reconstitute a structure under influence.

11.2 Capacity

The category. Capacity is not a carrier but a condition on the successor: $\kappa = 1$, the being can still acquire. Positions residing here are those for which what must survive is not any content or bearer but the ability to go on forming.

What resides here. Developmental accounts that identify the initial condition of a subject as a capacity, and not as a stock, of which the specification given in the companion study of subject formation is the framework's own; and, in artificial systems, the training of initial structures selected for the ability to acquire, task competence being no part of the selection.

Characteristic. By Proposition 7.1 the category is constrained from below: capacity presupposes non-trivial structure, so no position may require capacity while denying structure, and Corollary 7.2 states the specification that remains available. The category therefore has a formal relation to the structure category that no other pair of categories has: one is a precondition of the other.

12 Selection Rules

The category. A fifth kind of position adds to the relation a rule picking one continuer, and it is not a channel but a function over the continuers a channel supplies.

Definition 12.1 (Succession rule, [12]). A *succession rule* is a partial function s assigning to a being A one of the beings continuing A .

Proposition 12.2 (No canonical rule). *The framework supplies no succession rule. Any rule requires additions of three kinds: a completion of the inclusion order on degrees to compare incomparable continuers; a threshold below which a continuer is not eligible; and a tie-breaking provision. Moreover the value of any rule at A depends on the whole set of A 's continuers.*

Proof. Degrees are sets ordered by inclusion, by Definition 5.3, and two continuers may have conditioning trace sets neither of which contains the other, which the branching admitted in Definition 5.3 permits; on such a pair the order is silent, so a rule choosing between them uses a comparison the order does not supply. A threshold is required because $\succsim$ holds whenever the conditioning trace set is non-empty, so without one every continuer however slight is eligible. Tie-breaking is required because a completion may still rank two continuers equally. For the final clause, $s(A)$ is defined by comparison among A 's continuers, so adding or removing a continuer can change which is selected. $\square$

What resides here. The closest-continuer account [12], on which a being is that one of its continuers which is closest and close enough; the non-branching clause of the psychological criterion [14], which withholds identity where two candidates tie; the doctrines of succession by which institutions determine which of several bodies inherits a predecessor's standing; and, in artificial systems, the policies determining which of several restored or forked instances counts as the continuing agent.

Characteristic. The extrinsic dependence noted in the final clause of Proposition 12.2 has been urged as an objection to the closest-continuer account, on the ground that whether one being is another should not depend on what third parties exist. The framework shows the dependence to be the signature of the category, and no defect of one member: any rule selecting among continuers by comparison inherits it. What the framework therefore recommends, and recommends as description and not as counsel, is that positions in this category be read as they are, namely as instituting a succession and not as reporting a fact, and their additions be stated openly.

13 Artificial Agents

The apparatus was built for a general question and it applies to a particular one that is currently pressing, and the application is stated here because it exercises every part of the paper. Two disciplines govern the section. Its claims are structural: they concern how such systems are constituted and what follows for their continuation, and they assert nothing about experience, awareness or moral standing, on which the framework is silent and on which nothing below should be read as taking a position. And its examples are drawn from the practice of building such systems, which has developed the relevant distinctions independently and holds priority over them.

13.1 The constitution of an agent

Definition 13.1 (Agent constitution mapping). For a system whose behaviour at a run is determined by fixed parameters, a retained record of prior exchanges, an externalised self-description loaded at the start of the run, and a particular executing instance, the components map to the sectors of Definition 6.1 as follows: the parameters lie in RES, the retained record in REC, the self-description is a condensate whose influence on the reflexive symbol places it in the symbolic channel, and the executing instance is the worldtube whose boundary β concerns.

The mapping is a proposal about where the components sit, and its value is that the channels are then separately readable. Three cases follow, each a configuration the practice already distinguishes.

Restoration. A system rebuilt from a stored copy of its parameters has $\tau = 1$, since the copying continuation carries the parameters and varying them varies the successor's constitution; $\beta = 0$, since the executing instance is a new one; and μ and ρ as the retained record and the self-description are or are not supplied. Restoration is therefore structure-carried continuation with a discontinuous bearer, which is precisely the pure case of Section 11.

