

# Partition, Discrimination, and the Internal Observer in a Background-Independent Relational Ontology: A Preliminary Discussion

Wanhong Huang

huangwanhong@serendip.ngo

## Abstract

This paper treats observation 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 every structure, extent and order included, is carried by the relations themselves. The substrate is used here as a formal template, and no physical claim is made of the objects described. The setting imposes a constraint that organises the paper: every observer is a subsystem of the complex it observes, and there is no description made from no partition. Observation is located combinatorially, with the observer a worldtube, the observation an event at its boundary, and the record a persistent trace whose generation depends on the boundary configuration; a ladder of nested conditions runs from bare coupling to the observation of one's own records. Three effects of observation are separated: an observation adds to the complex; its record mediates the observer, so that having observed narrows the observer's own continuations; and where the observed party's continuations depend on the record, the record acts back on the observed. Elementary limitative results follow from the definitions: a subsystem's discrimination excludes its own cells, so no subsystem discriminates the totality of a complex containing it; a party is discriminated at most up to its boundary presentation, so complete transparency excludes interiority; and environments presenting identically are indistinguishable from within, which yields a known sceptical conclusion by a substitutability route. Objectivity is defined as redundant recording across a family of partitions, intersubjectivity as mutual reproductive closure of an interface structure, and surveillance as one-sided record formation across a coupling. The paper's declared centre is the partition problem: every result above is indexed to a partition whose selection the framework leaves to the describer, and the two available responses are stated with their costs. The contribution claimed is a vocabulary and a set of elementary consequences, and the limitative results restate, at this level, conclusions that established work has reached by other routes. The paper is conceptual and preliminary; its results are definitions, short propositions, and an explicit register of open problems.

**Keywords:** internal observer; partition; discrimination; records; background independence

**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](mailto: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.

Suggested citation: Wanhong Huang, *Partition, Discrimination, and the Internal Observer in a Background-Independent Relational Ontology: A Preliminary Discussion*, working draft, 2026.

## 1 Introduction

Accounts of observation ordinarily begin with an observer already in place: a standpoint outside the system observed, equipped with access to it. The setting used here withholds that starting point twice over. It is a combinatorial substrate of labelled cells with a relation of admissible continuation, of the kind developed in background-independent approaches to quantum gravity, group field theory among them, as models of the emergence of a discrete spacetime; it is used as a formal template, and no physical claim is made of the subsystems described. There is no outside, since an observer is a subsystem of the same complex; and there is no standing equipment, since what a subsystem can distinguish is fixed by its boundary, its configuration and its context class, all of which its history has produced. Observation must therefore be reconstructed from within, as something a region of the complex does across its own boundary, and the reconstruction has consequences that an external starting point conceals.

The consequences divide into three groups, and the paper is organised around them. The first group is constitutive: what an observation is, where it resides, and how it differs from the coupling, the record and the observer that ordinary usage folds into it. The second group is limitative: what a subsystem cannot, in principle, distinguish, including the totality of any complex containing it, the interior of any party beyond its boundary presentation, and any environment that presents identically to the actual one. The third group is relational and political: what the asymmetries of recording amount to, what objectivity and intersubjectivity can mean where no shared object is available, and what it is for one party to control the conditions of another's observation.

Behind all three groups stands a single dependency, which the paper states as its centre and keeps in view. What counts as an observation depends on the domain of discrimination; the domain depends on the boundary; the boundary is a partition; and the selection of a partition is a choice the framework leaves to the describer. Every result below is indexed to that choice, and Section 11 treats it directly.

The contribution claimed is modest and is worth stating at the outset. The limitative results restate, in this vocabulary, conclusions that established work has reached by other and more rigorous routes, and the paper cites them as prior art wherever it states them. What the vocabulary adds is a common formulation: observation, recording, surveillance, objectivity, intersubjectivity and the conditioning of a party's perceptual domain become configurations of the same few relations, so that their connections are storable and their differences checkable.

