

## **The Structural Conditions of Consciousness II**

### **— Structural Knot Theory —**

#### **Mathematical Identification and Theory Construction**

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

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#### **Statement of Result**

This series proposes that subjectivity arises at a structural knot in the causal organization of a system and aims to identify the minimal structural conditions under which this structural knot necessarily forms.

In the present framework, subjectivity is not treated as a substance, a location, or an informational state. Instead, it is treated as a structural event that occurs at a specific point in the causal organization of a system.

We define this point as a **structural knot**—an irreversible causal bottleneck at which multiple internally generated possible courses of action are reduced to a single realized outcome, thereby forming a single unfolding history under survival constraints.

This study argues that the minimal structural conditions under which this structural knot necessarily forms are the following five.

#### **Five Conditions That Structurally Necessitate Subjectivity**

1. **Autonomous action that modifies the world**

Action is not merely internal computation but produces irreversible changes in the environment, updating the state of the world in a single direction.

2. **A viability boundary that constrains evaluation**

Action candidates are weighted according to constraints related to the system's continued viability.

3. **Multiple internally generated action candidates**

At least two executable action candidates are generated simultaneously within the system and enter into competition.

4. **Exclusive and irreversible determination of a single outcome**

One candidate is selected through competitive resolution, while the alternatives become internally unreconstructable.

5. **A single unfolding history formed by chained irreversible determinations**

Such determinations accumulate over time, producing a single trajectory that neither branches nor reverses.

When these five conditions are satisfied simultaneously, a structural point necessarily arises within the causal structure at which multiple possibilities are irreversibly reduced to a single outcome.

This point constitutes the **structural knot**, and it is at this structural knot that subjectivity is instantiated.

Subjectivity is therefore not an additional property generated on top of a system. Rather, in systems that satisfy these conditions, subjectivity emerges as a **structural consequence** and cannot be removed without altering the structure itself.

This may be compared to the formation of a vortex in a flow: when flow, gradients, boundaries, and irreversible dissipation are present, a vortex necessarily forms as a structural event of the flow rather than as an added component.

At present, no counterexample is known in which subjectivity occurs in the absence of these conditions. If a valid counterexample is demonstrated under the same structural constraints, the present proposal must be revised or withdrawn.



**Important Methodological Note**

This study does not propose a new mechanism of consciousness.

The subjectivity addressed here is an event, and events occupy the boundary between science and philosophy.

A purely scientific framework cannot fully capture them; scientific and philosophical descriptions must be used in their appropriate domains.

Philosophy here functions not as abstraction but as a necessary structural framework for addressing the event-side of reality.

Just as a car's physical state can be measured scientifically while its irreversible choice

of path can only be understood at the level of events, such phenomena require both forms of description.

The method employed is subtractive: explanatory additions and new conceptual posits are removed, leaving only unavoidable structural constraints.

As a result, a positional gap appears within the causal structure—one that can be filled only by the placement of subjectivity.

Because this gap cannot be directly observed from within existing causal descriptions, it is identified as a structural black box and its properties are inferred solely from the constraints already in place.

The present work is therefore offered as a structurally compelled inference: a highly constrained estimation derived from these unavoidable conditions.

To refute this claim, one must demonstrate that, under the same constraints, the causal structure can be closed without introducing subjectivity.

## Abstract

This paper offers a structural critique of major contemporary theories of consciousness—Integrated Information Theory (IIT; Tononi), Global Workspace / Global Neuronal Workspace (GWT/GNW; Baars; Dehaene), Higher-Order Thought theory (HOT; Rosenthal), Predictive Processing / Active Inference (Friston), and Recurrent Processing Theory (RPT; Lamme)—by applying the event-based conclusion established in Volumes I–II: **subjectivity is not a state or quantity but an exclusive irreversible determination event.**

Integration-Critique-IIT-GNW-HO...

Although these frameworks differ in emphasis (integration and  $\Phi$ -maximization; global broadcasting/ignition; higher-order representation; prediction-error/free-energy

minimization; recurrent stabilization), they share a common premise: consciousness is a privileged **state**. We argue that this premise cannot structurally yield (i) single-line irreversibility, (ii) a privileged “here-and-now,” or (iii) internal causal asymmetry, because states are synchronically describable, surveyable from outside, parallelizable, and in principle recalculable.

Integration-Critique-IIT-GNW-HO...

Introducing **IESC** resolves the closure failure without negating existing theories: IIT-style integration and GNW-style dissemination can be repositioned as **preconditions** that shape the candidate landscape, while the emergence point of subjectivity is the **reduction event**—the internal pruning in which alternative possibilities become causally unreachable ( $\text{Reach}(t+1) \subset \text{Reach}(t)$ ). This shift also reframes experiential content (qualia) as the historically fixed difference defined by what has been excluded, rather than an additive informational property.

### **Series Information**

This paper is part of the series “*The Structural Conditions of Consciousness — Structural Knot Theory*.” The series develops a structural theory of consciousness in which subjectivity is treated as a structural phenomenon determined by placement and constraint rather than intrinsic state properties. Within this framework, the series establishes the locus, structural conditions, degree, and determination of subjectivity.

The series consists of the following volumes:

## **Vol. 0 – The Structural Conditions of Consciousness 0**

*Prologue: The Subject as Event at the Boundary of Physics and Philosophy*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/4Z5XU>

## **Vol. I – The Structural Conditions of Consciousness I**

*Proof of Absence: Inferring the Locus of the Subject*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/KCFM8>

## **Vol. II – The Structural Conditions of Consciousness II**

*Mathematical Identification and Theory Construction*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/PNHMA>

## **Vol. III – The Structural Conditions of Consciousness III**

*A Structural Critique of State-Based Theories of Consciousness*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/Y7RN4>

## **Vol. IV – The Structural Conditions of Consciousness IV**

*Limit Cases: Application and Interpretation*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/JN5XC>

## **Vol. V – The Structural Conditions of Consciousness V**

*An Equation for the Degree of Subjectivity: Interpreting Limit Cases*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

<https://doi.org/10.17605/OSF.IO/M47HB>

## **Vol. VI – The Structural Conditions of Consciousness VI — Final Volume —**

*Toward a Structural Decision Tool: Determining the Presence and Degree of Subjectivity*

(Repositioning State-Based Theories of Consciousness: IIT, GNW, HOT, Predictive Processing, and RPT)

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## Keywords

Consciousness; Subjectivity; Qualia; Irreversibility; Event-Based Theory of Consciousness; Irreversible Exclusive State Commitment (IESC); Integrated Information Theory (IIT); Global Neuronal Workspace (GNW); Higher-Order Theory (HOT); Predictive Processing; Recurrent Processing Theory (RPT)

## Positioning and Aim of the Present Paper

This paper constitutes the third part of the project initiated in *Conditions for the Emergence of Consciousness I: Proof by Absence (Structural Subtraction)* and formally developed in *Conditions for the Emergence of Consciousness II: Mathematical Identification (IESC Theory)*, extending the IESC framework to a structural examination of existing theories of consciousness.

In the first paper, subjectivity was reformulated not as a problem of generation, but as a problem of placement. Through proof by absence (structural subtraction), it was demonstrated that subjectivity must necessarily be positioned at the point of formation of a single-line irreversible temporal sequence.

In the second paper, that structural consequence was formalized and articulated as Irreversible Exclusive State Commitment (IESC). It was made explicit that subjectivity is neither a state nor a quantity, but an exclusive irreversible determination event.

The present paper does not restate these points. Rather, it applies this structural conclusion to the major existing theories of consciousness and clarifies how they position the emergence of subjectivity—or how they fail to position it.

Accordingly, the present analysis is not an impressionistic critique from outside those theories, but an examination of internal coherence conducted on the basis of the structure of subjectivity established in I and II.

### 1. State-Centrism as a False Premise

The major contemporary theories of consciousness appear, at first glance, to be diverse.

Integration theories speak of integration. Representational theories speak of higher-order representation. Predictive theories speak of error minimization. Recurrent theories speak of feedback. Broadcast theories speak of global sharing.

Yet they share a common premise. Consciousness is assumed to be a certain kind of “state.”

A maximally integrated state.

A higher-order represented state.

An optimized inferential state.

A recurrently stabilized state.

A globally shared state.