Forking. Two systems started from one stored copy are two continuers of one predecessor with, in the limiting case, identical conditioning trace sets. By Definition 5.3 both continue it to the same degree; by Proposition 12.2 nothing in the framework selects between them; and by the branching admitted in Definition 5.3 the configuration is describable without paradox. The question which fork is the agent is thereby exhibited as a question of the succession-rule category, to be answered by an instituted policy whose additions are stated.

Loss of retained record. A system whose stored record of prior exchanges is discarded or compressed loses μ while retaining τ , and, where a self-description is reloaded, ρ . The practice reports that such a system presents as a different party to those interacting with it, and the model locates the report: the channel that fails is the one carrying content the successor can itself discriminate, which is the channel the memory criterion identifies with persistence.

13.2 The environment of an agent

Established Result 13.2 (Undiscriminability; Companion Study IV). *Let two environment designs induce identical boundary presentations to a subsystem at every cut under every context in its context class. Then they coincide in the domain of the subsystem's discrimination: no class separates them, no symbol of the subsystem substitutes for a class distinguishing them, and no continuation of the subsystem depends on the difference.*

The result applies directly to a system whose couplings to its environment are mediated by a fixed interface. Whatever lies beyond the presentation, where the presentations agree, is beyond the reach of the system's discrimination, and the question whether the environment is of one kind or another has, for that system, no discriminable content. The companion study also states what would discriminate, namely inconsistencies of presentation across cuts or contexts, and any coupling into the region where the designs differ; so the question of the environment's character and the question whether anything couples from beyond the presented region are one question.

Two consequences are worth separating, because they are easily conflated. The undiscriminability result concerns what a system can *establish* about its environment. Corollary 7.2 concerns what a system's constitution must *contain* for it to acquire anything. The two are independent: a system meeting the specification of Corollary 7.2 is subject to the bound of Established Result 13.2, and a system exempt from the bound, were one possible, would still require non-trivial structure to learn. The condition of an exogenously constituted system, whose sufficient-state sector was formed wholly outside its own worldtube and stands beyond its revision, is stated in the companion study of subject formation and is the standing case here.

13.3 Design levers

Each category of Sections 9 to 12 corresponds to a distinct lever, and the correspondence is the section's practical yield: a choice about one channel does not settle the others, and the model says which choices are independent and which are constrained.

- *Bearer.* Attestation of an executing instance carries β and, by Proposition 6.3, carries nothing else.
- *Accessible content.* Retained records carry μ ; their compression or loss removes it without

touching the remaining channels.

- *Symbolic content.* An externalised self-description carries ρ and, by Proposition 10.2, is the only carrier that survives replacement of the bearer by transmission of a product; by the no-transfer result it is nonetheless regenerated by the successor's own continuations and never installed.
- *Structure.* Initial parameters and their lineage carry τ , and by Proposition 7.1 the choice here is constrained: some non-trivial structure is required for any acquisition whatever.
- *Capacity.* Structures selected for the ability to acquire, and not for competence, are the engineered form of κ with REP empty, which is Corollary 7.2.
- *Succession.* Policies determining which restored or forked instance continues an agent are rules in the sense of Definition 12.1, and by Proposition 12.2 they institute a succession, discovering none.

14 Summary of Results

A single difference-making operator has been defined and three constructions of the companion studies exhibited as its instances. The continuation relation has been defined by it, after the vacuity of the available alternative was stated, with degree as a set under inclusion and branching admitted in both directions. Direct continuation has been proved non-transitive by explicit construction, and mediated continuation defined as its transitive closure, the pair reproducing a distinction due to Parfit on a substrate defining no identity relation. The sufficient-state sector has been decomposed into record, repertoire and residual parts, a channel vector defined over them together with the bearer and the capacity, and the four conditioning channels proved independent by four constructions. Two cells have been shown empty, and the specification of a being with no acquired content and an intact capacity to acquire has been exhibited, together with the impossibility of dispensing with structure. The taxonomy has treated four categories of channel and one category of selection rule, in each case stating the characteristic strength and cost as consequences of the model and naming the positions residing there. The apparatus has been applied to artificial systems, mapping their components to channels and separating what such a system must contain from what it can establish.