## 2 The Relational Setting

This section states the apparatus used below. The definitions are given in full, so that the paper may be read on its own; their derivation, and the results about them cited here, are given in three companion studies, hereafter Companion Study I on symbol emergence [7], Companion Study II on Marxian alienation [5], and Companion Study III on subject formation [6], this paper being the fourth of a set of five. Results imported from them are stated in full where used, their proofs alone remaining with their sources.

### 2.1 Preliminaries

The setting descends from physics and the bookkeeping from elementary mathematics. One paragraph of each suffices. In several programmes of quantum gravity, spacetime is built in place of being assumed: the elementary object is a network of dots (vertices), links (edges) and spanning surfaces (faces); a history of such a network, its parts persisting, appearing and recombining, is called a *spin foam*; group field theory is a machinery whose expansion

**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 2.1  |
| $\mathcal{W}_I$                                     | worldtube: a subsystem whose boundary persists                             | Definition 2.1  |
| $u \preceq v$                                       | $u$ precedes $v$ in the record-generated order                             | Definition 2.2  |
| $\chi, X_I(\chi)$                                   | clock; the configuration on its level set, a cut                           | Definition 2.2  |
| $X = (E, X_I)$                                      | joint configuration: environment on the boundary, and subsystem            | Definition 2.3  |
| $X \rightsquigarrow X'$                             | $X'$ is an admissible continuation of $X$                                  | Definition 2.3  |
| $\text{Con}_I(X), \text{Con}_I^h(X)$                | continuation set; admissible $h$ -step continuation sequences              | Definition 2.3  |
| $U \otimes V, \cdot$                                | composition of configurations on disjoint regions; a component held fixed  | Definition 2.3  |
| $\mathcal{P}_I$                                     | context class: the admissible boundary variations compared                 | Definition 2.4  |
| $Z \approx_{I,X} Z'$                                | indistinguishable for $I$ at $X$ ; $\sim_{I,X}$ on boundary configurations | Definition 2.4  |
| $[E]_{I,X}$                                         | a discrimination class                                                     | Definition 2.4  |
| $T \sqsubseteq X$                                   | $T$ is a subconfiguration of $X$                                           | Definition 2.5  |
| $\pi$                                               | product: a trace whose presence alters $\text{Con}_I$                      | Definition 2.5  |
| $\sigma \dashv_y [E]_{I,X}$                         | $\sigma$ substitutes for the class over the interaction class $y$          | Definition 2.6  |
| $\varrho$                                           | residue: the interactions at which substitution fails                      | Definition 2.6  |
| $\Sigma_I$                                          | repertoire: $I$ 's set of symbols                                          | Definition 2.6  |
| $\text{Med}(\pi)$                                   | the subsystems $\pi$ mediates                                              | Definition 2.7  |
| $\text{Rev}_h(\sigma)$                              | the subsystems able to revise $\sigma$ within $h$ steps                    | Definition 2.8  |
| $[\text{L2}], [\text{L3}]$                          | level tags: combinatorial; effective                                       | §2              |
| $X^S$                                               | sufficient-state sector                                                    | Definition 2.10 |
| $\text{Pres}(\sigma, X)$                            | persistence set                                                            | Definition 2.9  |
| $s$                                                 | separation: internal vertices between boundary-incident ones               | Definition 2.10 |

generates such histories; and geometric quantities are labels carried on the network's parts. *Background independence* names the situation in which 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 with the record of which touches which, as bookkeeping for relations, and borrows none of the physics' quantum-mechanical or geometric results.

Of mathematics the paper uses: relations and the membership notation ( $x \in S$ :  $x$  belongs to  $S$ ;  $S \subseteq T$ : every member of  $S$  belongs to  $T$ ); *equivalence relations*, sortings of objects into classes, with the *quotient* the collection of the classes; *partial orders*, rankings that leave some pairs unranked, claimed here where a stronger vocabulary would claim numbers; and *horizons*, stated numbers of steps bounding every claim made at them.

## 2.2 Substrate, subsystems, and time

**Definition 2.1** (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 2.2** (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*  $\chi$  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 2.3** (Admissibility and continuation sets). The dynamics is a relation  $\rightsquigarrow$  between joint configurations at successive cuts,

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

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.