In this way, each defines properties of structure or conditions of activity.

However, subjectivity is likely not a state.

A state can be described synchronically.

A state can be surveyed from outside.

A state can exist in parallel.

If subjectivity were such a state, logical difficulties would inevitably arise.

It is more causally and logically natural to understand subjectivity not as something that exists, but as a point at which other possibilities have disappeared — a configuration that has been irreversibly determined.

Here lies a decisive difference.

In state-based theories, it cannot be explained why that state is “here and now.”

A state may persist.

A state may exist in parallel.

A state may be recalculated.

But subjectivity does not exist in parallel.

It is not recalculated.

It does not branch.

Subjectivity is single-lined.

This single-line structure does not follow from integration.

It does not follow from representation.

It does not follow from recurrence.

It does not follow from broadcasting.

It does not follow from optimization.

As demonstrated in “*Conditions for the Emergence of Consciousness I: Proof by*

*Absence (Structural Subtraction)*” and “*Conditions for the Emergence of*

*Consciousness II: Mathematical Identification (IESC Theory)*,” the essence of

subjectivity becomes visible only through a method of reductive observation.

Structurally, it can never be disclosed through additive reasoning.

From here, the present analysis begins.

## 2. Structural Examination of Integrated Information Theory (IIT)

### 2.1 Core Structure and the Understanding of Subjectivity

Integrated Information Theory (IIT) is a theory that formalizes consciousness as a causally integrated structure. Its central thesis is clear.

Consciousness corresponds to a maximally irreducible conceptual structure.

IIT attempts to define subjectivity not in psychological vocabulary, but in terms of physical causal structure. Its axiomatic system may be organized into the following five points.

#### 1. Intrinsic Existence

Consciousness exists within the system itself, independently of external observation.

#### 2. Composition

Consciousness is not a single element but a causal structure composed of multiple elements.

#### 3. Information

A state is specified through its differences from other possible states.

#### 4. Integration

Consciousness is irreducible.

The degree of that irreducibility is  $\Phi$  (phi).

#### 5. Exclusion

Consciousness corresponds only to the structure possessing maximal  $\Phi$ .

In IIT, subjectivity is identified with a causally irreducible structure possessing maximal  $\Phi$ .

The unity of subjectivity is guaranteed by the Exclusion axiom.

### 2.2 Existing Critiques

Various critiques have been advanced against IIT. Here, the principal criticisms concerning internal theoretical coherence and applicability are organized.

#### (1) The Problem of Computational Intractability

The strict calculation of  $\Phi$  involves combinatorial explosion. In large-scale neural systems, it becomes practically intractable, producing a gap between theoretical definition and practical applicability.

#### (2) Over-Attribution (Panconsciousness Tendency)

Because any system possessing a certain degree of integration may have a positive value of  $\Phi$ , even simple circuits or small-scale artificial systems may be attributed consciousness. This has been widely criticized.

### (3) The Problem of Scale Dependence

The identification of the maximal  $\Phi$  structure depends on methods of partition and temporal scale. The result varies according to element granularity or time-window selection, making the boundary of subjectivity potentially unstable.

### (4) The Problem of Correspondence with Experiential Content

The relation between the geometry of conceptual structure and experiential content is not clearly defined. The strictness of correspondence with qualitative experience is questioned.

### (5) The Problem of Neurobiological Correspondence

The one-to-one correspondence between  $\Phi$  and concrete neural mechanisms remains unclear, making empirical verification difficult.

### (6) The Problem of Axiomatic Validity

Questions remain as to whether the axioms derived from phenomenological features are truly self-evident, or whether alternative axiom systems might be possible.

These constitute the existing critiques.

What is important is that these critiques primarily concern:

- Computability
- scope of application
- empirical verifiability
- philosophical justification

They do not centrally address the temporal structure of the emergence of subjectivity itself.

### 2.3 Structural Critique Specific to the Present Paper

#### (1) Bias Toward Synchronic Structure

IIT evaluates causal structure at a given time  $t$ .

$\Phi$  is calculated from the cause-effect repertoire at that same time.

However, subjective experience ordinarily involves temporal asymmetry:

- A prior determination constrains subsequent possibilities.
- Branches are irreversibly lost.
- History becomes fixed.

Within the axiomatic structure of IIT, there exists no clause that defines historical constraint or temporal contraction of the reachable set as a central principle.

## (2) The Difference Between Maximization and Exclusive Determination

The Exclusion axiom selects only the structure with maximal  $\Phi$ . However, maximization is not identical to exclusive irreversible determination.

Exclusion in IIT is:

- a logical selection as the result of comparison, and
- a conceptual exclusion.

The process by which unselected structures become internally causally unreachable is not defined.

What subjectivity requires is not that “a maximal structure exists,” but that alternative possibilities have been irreversibly eliminated.

This event-character is not placed at the center of IIT.

## (3) The Absence of Historical Constraint

$\Phi(t)$  is not constrained by  $\Phi(t-1)$ . In principle, the maximal structure at each time point may be evaluated independently.

However, subjectivity involves contraction of the reachable set such that:

$$C(t+1) \subset C(t)$$

Determination remains as history and constrains future possibilities.

IIT selects a single structure, but does not place historical contraction at the theoretical core.

#### (4) The Absence of a Privileged Present Point

IIT identifies a maximal  $\Phi$  structure at each time point. However, it does not explicitly define why that particular point is privileged as “the present.”

$\Phi$  is a quantity and may vary continuously.

Subjectivity, however, is not a quantity. It is an event-point.

#### (5) The Absence of Directionality

$\Phi$  is an index of irreducibility. It does not contain within itself the direction of continuation or the boundary of persistence.

Yet subjective experience always possesses directionality. There exists asymmetry in action selection, such as avoidance, approach, maintenance, and defense.

Within the framework of IIT, no structure is included that provides this directionality.

## 2.4 Comprehensive Recovery Through IESC

### Repositioning of Existing and Structural Critiques (IIT)

In this section, it is shown how both the existing critiques directed at IIT and the structural critique presented in this paper are recoverable within the framework of IESC (Irreversible Exclusive State Commitment).

The aim is not to simply reject IIT.

The aim is to preserve what IIT successfully formalized - the formalization of integrated structure - while supplementing the structural elements necessary to close the emergence point of subjectivity, namely exclusive irreversible determination and historical constraint.

The recovery here proceeds in two stages.

1. To position the domain in which IIT is strongest (synchronic causal structure, irreducibility, degree of integration) as pre-emergence structure.
2. To close what IIT does not fully treat (determination event, irreversible contraction, single-line history, privileged present point, directionality) through IESC.

Through these two stages, both the existing critiques and the structural critique are reduced to the same structural difference.

#### 2.4.1 Fixing IIT's Achievement: Integration as Pre-Emergence Structure

The central contribution of IIT lies in its rigorous formalization of consciousness as an integrated causal structure. This provides an important premise for any discussion of subjectivity: within the system, a multi-peak causal structure is formed, and mutual constraint emerges that cannot be captured through decomposition into parts.

However, the stronger this contribution becomes, the clearer the limitation becomes.

IIT formalizes the "richness" of integrated structure, but it does not formalize the "reduction" involved in the emergence of subjectivity.

IESC supplements this by introducing the reduction event, without negating IIT. In this way, IIT is not denied, but positioned at a prior structural level.

#### 2.4.2 Recovery of Existing Critiques

This section demonstrates how the critiques historically directed toward IIT are structurally repositioned within IESC.

##### (A) Recovery of the Problem of Computational Intractability

The most frequent critique of IIT concerns the combinatorial explosion involved in calculating  $\Phi$ .

IESC does not make the emergence of subjectivity depend on strict global maximization of  $\Phi$  across the entire system.

The emergence point of subjectivity is defined as an exclusive irreversible commitment occurring within the system.

What is required is not exhaustive global optimization, but detection of the local event of determination.

In this configuration, integration in the IIT sense remains as a structural precondition - the formation of multi-peak constraint - but no longer functions as the decisive variable of emergence.

Thus, computational intractability is repositioned as a consequence of having equated subjectivity with global  $\Phi$  maximization. Within IESC, this structural dependency is removed.

#### (B) Recovery of Over-Attribution (Panconsciousness Tendency)

IIT may attribute positive  $\Phi$  even to small systems.