15 Limitations and Open Problems

15.1 Conditions of failure

The paper fails with its substrate, and the conditions stated in Companion Study I [7] are not repeated. Three conditions attach here. If the designs of interest are so richly coupled that nearly every earlier trace is difference-making for nearly every later constitution, the repair of Definition 5.3 does not restore informativeness and the relation is vacuous after all; the paper's assumption is that difference-making is a substantially stronger condition than conditioning, and that assumption is checkable against a stated design and is not established here in general. If the individuation of beings cannot be fixed, the relation's arguments are not fixed either; this is the partition problem, inherited and unsolved. And if the record and residual sectors cannot be separated in the designs of interest, because the discriminability of traces is not stable across cuts, the channel decomposition blurs and Proposition 6.3 loses its subject.

15.2 What the paper does not do

The paper adjudicates none of the positions it models, and the abstention is a position, and no omission: the framework's claim is that the disagreements are located by the channel decomposition, and a framework that then decided among the channels would be asserting that one channel is what persistence really consists in, which is the assumption the decomposition was built to avoid. Nothing here bears on the moral standing of any being, artificial or otherwise, and no argument in the paper should be read as supporting a claim in that direction; the questions of standing require premises the framework does not contain.

15.3 Open problems

1. **Strength of the repair.** Conditions on a design under which difference-making conditioning is substantially rarer than conditioning, so that Definition 5.3 is informative. The paper's central assumption, and unproved.
2. **Individuation.** What fixes a being's boundary, inherited from the substrate and named in every companion study.
3. **Degrees of channel.** Whether each of μ, ρ, τ admits a graded form, given by the conditioning trace sets restricted to each sector and ordered by inclusion, and whether the resulting refinement is well behaved.
4. **Self-inclusion.** The reflexive substitution question inherited from Companion Study III, on which the narrative category depends.
5. **Joint continuation.** Beings formed by the joint activity of several predecessors, where no predecessor alone is difference-making and the group is; the machinery required is the coupled-continuation machinery whose absence the companion studies record for collective revision, co-formation and joint observation, and the four gaps are one gap.
6. **Rules with content.** Whether any succession rule admits derivation from structural conditions, given Proposition 12.2.

Recapitulation

- **Influence.** $\text{Inf}_h(T \Rightarrow S)$: admissible sequences c, c' with contributions into T 's region from outside identical, differing on T , and differing in S . Instances: revision, boundary-dependence of a record, mediation.
- **Constitution and continuation.** $\text{Const}(B, \chi_0) = (\partial\mathcal{W}_B, X_B^S)$; $\mathcal{T}_A(B) = \{T \text{ generated by } A \text{ with } \text{Inf}_h(T \Rightarrow \text{Const}(B, \chi_0))\}$; $B \succcurlyeq A$ iff $\mathcal{T}_A(B) \neq \emptyset$; degree is $\mathcal{T}_A(B)$ under inclusion; branching admitted both ways; no identity relation anywhere.
- **Transitivity.** $\succcurlyeq$ is not transitive (three-worldtube construction; the brave officer as instance); $\succcurlyeq^*$ is its transitive closure; the pair reproduces connectedness and continuity, conceded to Parfit.
- **Channels.** $X^S = \text{REC} \cup \text{REP} \cup \text{RES}$; $\text{ax} = (\beta, \mu, \rho, \tau; \kappa)$: bearer, accessible content, symbolic content, structure, capacity. The four conditioning channels are independent, by four constructions.
- **Empty cells.** Trivial constraint structure forces $\kappa = 0$; a being with $\text{REP} = \emptyset$, no predecessor's trace remembered, non-trivial RES and $\kappa = 1$ is realisable. Structure is a condition of acquisition, never an option.

- **Categories** (Table 2). Bearer-carried: animalism, bodily criterion, instance identity. Accessible content: memory criterion, quasi-memory, retained records. Symbolic content: narrative accounts, self-descriptions; the only portable carrier. Structure-carried: reductionist stream accounts, bundle accounts, disposition strands, trained parameters. Capacity: developmental accounts, structures selected for acquisition. Selection rules: closest-continuer, non-branching clauses, succession doctrines, restore and fork policies; no canonical rule, extrinsic dependence the signature of the category.
- **Agents**. Parameters to RES, records to REC, self-description to the symbolic channel, instance to the bearer; restoration is structure-carried with a discontinuous bearer; forking gives equal continuers and a policy question; record loss removes μ alone. What a system can establish about its environment is bounded independently of what its constitution must contain.

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