### 2.3 Discrimination

**Definition 2.4** (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  $X$ ,

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

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.

### 2.4 Traces, products, symbols

**Definition 2.5** (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  $\pi$  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 2.6** (Symbol and residue). For a class  $\mathcal{Y}$  of interaction configurations, a product  $\sigma$  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*  $\Sigma_I$  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.

## 2.5 Mediation and revision

**Definition 2.7** (Mediation and the mediation set). A product  $\pi$  *mediates*  $I$  at  $X$  when  $\text{Con}_I$  depends on it: there are  $X, X'$  agreeing except on  $\pi$  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 2.8** (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  $\sigma$  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.

## 2.6 Persistence, subjection, and the internal sector

**Definition 2.9** (Persistence set, subjection, closure). For  $\sigma \sqsubseteq X$ ,

$$\text{Pres}(\sigma, X) = \{ X'_I \in \text{Con}_I(X) : \sigma \sqsubseteq (E', X'_I) \text{ for every admissible joint realisation } \}.$$

$I$  is *subject* to  $\sigma$  at horizon  $h$  when  $I \in \text{Med}(\sigma)$  and  $I \notin \text{Rev}_h(\sigma)$ ; and  $\sigma$  *reproductively closes*  $I$  when  $\text{Con}_I(X) \subseteq \text{Pres}(\sigma, X)$ , non-vacuously, with  $I \in \text{Med}(\sigma)$ . Both are established in Companion Study II.

**Definition 2.10** (Sufficient-state sector, separation, simulator). A decomposition  $X_I = (X^R, X^S)$  is admissible when  $\text{Con}_I$  at a cut is a function of  $(E, X^R, X^S)$  there while failing to be a function of  $(E, X^R)$  alone;  $X^S$  is the *sufficient-state sector*. A worldtube has *s-separation* on a stretch when at least  $s$  *internal* vertices, cells not incident to  $\partial\mathcal{W}_I$ , lie between consecutive boundary-incident vertices. A *simulator* is an internal subconfiguration whose internal continuations complete symbols before the next boundary-incident vertex.

A simulator requires separation, since an internal continuation completing a symbol needs the internal steps of its generation; the point is established in Companion Study III and is used in Section 7.

## 2.7 Standing constraints and the status of the paper

Four constraints hold throughout. Comparisons between subsystems proceed by structure. 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]. The dynamics is an admissibility relation carrying no weight over histories, so every construction below is combinatorial, and where a result from quantum theory is mentioned it is mentioned as prior art and is not transferred.

This is a conceptual and discussion paper: definitions, short propositions, and an explicit register of open problems. Sections 3 to 5 constitute observation and its effects; Sections 6 to 8 establish the asymmetries and the limits; Sections 9 to 10 construct objectivity and intersubjectivity; Section 11 treats the partition problem, Section 12 its politics, and Sections 13 and 14 close.

### 3 Observation Located

Ordinary usage runs together four things: the one who observes, the act of observing, the trace the act leaves, and the coupling that makes any of it possible. The reading of the strata recalled in Section 2 supplies a distinct combinatorial home for each, and the discipline of the section is to keep them apart.

**Definition 3.1** (Observation event, [L2]). An *observation event* of  $I$  is a vertex  $v$  of  $\mathcal{W}_I$  incident to  $\partial\mathcal{W}_I$  at which a generating continuation completes a trace  $\text{tr} \sqsubseteq X^S$  whose generation is *boundary-dependent*: under some admissible variation of  $E$  within  $\mathcal{P}_I$ , no continuation through  $v$  generates  $\text{tr}$ . The *observer* is the worldtube  $\mathcal{W}_I$ ; the *record* is the trace.

The definition assigns the observer, the observation and the record to different strata: a persisting partition, an event, and a persistent configuration respectively. Each clause does work. Incidence to the boundary excludes purely internal generation from counting as observation of the environment. The trace's membership in the sufficient-state sector makes the record part of what the subsystem thereafter carries. And boundary-dependence is the difference between recording the environment and merely producing while coupled to it: a trace that would have been generated identically under boundary variation records nothing about the boundary.