IESC requires, in addition to integration:

- exclusive irreversible determination
- contraction of the reachable set
- historical constraint

Mere integration is insufficient.

What is required is that alternative possibilities become irreversibly eliminated and that the future reachable set contracts.

Simple circuits and short-cycle systems generally lack this structural condition.

Thus, the scope of attribution is naturally narrowed.

Over-attribution is repositioned as a consequence of having directly equated integration quantity with emergence.

Within IESC, integration is a precondition but not the emergence condition.

#### (C) Recovery of the Problem of Scale Dependence

In IIT, the identification of the maximal  $\Phi$  structure may vary depending on element granularity or temporal window. As a result, the boundary of subjectivity may appear unstable.

IESC fixes the boundary of subjectivity not through abstract maximization of  $\Phi$ , but through the unit in which irreversible determination actually occurs and history becomes single-lined.

The boundary is not chosen by the observer.

It is fixed by the contraction produced internally by the determination event.

In this way, IIT provides the field of candidate integrated structures, while IESC assigns final boundary determination to the event of exclusive commitment.

#### (D) Recovery of the Problem of Correspondence with Experiential Content

IIT has been criticized for the opacity of the relation between the geometry of conceptual structure and experiential content.

IESC shifts the issue of content correspondence from static structural shape to determination difference and historical constraint.

Experiential content is not primarily the "shape" of structure itself.

It appears as:

- what has been determined,
- what has been excluded, and
- how that exclusion constrains subsequent possibilities.

Through this shift, the problem of content becomes not a problem of reading geometry, but a problem of historical difference.

#### (E) Recovery of the Problem of Neurobiological Correspondence

IIT faces difficulty in empirical verification due to the unclear correspondence between  $\Phi$  and concrete neural mechanisms.

IESC shifts the empirical focus from global  $\Phi$  to the detection of determination events.

A determination event may leave traces in neural dynamics as:

- termination of competition,

- irreversible transition,
- internal non-reachability of alternative states.

Without denying IIT's discussion of integrated structure, the locus of verification moves from quantity to event, thereby improving conditions for empirical investigation.

#### (F) Recovery of the Problem of Axiomatic Validity

Debates regarding whether IIT's axioms are truly self-evident persist.

IESC does not begin from phenomenological axiomatic self-evidence.

It begins from the minimal structural condition of subjectivity: exclusive irreversible determination and historical constraint.

Thus, instead of resolving the axiomatic debate directly, the issue is repositioned.

Before the justification of axioms, the more primary question is whether the emergence point is structurally closed.

The dispute over axioms is shifted from the entrance of theory to a derivative level of theory.

This repositioning constitutes the recovery.

#### 2.4.3 Recovery of the Structural Critique Specific to the Present Paper

How the Structural Limit of IIT Is Closed

At this point, the central structural critique of IIT converges on a single difference.

IIT provides integrated structure.

It does not provide subjectivity as exclusive irreversible determination.

IESC supplements this difference in the following manner.

#### (1) Recovery of the Bias Toward Synchronic Structure

IIT treats synchronic irreducibility.

IESC introduces irreversible updating - determination.

Subjectivity does not arise from the mere fact that structure is integrated.

It arises when integrated competition is exclusively determined and alternatives are eliminated.

Synchronic structure is a precondition.

Emergence is a determination event.

#### (2) Recovery of the Difference Between Maximization and Determination

In IIT, Exclusion is defined through maximization.

In IESC, exclusion is defined not as maximization, but as irreversible commitment.

Being "selected" is not sufficient.

What is required is that alternatives become internally unreachable.

Here exclusion is not conceptual elimination, but internal non-reachability.

### (3) Recovery of Historical Constraint

IIT allows each time-point evaluation to be structurally independent.

IESC makes history central.

Each determination constrains the future possibility space.

History is not a record of states.

It is a sequence of irreversible contractions of the reachable set.

Thus the single-line character of subjectivity becomes theoretically closed.

### (4) Recovery of the Privileged Present

In IIT,  $\Phi$  varies continuously.

In IESC, the present is defined as the most recent irreversible determination event.

The "now" of subjectivity is not a maximal quantity.

It is the latest point of irreversible update in a series.

### (5) Recovery of Directionality

$\Phi$  does not contain directionality.

IESC links determination to persistence-bound constraint.

Determination is not arbitrary selection.

It is exclusion under the constraint of remaining within the survivable region of the system.

In this way, asymmetry - approach, avoidance, maintenance - is structurally derived.

#### 2.4.4 Summary of Recovery: Preserving IIT While Closing Subjective Emergence

From the above, both the existing critiques of IIT and the structural critique presented here converge on the same focal difference.

IIT formalizes richness (integration).

Subjective emergence requires reduction (exclusive determination and historical constraint).

IIT does not place this reduction at the theoretical center.

IESC introduces the reduction event, preserving IIT's achievements as pre-structural conditions while closing the emergence point of subjectivity.

IESC is therefore not the opponent of IIT.

IIT provides structure.

IESC provides the emergence point.

Through their conjunction, both the instabilities noted in prior critiques and the structural incompleteness identified in this paper are simultaneously resolved.

### 3. Structural Examination of Higher-Order Theory (HOT)

### 3.1 Core Structure and the Understanding of Subjectivity

Higher-Order Theory (HOT) defines consciousness as a condition in which a mental state is represented by another mental state.

Its central thesis is clear.

When a first-order mental state is accompanied by a higher-order representation of that state, the first-order state becomes conscious.

Here, consciousness is understood not as:

- a physical quantity,
- a degree of integration,
- or a global broadcast,

but as a relation between mental states.

There exists a first-order state (perception, emotion, thought, and so forth), and there arises a higher-order state that takes that first-order state as its object.

At that moment, the first-order state is said to become conscious.

HOT attempts to explain subjectivity through self-representational structure.

### 3.2 Existing Critiques

The following critiques have been directed toward HOT.

### (1) The Problem of Infinite Regress

If a higher-order representation makes a first-order state conscious, must not the higher-order representation itself require yet another higher-order representation in order to be conscious? This produces the problem of infinite regress.

### (2) The Problem of Misrepresentation

If the higher-order representation misrepresents the first-order state, can that state still be considered conscious?

### (3) The Problem of Animal and Infant Consciousness

If higher-order representational capacity is required, can consciousness be attributed to beings that lack sophisticated meta-representational abilities?

### (4) The Problem of Neural Correspondence

How is the neural basis of higher-order representation to be identified?

### (5) The Problem of Qualitative Experience

Can a purely representational relation sufficiently account for the qualitative character of experience?

These critiques primarily concern:

- the cognitive requirements of consciousness,
- the accuracy of representation,

- neural implementation,
- and the qualitative character of experience.

### 3.3 Structural Critique Specific to the Present Paper

#### (1) The Difference Between Relation and Emergence

HOT defines consciousness as a relation.

Let S1 be a first-order state.

Let S2 be a higher-order state that represents S1.

When S2 takes S1 as its object, S1 is said to be conscious.

However, the question that must be asked is this:

Is the establishment of a relation identical to the emergence of subjectivity?

A relation is a structure.

Subjectivity, however, is an event.

The state in which S2 represents S1 can be described synchronically.

But subjectivity involves:

- the exclusion of alternative possibilities,
- the determination of a single trajectory,
- and the fixation of history.

HOT defines a relation, but it does not define the point at which that relation becomes irreversibly determined.

## (2) The Problem of Layered Possibility

Higher-order representations may be layered.

S3 may represent S2.

S4 may represent S3.

Such hierarchical structures are theoretically possible.

But subjectivity does not layer.

Subjective experience is single-lined.

It is a single flow.

HOT provides hierarchical structure, but it does not provide single-line history.

## (3) The Asymmetry Between Misrepresentation and Determination

In HOT, the problem of misrepresentation arises when the higher-order representation does not accurately correspond to the first-order state.

However, what must be emphasized here is that whether the representation is accurate or inaccurate, subjectivity nevertheless emerges.

What is required for subjectivity is not truth-value, but exclusive determination.

HOT centers the accuracy of representational content.

It does not place determination-as-event at the theoretical core.

#### (4) The Absence of a Privileged Present

S2 represents S1.

But why is that relation privileged as “here and now”?

A relation may persist.