### 4 The Observation Ladder

**Definition 4.1** (Ladder, [L2]). For an event at  $\partial\mathcal{W}_I$ , define nested conditions:

- L0. *Coupling*: incidence across the boundary.
- L1. *Record formation*: L0, and a trace is generated at the event.
- L2. *Observation*: L1, the generation is boundary-dependent, and the trace participates.
- L3. *Symbolic observation*: L2, and the trace is a symbol, substituting for a discrimination class of the boundary.
- L4. *Reflexive observation*: L3, with the substituted class drawn from the subsystem's own records.

The ladder replaces a binary, observed or not, with graded structural conditions, each checkable on objects already defined. Its two ends carry the section's content. At the bottom, coupling without record formation is interaction that leaves nothing: most of what crosses any boundary is of this kind, and an account that equates being coupled with being observed has lost the distinction that matters. At the top, L4 is observation of observation: a record whose

substituted class consists of the subsystem's own records, which is the structural location of self-monitoring, of audit, and of every practice in which a party attends to what it has registered. The tradition of second-order observation holds priority over this rung and over the blind-spot result of Section 7, and the concession is made there where the result is stated. L4 also inherits the open self-inclusion question of reflexive symbols, recorded in Companion Study III [6] and in Section 14.

## 5 Effects of Observation

Three ways an observation makes a difference are separated here, because arguments about the observer effect habitually slide among them.

**Proposition 5.1** (Generation and self-constraint, [L2]). *An observation event is a vertex, and observing adds to the complex. Its record is a product; where the record mediates  $I$ , the continuations of  $I$  thereafter depend on it.*

*Proof.* The first clause restates Definition 3.1: the event is a cell and its generating continuation extends the configuration. The second applies the definitions of product and mediation to the record.  $\square$

The first clause is kinematic and modest: every interaction adds vertices, so the point is not a special power of observation. Its force is exclusionary: a description made by no subsystem, adding nothing, from nowhere, is not among the structures the substrate contains. The second clause is the self-directed effect, and it deserves its own sentence: having observed narrows the observer's own continuations, since the record is a persistent product carried in the observer's sufficient-state sector, and the observer is generically among the subsystems it mediates. An observer accumulates its observations as conditions on itself.

The third effect runs outward. Where the environment contains another subsystem  $J$ , and  $J$ 's continuations depend on a record of  $J$  held by  $I$ , the record mediates  $J$ : classifications of parties are products the classified are mediated by. The structure is available by composition of definitions and asserts nothing about frequency; the empirical identification of the phenomenon for human kinds, classifications that alter the classified and thereby their own extension, belongs to Hacking [4], and is conceded as the observation this clause formalises a location for.

## 6 Asymmetric Recording

Coupling is symmetric in incidence: a boundary is shared. Record formation is not: one side of a coupling may generate records of it while the other does not, and the asymmetry is a structure with a name.

**Definition 6.1** (Recording, one-sidedness, surveillance, [L2]). For coupled  $A, B$ :  $A$  records  $B$  over an interval when  $A$  generates symbols substituting for classes of  $B$ -presented configurations. Record formation is *one-sided* when  $A$  records  $B$  and  $B$  does not record  $A$ .  $A$  *surveils*  $B$  when record formation is one-sided; the surveillance is *covert* when, in addition, the record-forming events fall within a single indistinguishability class of  $B$ 's, so that  $B$  cannot discriminate whether recording occurs.

The definition places surveillance where the framework can carry it: in the asymmetry of record formation across a symmetric coupling, with covertness as a further clause about the observed party's discrimination. Nothing about intent appears, in keeping with the standing constraints, and the tradition that identified asymmetric visibility as a form of power, of which

Foucault's analysis is the standard reference [2], holds priority over the phenomenon; the definition contributes a combinatorial formulation in which the asymmetry, and the observed party's inability to discriminate it, are separately checkable conditions. Two connections are recorded. A one-sided record is a product; it can outlive the coupling, in the manner of a condensate, established in Companion Study I [7], mediating the recorded party and parties beyond it, with the default absence of a revision channel; the archive of a surveillance is a condensate. And covertness connects to Section 8: recording indistinguishable by the recorded is a local instance of the general limit on discriminating what presents identically.