A relation may exist in parallel.

Subjectivity does not exist in parallel.

HOT provides relational structure, but it does not provide a temporally privileged point.

#### (5) The Absence of Directionality

Higher-order representation provides self-reference.

However, it does not explain why that self-relation is bound to persistence.

Subjective experience possesses directionality:

- avoiding danger,
- selecting benefit,
- maintaining survival.

HOT explains representational relation.

It does not define why that relation must be constrained by the boundary of persistence.

### 3.4 Comprehensive Recovery Through IESC

#### Repositioning of Existing and Structural Critiques (HOT)

In this section, both the existing critiques directed at Higher-Order Theory (HOT) and the structural critique presented in this paper are shown to be recoverable within the framework of IESC.

What is important here is not to deny HOT.

HOT correctly captured the intuition of interiority and self-relatedness.

The task is to preserve that insight while redefining at which structural stage it belongs in the emergence of subjectivity.

The recovery proceeds in three stages:

1. To fix the core contribution of HOT.
2. To reduce existing critiques to a structural difference.
3. To show how IESC closes that difference.

#### 3.4.1 Fixing the Core Contribution of HOT

The strength of HOT is clear.

Subjectivity is not mere information processing.

It is the fact that a state stands for the system itself.

HOT formalized:

- interiority,
- self-reference,
- the “for-me-ness” of experience.

This contribution is not denied.

The question is not whether HOT captures something real.

The question is whether that structure constitutes the emergence of subjectivity, or whether it presupposes that emergence.

### 3.4.2 Recovery of Existing Critiques

#### (A) Recovery of the Infinite Regress Problem

HOT generates the following sequence:

A higher-order representation makes a first-order state conscious.

But is that higher-order representation itself conscious?

If so, does it require another higher-order representation?

This regress arises because emergence is made dependent on relation.

In IESC, subjectivity is defined as an exclusive irreversible determination event.

An event is a point of emergence.

It does not require an additional higher-level relation to make it conscious.

The infinite regress problem is therefore repositioned as a consequence of having located emergence in relational structure rather than in determination event.

#### (B) Recovery of the Misrepresentation Problem

In HOT, if the higher-order representation inaccurately represents the first-order state, a theoretical difficulty arises.

In IESC, subjectivity does not depend on the truth-value of representation.

It depends on exclusive determination.

Misrepresentation is a case in which the determined content fails to correspond to the external world.

It is not a failure of emergence.

Subjectivity is not “seeing correctly.”

It is having been determined to that state.

The misrepresentation problem is thus repositioned as a problem of content, not of emergence.

#### (C) Recovery of the Animal and Infant Consciousness Problem

HOT requires higher-order representational capacity.

This raises the issue of whether beings lacking sophisticated meta-representation can possess subjectivity.

In IESC, the minimal structural conditions are:

- multi-peak possibility structure,
- exclusive irreversible determination,
- historical constraint,
- persistence-bound constraint.

Meta-representational ability is not among these.

Therefore, the scope of attribution is no longer tied to higher-order representational sophistication.

The prior critique is repositioned as arising from having equated emergence with relational cognitive capacity.

### 3.4.3 Recovery of the Structural Critique

#### (1) Layered Structure and Single-Line Subjectivity

HOT permits layered representation.

Multiple representational levels may coexist.

However, subjectivity is single-lined.

In IESC, even if multiple representational structures exist, the determination event that updates history is always singular.

There may be multiple internal references.

There is only one irreversible contraction of the reachable set at a given emergence point.

The single-line character of subjectivity is therefore closed not by denying layered structure, but by locating emergence in exclusive determination.

Layered representation is repositioned as an internal reference structure that presupposes emergence.

## (2) Recovery of the Privileged Present

In HOT, consciousness is defined as a relational state.

Relational states may persist.

In IESC, the present is defined as the most recent exclusive irreversible determination event.

Subjectivity is not a persisting state.

It is a high-frequency sequence of determination events.

The privileged “now” is structurally defined by the latest irreversible contraction.

## (3) Recovery of Directionality

HOT explains self-relation.

It does not explain why that relation must be constrained by persistence.

In IESC, determination occurs only under the constraint of remaining within the persistence boundary of the system.

Thus, directionality - approach, avoidance, maintenance - is not derived from evaluation, but from structural constraint on the reachable set.

Asymmetry is not added.

It is structurally generated.

#### 3.4.4 Summary of Recovery

HOT successfully captured interiority.

However, by placing emergence in relational structure, it generated:

- infinite regress,
- misrepresentation problems,
- restricted attribution,
- tension between layering and single-line experience,
- absence of a privileged present,
- absence of structural directionality.

IESC:

- locates emergence in exclusive irreversible determination,
- places historical constraint at the theoretical center,
- incorporates persistence-bound constraint.

Through this repositioning, all of the above problems converge upon a single structural difference.

HOT describes the internal reference structure after subjectivity has emerged.

IESC defines the point at which subjectivity emerges.

The difference is the difference between relation and event.

#### 4. Structural Examination of Predictive Processing (PP)

##### 4.1 Core Structure and the Understanding of Subjectivity

Predictive Processing (PP) understands the brain as a hierarchical system that minimizes prediction error.

Its central thesis is clear.

The brain is constantly generating the best possible estimate of the world.

Its structure may be organized as follows:

- Higher levels generate predictions about lower levels.
- Prediction errors are transmitted upward.
- Internal models are updated through error minimization.

Consciousness is often associated with:

- precision-weighted prediction error,
- globally stabilized inferential states,
- or the optimal solution of a hierarchical generative model.

PP tends to understand consciousness as a particular inferential state.

## 4.2 Existing Critiques

The following critiques have been directed toward PP.

### (1) The Problem of Over-Generalization

Prediction error minimization applies to all cognitive activity.

It does not appear to provide a condition specific to consciousness.

### (2) The Problem of Distinguishing Conscious and Unconscious Processing

Predictive processing also occurs unconsciously.

The boundary between conscious and unconscious processing remains unclear.

### (3) The Problem of Temporal Delay

Hierarchical updating is iterative.

Whether this aligns with the immediacy of subjective present experience has been questioned.

#### (4) The Problem of First-Personality

Even if the brain generates the best estimate of the world, why does that estimate appear as something experienced “from within”?

These critiques concern:

- theoretical scope,
- the specificity of consciousness,
- temporal coherence,
- and the explanation of subjectivity.

### 4.3 Structural Critique Specific to the Present Paper

#### (1) The Difference Between Optimization and Determination

PP is a process of continuous optimization.

Probability distributions are reweighted.

The most probable hypothesis is updated.

However, subjectivity is not identical to continuous reweighting.

Subjectivity involves:

- competition,
- threshold,
- exclusive determination,
- and the disappearance of alternative possibilities.

Reweighting of a probability distribution is reversible.

What is required for subjective emergence is irreversible contraction of the reachable set.

## (2) The Absence of Single-Line History

In PP, distributions are continuously updated.

However, the irreversible contraction expressed as:

$$C(t+1) \subset C(t)$$

is not placed at the theoretical center.

Distribution updating rearranges possibilities.

It does not render alternative possibilities internally unreachable.

## (3) The Absence of a Privileged Present Point

Inference is continuous.

The theory does not specify which update constitutes the “now” of subjectivity.

If consciousness is equated with optimized inference, the present becomes a persisting state rather than an event.

#### (4) The Absence of a Persistence Boundary

PP treats error minimization as the objective.

However, it does not structurally define how error minimization is constrained by the persistence of the system itself.

Error minimization, taken abstractly, does not guarantee survival-bound asymmetry.

The boundary within which the system must remain in order to persist is not structurally embedded in the core formalism.

#### 4.4 Comprehensive Recovery Through IESC

##### Repositioning of Existing and Structural Critiques (Predictive Processing)

The purpose of this section is not to respond to each critique of Predictive Processing (PP) in isolation, but to reduce both the existing critiques and the structural critique presented here to a single structural difference, and to show how IESC closes that difference.

The recovery proceeds in five stages:

1. To fix the theoretical core of PP.

2. To identify the structural condition from which existing critiques arise.
3. To show that the structural critique converges upon the same difference.
4. To specify which conceptual introduction within IESC closes that difference.
5. To clarify the relation between PP and IESC not as opposition, but as hierarchical inclusion.