## 7 Limits of Internal Observation

**Proposition 7.1** (Domain exclusion, [L2]). *The discrimination relation  $\approx_{I,X}$  is defined on configurations presented across  $\partial\mathcal{C}_I$ . Configurations of a containing complex that differ only on  $I$ 's own cells lie outside its domain. Hence no subsystem discriminates the totality of a complex containing it.*

*Proof.* By inspection of the definitions: discrimination and indistinguishability compare configurations presented to the subsystem, and the subsystem's own cells are not among what is presented across its boundary.  $\square$

The proposition is elementary and is stated with its elementarity acknowledged: it is a fact about the domain of a definition, not a deep theorem. Its role is to fix, at this level, a limit that rigorous results establish in richer settings, and those results are the section's prior art, cited and not transferred: that an observer contained in a system cannot distinguish all its states [1]; that no two inference devices can be mutually fully predictive, and none fully predicts a system containing it [13]; and that classical self-prediction fails [9]. The claim itself, that every observation is made with a distinction the observer does not observe in the act, belongs to the tradition of second-order observation founded by von Foerster and developed by Luhmann [12, 8], and the priority is conceded without reservation. The blind spot is constitutive: the same boundary that gives a subsystem a domain of discrimination excludes the subsystem's own cells from it, and there is no repositioning from which the exclusion disappears, since every position is a partition with an exclusion of its own.

**Proposition 7.2** (Presentation bound, [L2]). *Configurations of a subsystem  $J$  that differ only on  $J$ 's internal cells present identical boundary configurations to any other subsystem  $I$ .  $I$  discriminates  $J$  at most up to  $J$ 's boundary presentation, and complete discrimination of  $J$  by another subsystem requires every cell of  $J$  to be boundary-incident.*

*Proof.*  $E$  in the continuation relation is the environment's configuration on the boundary; internal differences of  $J$  that leave the boundary configuration unchanged are identical in the domain of  $I$ 's discrimination, which gives the bound. Complete discrimination requires that no two distinct  $J$ -configurations present identically, which fails as soon as  $J$  has a cell not incident to the boundary.  $\square$

**Proposition 7.3** (Transparency excludes interiority, [L2]). *If  $J$  is completely discriminable by another subsystem, then  $J$  has no internal cells, so  $J$  has separation  $s = 0$  on every stretch, and so has no simulator. Mutual complete transparency excludes interiority on both sides.*

*Proof.* Immediate from Proposition 7.2 and the separation requirement recalled in Section 2.  $\square$

Proposition 7.3 is a cross-paper consequence and the section's one non-obvious result. A party wholly open to another's discrimination has nothing between its exchanges: no internal vertices, hence no internal continuations, hence no sector completing anticipations before the

exchanges they anticipate. The familiar thought that a fully transparent being has no inner life is thereby made precise as a statement about structure, with no clause about experience anywhere, and it cuts in both directions: interiority is bought at the price of opacity to others, and demands for complete mutual transparency are, structurally, demands for the abolition of the internal sector.

## 8 Undiscriminability of a Consistent Environment

**Proposition 8.1** (Undiscriminability, [12]). *Let two environment designs induce identical boundary presentations at every cut under every context in  $\mathcal{P}_I$ . Then they coincide in the domain of  $\approx_I$ : no discrimination class separates them, no symbol of  $I$  substitutes for a class distinguishing them, and no continuation of  $I$  depends on the difference.*

*Proof.* The domain of discrimination consists of boundary presentations under contexts; identical presentations under every context are one element of the domain. Classes, substitutions and continuation dependencies are all defined over that domain.  $\square$

Three corollaries carry the section. First, a hypothesis distinguishing the two designs has no discriminable content for  $I$ : the subsystem's symbols substitute for classes fixed by its own responses, so its terms are about its world whatever that world's substrate, and the conclusion familiar from the sceptical literature, and from Putnam's argument in particular [10], arrives here by a substitutability route, with no theory of reference invoked. Second, the proposition states its own boundary of application, which is where discrimination becomes possible: presentation differences, that is, seams, inconsistencies of presentation across cuts or contexts, and any coupling into the region where the designs differ. The sceptical question and the question whether anything couples from beyond a given region are therefore one question, and the framework registers their identity as a result. Third, and flagged as speculative in one sentence: a subsystem might register an anomaly not in its environment's presentation but in its own separation budget, a mismatch between the internal steps its anticipations require and those its stretches supply, which would be an internal seam; nothing further is claimed for the case.

## 9 Redundancy and Objectivity

No shared object is available on this substrate: classes are party-indexed, local symbolic systems are local, and the merged common order is declined. The definable notion is redundancy.

**Definition 9.1** (Redundant recording, [12]). *A family of subsystems  $\{I_k\}$  redundantly records a structure when each  $I_k$  carries a symbol substituting for its own corresponding class  $[E]_{I_k}$ . A structure is *objective for the family* to the degree given by the family, with the partial order of inclusion among families. A *social fact* is a structure redundantly recorded across a stated family.*

Objectivity so defined is graded, is indexed to a family of partitions, and is weaker than agreement: the parties' classes are their own, and nothing requires that they coincide or that any common object exist of which the records are copies. The definition's quantum ancestor, on which the account of objectivity as redundancy of records was first made precise [14], is conceded; the apparatus that carries it there is unavailable here under the enrichment requirement, and the combinatorial statement stands on its own. Its yield for the social case is a formal home for a familiar category: a social fact is not a thing over and above the parties but a structure whose records are carried, severally and redundantly, across a family, and its objectivity rises and falls with the family that carries it.

## 10 Mutual Observation and Interface Locking

Mutual observation, each party observing the other across a shared boundary, generates records on both sides and, structure on the interface belonging to neither, since the continuations of a coupled pair are not the pairs of separately admissible continuations. The question of this section is what stable mutual observation amounts to, and the answer uses Paper II with nothing added.

**Definition 10.1** (Interface locking, [L2]). A boundary-borne structure  $\sigma_{AB}$ , a coupling carrying its own configuration, *locks*  $A$  and  $B$  on a stretch when  $\sigma_{AB}$  reproductively closes both  $A$  and  $B$  on that stretch, the persistence set read at each cut with each party's own continuation set.

Locking is mutual reproductive closure of a shared structure, and it is the deflationary account of intersubjectivity this substrate can carry: a stabilised pattern that both parties' admissible continuations maintain, a relation the parties enact, with no merged object anywhere. Its static counterpart is the redundancy of Section 9; locking is the dynamical form, redundant recording the standing trace.

The revision sets then split the locked case, and the split is the section's point. Where  $A, B \in \text{Rev}_h(\sigma_{AB})$ , the interface structure is jointly maintained and jointly revisable: the parties hold their common pattern and hold channels over it, which is the structure of a working language, a working practice, a working relationship. Where  $A, B \notin \text{Rev}_h(\sigma_{AB})$ , the parties are in mutual subjection to a structure their own continuations maintain: each is conscripted into reproducing an interface neither can revise, which is the structure of the degraded pair, mutually entrapped, each holding the other in place through a pattern that answers to neither. The received observation that both positions in a degraded relation are gripped, the dominating included, is available here as a statement about closure and revision, with no scalar and no diagnosis.

## 11 The Partition Problem

Every result of this paper is indexed to a partition, and the dependency deserves assembling in one place, since its links have been proved severally. The partition fixes the boundary; the boundary fixes the domain of discrimination (Propositions 7.1 and 7.2); the domain fixes which events are observations and which traces records (Definition 3.1); the records generate the causal order; the order admits the clocks; and orientation, where available at all, is available relative to the same cut. What counts as an observation, and everything built on it, is therefore relative to a partition, and the framework contains no criterion selecting one: the complex admits every subcomplex, and the selection is a design act, and the mark is left standing.