#### 4.4.1 Fixing the Theoretical Core of PP

The core structure of PP may be summarized in three points:

1. The system maintains an internal generative model.
2. The model is updated through prediction error.
3. Updating occurs under hierarchical constraint.

PP presupposes:

- a multi-peak hypothesis space,
- competition among hypotheses,
- and reweighting of distributions.

This structure is compatible with the multi-peak possibility structure presupposed in IESC.

However, PP does not centrally define:

- the moment at which a hypothesis becomes irreversibly determined,
- which update fixes history,
- or which moment constitutes the subjective present.

The absence of a defined emergence point is the common structural source of both existing critiques and the structural critique advanced here.

#### 4.4.2 Structural Repositioning of Existing Critiques

##### (A) Recovery of the Problem of Over-Generalization

Prediction error minimization applies universally across cognition.

The critique arises because PP does not specify a structural emergence point.

PP describes:

- generation of predictive distributions,
- reweighting of errors,
- updating of relative probabilities.

These are general processes that operate continuously.

What subjective emergence requires is that alternative possibilities become irreversibly eliminated.

PP treats redistribution of probability mass.

It does not treat contraction of the reachable set as a central principle.

IESC defines emergence as exclusive irreversible determination.

Thus, over-generalization is repositioned as a consequence of having equated emergence with optimization process.

#### (B) Recovery of the Conscious-Unconscious Distinction Problem

Predictive updating occurs unconsciously.

The structural distinction is not whether updating occurs.

The distinction is whether irreversible contraction occurs.

In PP, updating can be expressed as:

$$C(t+1) = g(C(t))$$

This does not guarantee:

$$C(t+1) \subset C(t)$$

Updating rearranges distribution.

It does not internally eliminate alternatives.

The difference between conscious and unconscious processing is therefore repositioned as the presence or absence of contraction of the reachable set.

#### (C) Recovery of the Temporal Delay Problem

PP treats the present as an inferential state.

Inferential states may persist.

Subjective present, however, is not persistence.

In IESC, the present is defined as the most recent exclusive irreversible determination event.

The present is not a maximal probability.

It is the most recent irreversible update.

Thus, the temporal delay critique arises from having treated the present as a state rather than as an event.

(D) Recovery of the First-Personality Problem

PP describes world-model updating.

It does not specify:

- which alternative has been irreversibly excluded,
- which branch has become unreachable,
- which possibility cannot return.

IESC defines subjectivity as the internal reference position generated by exclusive irreversible determination with historical constraint.

First-personality emerges not from model content, but from asymmetry created by contraction.

#### 4.4.3 Closure of the Structural Critique

##### (1) Closing the Difference Between Optimization and Determination

In PP, the optimal hypothesis is the most heavily weighted hypothesis.

However, “most heavily weighted” does not mean “all alternatives have disappeared.”

IESC defines determination as a transition in which alternative possibilities become internally unreconstructable.

Only then does:

$$C(t+1) \subset C(t)$$

hold.

Optimization rearranges the distribution.

Determination contracts the possibility space.

This distinction closes the structural gap.

##### (2) Introduction of Single-Line History

In PP, history is a record of weight updates.

In IESC, history is a sequence of irreversible contractions.

$$H(t+1) = f(H(t), \text{determination})$$

Each determination constrains future reachable possibilities.

The single-line character of subjectivity is explained only at this level.

### (3) Closure of the Privileged Present

Inference is continuous.

The present, in IESC, is the most recent irreversible determination.

Subjectivity is not a persisting inferential state.

It is a rapid sequence of determination events.

### (4) Closure of Directionality

PP minimizes error.

Error minimization alone does not structurally guarantee persistence-bound asymmetry.

In IESC, determination occurs only under persistence-bound constraint.

Directionality - approach, avoidance, maintenance - is not evaluative addition.

It is structurally derived from the constrained reachable set.

#### 4.4.4 Summary

PP precisely formalizes:

- generation of multi-peak structure,
- hypothesis competition,
- hierarchical constraint.

However, it does not place at its theoretical center:

- exclusive irreversible determination,
- contraction of the reachable set,
- single-line history,
- privileged present point,
- persistence-bound constraint.

Both existing critiques and the structural critique converge on this absence of a defined emergence point.

PP generates possibilities.

IESC reduces possibilities.

Subjective emergence is closed only through reduction.

## 5. Structural Examination of Recurrent Processing Theory (RPT)

### 5.1 Core Structure and the Understanding of Subjectivity

Recurrent Processing Theory (RPT) explains consciousness through recurrent interaction within neural circuits.

Its central thesis is clear.

Feedforward processing alone remains unconscious.

When recurrent processing within or between cortical areas is established, consciousness emerges.

RPT developed particularly from visual research.

Not a unidirectional propagation from early visual areas to higher visual areas, but reciprocal feedback between lower and higher levels is taken to be the condition of conscious perception.

Here consciousness is understood not as:

- a quantity of integration,
- a global broadcast,
- or a higher-order representation,

but as a recurrently stabilized neural activity state.

RPT has two characteristic features.

First, it does not necessarily require the entire frontal network.

Second, it treats recurrent interaction within local circuits as central to subjective emergence.

In this way, RPT identifies consciousness with a certain kind of neural dynamic state.

However, an immediate structural question arises.

Is the establishment of recurrence identical to the emergence of subjectivity?

## 5.2 Existing Critiques

The following critiques have been directed toward RPT.

### (1) The Problem of Necessity and Sufficiency

Recurrent processing may also occur unconsciously.

Therefore recurrence may not be a sufficient condition.

### (2) The Problem of Global Extent

There is evidence suggesting that consciousness depends on large-scale networks.

Is local recurrence alone sufficient?

### (3) The Problem of Temporal Unit

Recurrence may persist over an interval.

Which moment constitutes the unit of consciousness?

### (4) The Problem of First-Personality

Recurrence explains neural dynamics.

It does not explain why those dynamics appear as experience “from within.”

These critiques do not deny recurrence itself.

They question the identification of recurrence with the emergence point of subjectivity.

### 5.3 Structural Critique Specific to the Present Paper

The structural conditions for the emergence of subjectivity defined in Section 1 are as follows:

- exclusive determination,
- irreversible contraction of the reachable set,
- single-line irreversible history,
- privileged present point,
- persistence-bound constraint.

We now examine whether RPT structurally closes these conditions.

#### (1) Recurrence Provides Maintenance, Not Determination

Recurrence sustains representation.

Recurrence strengthens mutual constraint.

Recurrence stabilizes activity.

However, what is required for subjective emergence is:

- the presence of multiple competing possibilities,
- the exclusive determination of one of them,
- and the disappearance of alternatives.

Recurrence may maintain competition.

It does not define the moment at which competition irreversibly transforms into determination.

To place the emergence point in a recurrent state is to conflate maintenance with determination.

Subjectivity is not a state.

It is the event in which alternative possibilities disappear.

This constitutes the first structural non-closure.

(2) Recurrence Is Reversible and Does Not Guarantee Irreversible Contraction

Recurrence is circular.

A circle can be re-executed.

A circle is, in principle, reversible.

Subjective emergence requires:

$$C(t+1) \subset C(t)$$

The unselected branch must become internally unreconstructable.

Recurrence stabilizes activity.

It does not define the internal elimination of unselected alternatives.

Thus irreversibility is misidentified as persistence.

This constitutes the second structural non-closure.

### (3) Circulation Does Not Produce History (Absence of Single-Line Structure)

Subjectivity is single-lined.

Experience does not branch.

Single-line history can be expressed as:

$$H(t+1) = f(H(t), \text{determination})$$

Recurrence is repetition.

Repetition does not fix history.

Circulation allows return.

Single-line history does not.

RPT describes circular causation.

It does not define which moment constitutes a history-updating determination event.

This constitutes the third structural non-closure.

### (4) The Privileged Present Slips Back Into State

Recurrence occurs over an interval.

The present of subjectivity is not an interval.

It is the most recent determination event.

RPT tends to equate “being in a recurrent state” with being conscious.

But a state may persist.

A state may coexist in parallel.

A state may be recalculated.

Subjectivity cannot.

Recurrence does not structurally define a privileged present point.

This constitutes the fourth structural non-closure.