Two responses are available, in different registers, and the paper states both with their costs, adopting neither.

The first response is ontological: accept the relativity in full. There are no partition-free facts about observation, records or time; there are partition-indexed facts, and the substantive open problem is the set of consistency conditions relating descriptions indexed to different partitions, without which the position collapses into a perspectivism with no constraints. The problem is not peculiar to this framework: it is the cross-perspective problem of relational quantum mechanics, unsettled in that literature as well, and the relational tradition in physics holds priority over the response itself [11], measurement as correlation-establishing interaction and states relative to the correlated system being its prior articulation. The company is respectable and the debt is stated; the consistency conditions remain the first entry of Section 14.

The second response is a design act: adopt a criterion, and own the adoption as an assertion carrying obligations. Two candidates use only structure already defined. Persistence of a worldtube across the record order selects partitions whose boundaries endure in the order their own records generate, and is the criterion most native to the framework. Closure conditions on a subsystem's continuations under environment variation select partitions that screen their interiors, and are the combinatorial relatives of boundary conditions familiar elsewhere. Either adoption would convert results of the form "relative to a partition" into results simpliciter for the selected class, at the price of defending the selection. This paper continues to mark the relativity, because its results do not require the conversion and the defence has not been given.

## 12 Observational Subjection

The limits of Section 7 are constitutive and belong to every subsystem. A further condition is positional, and it is the political face of this paper.

**Definition 12.1** (Observational subjection, [L2]). *I* is *observationally subject* at horizon  $h$  when the placement and structure of  $\partial\mathcal{W}_I$ , and thereby the domain of  $\approx_I$ , are conditioned by products with  $I \notin \text{Rev}_h$  and some  $J \in \text{Rev}_h$ ,  $J \neq I$ .

The definition applies the mediation and revision apparatus with the boundary occupying the position a symbol occupies elsewhere, and its licence is already on the books: the analysis of the relations of production in Companion Study II [5] locates property in the placement of the boundary, and placement is a structure products can condition. The relocation adds the observational reading. The domain of a subsystem's discrimination is what its boundary presents; a party holding the only revision channel over the structures fixing that boundary holds a channel over what the subsystem can observe at all; and the subject's perceptual world, in the strict sense of its domain of possible discriminations, is then another's product.

Instances are ordinary and the definition collects them. The design of an instrument fixes what its user can distinguish; the layout of an interface fixes what its operator can attend to; a classification system fixes which differences among cases are registrable; the records a bureaucracy forms of a person fix in what form that person is presentable to it, and Definition 6.1 is the special case where the person forms no records in return; the visibility rules of a platform fix which parties present to which. In each, the structures conditioning a boundary are products, the products have mediation and revision sets, and the question the definition isolates is the asymmetry of those sets. The literature on epistemic injustice has treated the wrong done to parties in their capacity as knowers [3]; the definition contributes a location for one species of it, the conditioning of a party's discrimination domain by structures revisable only elsewhere, and the priority of the tradition over the phenomenon is conceded.

Two consequences close the section. Observational subjection composes with the conditions recalled in Section 2: where the boundary-conditioning products are moreover maintained by the subject's own continuations, the closure clause holds of them, and the subject's activity reproduces the conditions of its own observation, which is the reflexive form of reproductive closure. And the constitutive blind spot of Proposition 7.1 is not itself subjection: the exclusion of one's own cells belongs to every partition and answers to no party, and conflating the constitutive limit with the positional condition would charge the substrate with what only a position does.

## 13 Summary of Results

Observation has been located combinatorially: observer, observation event and record assigned to distinct strata, with boundary-dependence separating recording the environment from producing while coupled; a five-rung ladder from coupling to reflexive observation; and three effects separated, the kinematic addition, the self-constraint of the observer by its own records, and the back-action on observed parties mediated by records of them. The limitative results are the domain exclusion, the presentation bound, transparency excluding interiority, and the indiscriminability of identically presenting environments with its corollaries. The relational constructions are redundant recording as graded, family-indexed objectivity; interface locking as mutual reproductive closure, split by revision into working and entrapped forms; one-sided and covert recording as the definitions of surveillance; and observational subjection as the positional conditioning of a party's discrimination domain. The partition problem has been assembled as the dependency underlying all of it, with the two responses stated and neither adopted.