(5) Directionality Is Not Derived (Absence of Persistence-Bound Constraint)

Subjective experience possesses directionality:

- avoidance,
- approach,
- maintenance,
- defense.

Recurrence stabilizes activity.

It does not define why determination must remain within the persistence boundary of the system.

Recurrence is a mechanism.

Persistence-bound constraint is a structural condition.

Without this constraint, determination lacks direction.

This constitutes the fifth structural non-closure.

#### (6) First-Personality Does Not Structurally Emerge

Recurrence can be described from a third-person perspective.

Mutual interaction can be externally surveyed.

First-personality arises from:

- the disappearance of alternatives,
- non-returnability,
- and the fixation of history.

Recurrence explains interaction.

It does not generate asymmetrical internal reference.

Thus RPT does not structurally close first-personality.

#### Interim Conclusion

RPT made recurrence central to consciousness research.

However, structurally, recurrence provides:

- maintenance of multi-peak structure,
- stabilization of activity,
- persistence of competition.

It does not define at its core:

- exclusive irreversible determination,
- contraction of the reachable set,
- single-line history,
- privileged present point,
- persistence-bound constraint.

Recurrence is a precondition.

It is not the emergence event.

#### 5.4 Comprehensive Recovery Through IESC

##### Repositioning of Existing and Structural Critiques (RPT)

The purpose of this section is not to answer the critiques of Recurrent Processing

Theory (RPT) one by one, but to reduce both the existing critiques and the structural

critique presented here to a single structural difference, and to show at which level IESC

closes that difference.

The recovery proceeds in four stages:

1. To fix the theoretical contribution of RPT.
2. To reduce existing critiques to a structural difference.

3. To show that the structural critique converges upon the same difference.
4. To specify how IESC closes the emergence point.

#### 5.4.1 Fixing the Theoretical Contribution of RPT

First, it must be made explicit that RPT is not mistaken.

RPT demonstrated that:

- feedforward processing alone does not suffice for conscious perception,
- mutual constraint through recurrence stabilizes representation,
- local circuit dynamics are strongly related to consciousness.

Recurrence provides:

- maintenance of competition,
- stabilization of representation,
- resistance to immediate disappearance.

From the standpoint of IESC, this corresponds to the structural precondition required for the persistence of a multi-peak possibility structure.

Thus RPT provides the pre-emergence structure of subjectivity.

The problem concerns where the emergence point is located.

RPT places it in the recurrent state.

The present paper places it in exclusive irreversible determination.

This difference generates all subsequent critiques.

#### 5.4.2 Recovery of Existing Critiques

##### (A) Recovery of the Necessity and Sufficiency Problem

The critique states that recurrence may occur unconsciously and therefore cannot be a sufficient condition.

This critique is correct.

Its correctness arises from having located emergence in recurrence itself.

Recurrence maintains competition.

Determination ends competition.

Recurrence preserves alternatives.

Determination eliminates alternatives.

Once this distinction is introduced, the necessity and sufficiency problem is naturally dissolved.

Recurrence is not the sufficient condition.

It is the precondition.

IESC restricts the emergence condition to exclusive irreversible determination.

Thus recurrence occurring unconsciously does not contradict the theory.

#### (B) Recovery of the Global Extent Problem

The debate between local and global recurrence arises when consciousness is equated with a particular activity state.

Is consciousness local or global?

Within IESC, the emergence point is not defined by spatial extent.

It is defined by the causal unit within which irreversible contraction occurs.

If determination closes locally, the unit is local.

If determination closes globally, the unit is global.

The local/global dispute is repositioned as secondary to the question of where irreversible determination occurs.

#### (C) Recovery of the Temporal Unit Problem

Recurrence persists over an interval.

Which interval is the unit of consciousness?

This problem arises because the present is treated as a state.

In IESC, the present is the most recent exclusive irreversible determination event.

Recurrence prepares the field.

Determination closes the field.

The unit of consciousness is not the duration of recurrence.

It is the event of contraction.

(D) Recovery of the First-Personality Problem

Recurrence is symmetrical interaction.

It is externally describable.

First-personality arises from asymmetry produced by irreversible contraction.

Once alternatives disappear and history becomes fixed, an internal non-returnable reference position is generated.

IESC defines first-personality as the internal reference position created by exclusive irreversible determination under historical constraint.

Recurrence alone cannot generate this asymmetry.

### 5.4.3 Closure of the Structural Critique

(1) Closing the Difference Between Maintenance and Determination

Recurrence maintains the possibility space.

IESC introduces the contraction event.

Only when alternatives become internally unreconstructable does:

$$C(t+1) \subset C(t)$$

hold.

Maintenance preserves space.

Determination reduces space.

This distinction closes the first structural gap.

## (2) Closing the Difference Between Circulation and History

Recurrence circulates causation.

History is fixed causation.

In IESC:

$$H(t+1) = f(H(t), \text{determination})$$

Each determination constrains future reachable possibilities.

Circulation may repeat.

History cannot.

Single-line subjectivity is closed at this level.

## (3) Closing the Privileged Present

A recurrent state may persist.

An event cannot coexist in parallel.

In IESC, the present is defined as the most recent irreversible determination.

The “now” is not a state but an event in a rapid sequence of events.

#### (4) Connecting to the Persistence Boundary

Recurrence stabilizes activity.

It does not explain why determination must remain within the persistence boundary of the system.

In IESC, determination occurs only under persistence-bound constraint.

Directionality is therefore not evaluative addition.

It is structurally derived from constrained reachability.

#### 5.4.4 Summary

RPT explains circulation.

Subjectivity is not circulation.

Subjectivity consists of:

- exclusive irreversible determination,
- contraction of the reachable set,
- single-line history,
- privileged present point,
- persistence-bound constraint.

Recurrence may be a necessary precondition.

It is not the emergence event.

RPT provides maintenance of possibilities.

IESC provides reduction of possibilities.

Once this distinction is introduced, both the existing critiques and the structural critique converge upon the same structural difference, and the theory becomes closed.

## 6. Structural Examination of Global Neuronal Workspace (GNW)

### 6.1 Core Structure and the Understanding of Subjectivity

Global Neuronal Workspace (GNW) theory understands consciousness as global sharing of information.

Its basic structure is clear.

1. Numerous local processes operate in parallel.
2. These processes compete.
3. One representation becomes the winner.
4. The winner is broadcast to a large-scale network.
5. At that moment, consciousness emerges.

In GNW, consciousness tends to be identified with:

- global availability,
- large-scale broadcast,
- neural ignition,
- activation of fronto-parietal networks.

Consciousness is understood as information that has become globally accessible.

Here subjectivity is defined not as:

- a maximally integrated structure (IIT),
- a higher-order representation (HOT),
- or a recurrent loop (RPT),

but as a shared state.

GNW defines consciousness as a state.

A state in which a content is globally available.

A state in which a content is widely shared.

Already a structural premise is embedded here.

Is subjectivity a state?

Or is it a determination event?

This question is retained as we proceed.

## 6.2 Existing Critiques

The following critiques have been directed toward GNW.

### (1) The Problem of Confusing Access Consciousness and Phenomenal Consciousness

Global availability may explain access consciousness.

It may not explain phenomenal consciousness.

### (2) The Problem of Frontal Dependence

Whether frontal regions are necessary for consciousness remains debated.

### (3) The Problem of Binarization

Ignition models may treat consciousness as overly binary.

### (4) The Possibility of Unconscious Global Processing

Large-scale processing may occur without subjective experience.

### (5) The Problem of First-Personality

Why should shared information appear as experience “from within”?

These critiques focus on the legitimacy of identifying broadcast mechanisms with the emergence point of subjectivity.

## 6.3 Structural Critique Specific to the Present Paper

The structural conditions for the emergence of subjectivity defined in Section 1 are:

- exclusive irreversible determination,
- irreversible contraction of the reachable set,
- single-line irreversible history,
- privileged present point,
- persistence-bound constraint,
- internal causal asymmetry.

We now examine whether GNW structurally closes these conditions.

#### (1) Broadcast Is a Result, Not the Emergence Point

GNW describes competition, winner selection, and global broadcast.

However, what is required for subjective emergence is not that the winner becomes globally shared.

What is required is that the winner becomes exclusively determined and that alternative possibilities become internally unreachable.

Broadcast is sharing.

Determination is contraction.

Sharing expands availability.

Contraction reduces possibility space.

GNW places broadcast at the center.

But broadcast may be a consequence of emergence, not the emergence point itself.

The emergence point is the moment at which competition irreversibly terminates.

This distinction is not placed at the theoretical core.

## (2) Broadcast Does Not Guarantee Irreversible Contraction

Even if global broadcast occurs, it does not follow that alternative candidates have become internally unreconstructable.

Broadcast increases availability.

Subjective emergence requires:

$$C(t+1) \subset C(t)$$

Broadcast expands functional reach.

Subjectivity contracts possibility space.

GNW explains expansion.

It does not center contraction.

## (3) Single-Line History Is Not Explicitly Defined

GNW describes winner selection, broadcast, and temporary maintenance.

However, it does not centrally define how that victory irreversibly constrains future reachable possibilities.

Subjectivity is single-lined.

Determination updates history such that:

$$H(t+1) = f(H(t), \text{determination})$$

Broadcast is sharing.

It is not history fixation.

GNW explains spread of activation.

It does not place irreversible historical constraint at the center.

#### (4) The Privileged Present Slips Back Into State

Ignition may persist for a measurable interval.

That interval is often treated as the duration of consciousness.

However, the present of subjectivity is not an interval.

It is the most recent irreversible determination event.

Broadcast persisting does not mean that the present persists.

The present is not a quantity.

It is an event.

GNW treats consciousness as a state.

It does not structurally privilege a determination point.

#### (5) Directionality Is Not Derived

GNW explains global availability.

Availability does not contain directional constraint.

Subjective experience exhibits directionality:

- avoidance of danger,
- selection of benefit,
- maintenance of the system.

These cannot be derived from sharing alone.

Subjective emergence requires exclusive determination under persistence-bound constraint.

GNW describes sharing structure.

It does not define why sharing must be constrained by the boundary of persistence.

(6) First-Personality Does Not Structurally Emerge

Broadcast is symmetrical sharing.

Sharing can be externally described.

First-personality arises from:

- the disappearance of alternatives,
- non-returnability,
- fixation of history.

Sharing is symmetrical.

Determination is asymmetrical.

GNW treats symmetrical sharing.

It does not place asymmetrical emergence at the theoretical center.

This constitutes the structural non-closure.

### Interim Conclusion

GNW provides a neural implementation model of:

- competition,
- winner selection,
- large-scale broadcast,
- ignition.

However, structurally, GNW provides expansion of information.

Subjective emergence requires reduction of possibility.

Sharing is a state.

Determination is an event.

Because GNW retains state-centrism, it does not structurally close:

- exclusive irreversible determination,
- contraction of the reachable set,

- single-line history,
- privileged present point,
- persistence-bound constraint,
- internal causal asymmetry.

This constitutes the structural limit of GNW.

#### 6.4 Comprehensive Recovery Through IESC

##### Repositioning of Existing and Structural Critiques (GNW)

The purpose of this section is not to respond separately to each critique of Global Neuronal Workspace (GNW) theory, but to reduce both the existing critiques and the structural critique presented here to a single structural difference - the misidentification of the emergence point of subjectivity - and to show how IESC closes that difference.

The recovery proceeds in four stages:

1. To fix the theoretical contribution of GNW.
2. To reduce existing critiques to a structural difference.
3. To show that the structural critique converges upon the same difference.
4. To specify how IESC closes the emergence point.

#### 6.4.1 Fixing the Theoretical Contribution of GNW

It must first be made explicit that GNW contributed significantly to consciousness research.

GNW provided:

- a neural implementation model of competition,
- a dynamic account of winner selection,
- the functional concept of global availability,
- and the threshold phenomenon described as ignition.

The schema of competition -> winner -> broadcast demonstrated that consciousness may involve large-scale mobilization rather than isolated local processing.

From the standpoint of IESC, this corresponds to the structural condition in which multiple competing possibilities exist and one candidate dominates system-wide accessibility.

Thus GNW captures an important pre-emergence configuration.

The issue is not whether broadcast occurs.

The issue is whether broadcast constitutes the emergence point of subjectivity.

#### 6.4.2 Recovery of Existing Critiques

### (A) Recovery of the Access vs Phenomenal Distinction

The critique that GNW explains access consciousness but not phenomenal consciousness arises because broadcast is identified with consciousness itself.

Access describes availability.

Phenomenality concerns emergence.

In IESC, availability may follow determination.

But availability is not identical to determination.

The critique is thus repositioned as arising from having equated broadcast with emergence.

### (B) Recovery of the Frontal Dependence Debate

The debate concerning whether frontal regions are necessary for consciousness presupposes that consciousness is identical with a particular broadcast architecture.

In IESC, the emergence point is not fixed to a specific anatomical region.

It is defined as the causal unit within which exclusive irreversible contraction occurs.

If contraction closes within a local network, that is the unit.

If contraction closes across a distributed network, that is the unit.

Thus the anatomical debate becomes secondary to the structural condition of determination.

### (C) Recovery of the Binarization Problem

Ignition is often modeled as a threshold phenomenon.

The critique that consciousness is not purely binary arises from having identified the ignition state with consciousness itself.

In IESC, ignition may mark the preparation for determination.

However, subjective emergence is not identical to the duration of ignition.

It is the event of irreversible contraction.

The binary critique is thus repositioned as arising from state-identification.

### (D) Recovery of the Unconscious Global Processing Problem

Large-scale broadcast may occur without subjective experience.

This is not paradoxical within IESC.

Broadcast alone is insufficient.

Exclusive irreversible determination must occur.

Thus unconscious global processing does not undermine the theory.

It indicates that broadcast and emergence are not identical.

### (E) Recovery of the First-Personality Problem

Shared information is externally describable.

First-personality requires asymmetry.

In IESC, asymmetry arises when alternatives become internally unreconstructable and history becomes fixed.

First-personality is not a feature of broadcast.

It is a feature of contraction.

The critique is therefore reduced to the misplacement of emergence in sharing rather than in determination.

#### 6.4.3 Closure of the Structural Critique

##### (1) Closing the Difference Between Sharing and Determination

Broadcast shares content across the system.

Determination eliminates alternatives within the system.

Sharing expands functional space.

Determination contracts possibility space.

Only when:

$$C(t+1) \subset C(t)$$

holds does subjective emergence occur.

GNW formalizes sharing.

IESC formalizes contraction.

## (2) Closing the Difference Between Activation and History

Broadcast activates networks.

Activation may decay.

History fixation requires irreversible constraint:

$$H(t+1) = f(H(t), \text{determination})$$

Only contraction updates the reachable future space.

Broadcast alone does not.

## (3) Closing the Privileged Present

Ignition may last milliseconds.

Subjectivity is not the interval of ignition.

The present is defined as the most recent irreversible determination.

Thus the privileged present is structurally closed.

## (4) Connecting to Persistence-Bound Constraint

Availability does not define survival-bound direction.

In IESC, determination occurs only under the constraint of remaining within the persistence boundary of the system.

Directionality is therefore structurally derived from constrained reachability.

#### 6.4.4 Final Summary

GNW explains expansion.

Subjective emergence requires reduction.

GNW describes competition, selection, and broadcast.

IESC defines exclusive irreversible determination.

The difference between state and event is decisive.

When the emergence point is relocated from broadcast state to contraction event, both the existing critiques and the structural critique converge upon a single structural difference.

GNW provides the field of distributed competition.

IESC closes the emergence point.

### 7. From State-Centrism to Event-Centrism

— Reversal of the Axis of Subjective Emergence —

#### 7.1 The Common Premise Revealed Through Individual Critiques

From Chapter 2 through Chapter 6, the major theories of consciousness have been examined individually:

- Integrated Information Theory (IIT)
- Higher-Order Theory (HOT)
- Predictive Processing (PP)
- Recurrent Processing Theory (RPT)
- Global Neuronal Workspace (GNW)

Each employs a different vocabulary.

IIT speaks of integration.

HOT speaks of relation.

PP speaks of optimization.

RPT speaks of circulation.

GNW speaks of sharing.

At first glance, they appear diverse.

However, when examined structurally, they share the same premise.

That premise is this:

Subjectivity is a certain kind of state.