## 14 Limitations and Open Problems

### 14.1 Conditions of failure

The paper fails with its substrate, and the conditions stated in Companion Study I [7] are not repeated here. Three further conditions attach here. If the consistency conditions of Section 11 prove unformulable, the ontological response collapses into unconstrained perspectivism, and the paper's results hold only severally, per partition, with nothing relating them. If the designs of interest have every cell boundary-incident, the presentation bound is vacuous, transparency is universal, and Proposition 7.3 excludes interiority everywhere, which would contradict the appearances the companion paper explains and thereby count against the designs or the account. And if boundary-dependence in Definition 3.1 cannot be operationalised for the designs of interest, because the admissible variations of  $\mathcal{P}_I$  are unspecifiable there, the constitutive sections lose their footing independently of the rest.

### 14.2 Open problems

1. **Consistency conditions** relating partition-indexed descriptions. The paper's declared centre and the framework's largest single obligation.
2. **The partition criterion.** Carried over from the substrate, with the two candidates of Section 11 named and neither adopted nor defended.
3. **Degrees of transparency.** A partial refinement order between the presentation bound and complete transparency, without a scalar.
4. **Detectability of covert recording.** Conditions under which the recorded party could in principle discriminate that recording occurs; the complement of the covertness clause.
5. **Joint observers.** A coalition observing what no member observes requires coupled-continuation machinery; the gap is the same one recorded for collective revision and co-formation, and the three are one problem.
6. **Reflexive observation.** Rung L4 inherits the self-inclusion question of reflexive symbols, Companion Study III [6].

### 14.3 Subsequent work

The landscape treatment of knowledge, owed by the companion papers, will use this paper's limits directly: what a subsystem can reconstruct of the past, and what conditioning it can register at all, are bounded by the domain results established here, and the politics of reconstruction is observational subjection applied to records.

### Recapitulation

The paper's objects and results, collected for reference; the setting is that of Section 2.

- **Observation located.** Observer: a worldtube. Observation: a boundary-incident vertex at which a boundary-dependent trace of the sufficient-state sector is generated. Record: the trace. Ladder: coupling; record formation; observation; symbolic observation; reflexive observation.
- **Effects.** Kinematic: observing adds to the complex, and a description from no partition is excluded. Self-constraint: the record mediates the observer, whose own continuations narrow with what it has observed. Back-action: a record of  $J$  held by  $I$  can mediate  $J$ ; classifications of parties are products the classified are mediated by.
- **Asymmetric recording.** Surveillance: one-sided record formation across a symmetric coupling; covert when the record-forming events fall within one indistinguishability class of the recorded party; the archive a condensate.
- **Limits.** Domain exclusion: a subsystem's own cells lie outside the domain of its discrimination, so the totality of a containing complex is beyond it. Presentation bound: another party is discriminated at most up to its boundary presentation. Transparency and interiority: complete discriminability leaves a party with boundary-incident cells only, hence with neither separation nor simulator. Undiscriminability: identically presenting environments coincide in the domain of discrimination, and the difference between them supports no class, no symbol and no dependent continuation.
- **Objectivity and intersubjectivity.** Redundant recording: each member of a family carries a symbol for its own corresponding class; objectivity graded by the family; a social fact a redundantly recorded structure. Interface locking: a boundary-borne structure reproductively closing both parties on a stretch; jointly revisable where both hold channels, mutual subjection where both lack them.
- **The partition problem.** Partition fixes domain; domain fixes observations and records; records generate the order; the order admits the clocks. The selection of a partition is the describer's choice; the responses are full relativity with consistency conditions to be supplied, or an owned design criterion; both stated, neither adopted.
- **Observational subjection.** The boundary's placement and structure conditioned by products revisable elsewhere and beyond the party's own channels: another party holding a channel over what one can observe; distinct from the constitutive blind spot, which belongs to every partition.

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