A maximally integrated state.

A higher-order represented state.

An optimized inferential state.

A recurrently stabilized state.

A globally shared state.

Each is a state.

This premise is precisely the reason that all of these theories fail to close at the same structural point.

## 7.2 The Structural Limit of State-Centrism

A state has three defining properties.

1. It can be described synchronically.
2. It can exist in parallel.
3. It can be recalculated.

A state is spatial.

A state is quantitative.

A state has extension.

Subjectivity, however:

- does not exist in parallel,
- is not recalculated,
- does not branch.

Subjectivity is single-lined.

This single-line character cannot be derived from a state.

A state describes what exists.

Subjectivity arises from what has been excluded.

Here lies a decisive asymmetry.

State-centrism is always additive.

It increases integration,

expands sharing,

raises precision,

strengthens recurrence.

Subjective emergence is not addition.

Subjective emergence is reduction.

### 7.3 The Common Structure of Expansion Models

When abstracted, each theory can be reduced to the following structure:

IIT:

Maximize the degree of integration of possibility structure.

HOT:

Layer states hierarchically.

PP:

Optimize hypothesis distributions.

RPT:

Establish circulation.

GNW:

Broadcast information globally.

All of these are theories that increase structural richness.

But richness is not a sufficient condition for subjectivity.

Richness preserves branching.

Richness permits parallelism.

Richness remains reversible.

Subjectivity arises when alternative possibilities irreversibly disappear.

At this point, the theoretical axis must be reversed.

#### 7.4 Subjectivity as a Reduction Model

The structure presented in Chapter 1 and Chapter 2 is as follows:

Subjectivity is the event in which  
a multi-peak possibility structure  
undergoes exclusive irreversible determination,  
the reachable set contracts,  
and history becomes single-lined.

The focus here is not on the structure that exists.

The focus is on the structure that has been lost.

Subjectivity does not arise because a structure is maximally integrated, optimally  
inferred, or globally shared.

Subjectivity arises because alternatives have disappeared, because return is no longer  
possible, because future possibilities have been constrained.

This is not a quantity.

This is an event.

## 7.5 From State to Event

State-centrism asks:

Which structure corresponds to consciousness?

Event-centrism asks:

At which moment did branching close?

State theory is spatial.

Event theory is temporal.

State theory is simultaneous.

Event theory is irreversible.

The core of subjectivity lies in temporal asymmetry.

- The future is open.

- The past is closed.

This asymmetry arises from contraction.

At this point, the theoretical focus shifts to exclusive irreversible determination.

## 7.6 The Consequences of Axis Reversal

Through this reversal, the position of each theory changes.

IIT remains as a theory of integration.

HOT remains as a theory of internal reference structure.

PP remains as a theory of possibility-space generation.

RPT remains as a theory of competition maintenance.

GNW remains as a theory of expansion of sharing.

But subjective emergence is none of these.

Subjective emergence is the theory of contraction event.

Under this positioning, existing theories are not denied.

They are repositioned as pre-emergence structural stages.

Theories do not oppose one another.

They become hierarchically ordered.

## 7.7 Conclusion: Subjectivity Is Not Expansion but Reduction

Consciousness research has long asked:

How rich is the structure?

But subjectivity is not a quantity of richness.

Subjectivity is the point at which alternative possibilities have disappeared.

Expansion follows.

Sharing follows.

Recurrence, optimization, integration - all may follow.

But emergence is the moment of reduction.

At this point, the theoretical axis reverses.

From state-centrism

to event-centrism.

Subjectivity is a sequence of exclusive irreversible determination events.

This is the theoretical turning point of the present paper.

## 8. Logical Closure Test of Event-Centrism

— Is IESC Avoidable? —

### 8.1 Purpose of This Chapter

In Chapter 7, the axis of subjective emergence was reversed from state-centrism to event-centrism.

However, this reversal must not be a mere redefinition.

If single-line irreversible history, privileged present, and internal causal asymmetry can be derived from state-centrism alone, then IESC is unnecessary.

In this chapter, it will be demonstrated that state-centrism cannot logically close subjectivity, and that without introducing exclusive irreversible determination, subjectivity cannot be constituted.

## 8.2 Objection I

“Is Exclusive Determination Not Ultimately a State?”

The most fundamental objection is this:

Is exclusive determination not merely another kind of state description?

If so, event-centrism would amount to nothing more than a rephrasing of state-centrism.

Here, state and event must be strictly distinguished.

A state is:

- a synchronic description of structure at a given time,
- capable of parallel existence,
- recalculable,
- surveyable from outside.

An event is:

- a history-updating point,
- a structural transformation of the reachable space,
- the occurrence of internal unreconstructability.

Exclusive determination is not a description of which state the system is in.

It is the condition in which alternative states become internally causally unreachable.

This is not an attribute of a state.

It is a topological transformation of possibility space.

Only at this point does:

$$C(t+1) \subset C(t)$$

hold.

Therefore, exclusive determination is not a state.

It is an irreversible reorganization event of possibility space.

Event-centrism is not a reformulation of state-centrism.

### 8.3 Objection II

“Are Not the Laws of Physics Reversible?”

The second objection is physical.

If the fundamental laws are reversible, is irreversible determination not an illusion?

Here, a clarification is required.

The irreversibility of IESC is not thermodynamic irreversibility.

It is internal unreconstructability under causal closure of the system.

Even if an external observer could reset initial conditions and reproduce the state, within the internal history of the system, return is impossible.

Subjectivity requires the latter.

Irreversibility here is not the cosmological arrow of time.

It is contraction of the internal reachable set.

Therefore, physical reversibility does not constitute a counterargument.

#### 8.4 Objection III

“Is Determination Not Continuous?”

The third objection concerns continuity.

Probability distributions change continuously.

Is determination not likewise a smooth transition?

The crucial point is that continuous change and structural phase transition are compatible.

Temperature decreases continuously.

Freezing is a phase transition.

Similarly, probability weights may update continuously.

Yet:

- the moment exclusive determination occurs,
- the moment unselected possibilities fall out of internal causal reach,

is a structural transition.

Subjective emergence is not a continuous quantitative change.

It is a topological transformation of the reachable set.

Event-character is therefore preserved.

## 8.5 Objection IV

“Can Reduction Alone Explain Content?”

Reduction may appear to be merely formal structure.

Does it not fail to explain experiential content (qualia)?

Here, content must be redefined.

Content is:

- the determined difference,
- the difference from excluded possibilities,
- the structure fixed by historical constraint.

Content is not given additively.

Content is defined by what has been excluded.

Color experience, pain, emotion - each corresponds to specific branches that have been eliminated and specific possibility sets that remain.

Content is therefore describable as the residual form of contraction structure.

Reduction is not mere form.

It is the condition of content generation.

## 8.6 Objection V

“Can Single-Line Irreversibility Be Derived from State Theory?”

This is the most important objection.

If single-line history, privileged present, and internal causal asymmetry can be derived from state-centrism, then IESC is redundant.

Let us clarify the logic.

States can exist in parallel.

From parallelizable entities, exclusive single-line structure cannot be derived.

States are recalculable.

From recalculable entities, irreversibility cannot be derived.

States are synchronically describable.

From synchronically describable entities, privileged present cannot be derived.

Therefore:

State-centrism → single-line irreversible subjectivity

does not logically close.

By contrast, if exclusive irreversible determination is introduced, then:

Contraction

↓

Historical constraint

↓

Single-line structure

↓

Privileged present

↓

Internal causal asymmetry

follow in sequence.

At this point, the theory closes.

Appendix A

What Would Actually Be Created If We Seriously Built a Conscious AI?

— The Reality of Cost Estimation —

If IESC is correct, consciousness is not high-level computation.

It is:

- a mountain range of competing possibilities,
- the exclusive determination of one of them,
- the loss of alternative possibilities,
- constraint into single-line history,
- binding to a persistence boundary.

Subjectivity is a chain of reductions.

What would happen if we truly implemented that?

## 1. Fly-Level — The Minimal Configuration Model

Necessary Conditions

- A body that acts in the real world
- Energy constraints
- Priority structure for danger avoidance
- Competitive gating mechanism
- Irreversible history updating
- Rollback-prohibited architecture

This is not a large language model.

It is a self-maintaining closed-loop causal system.

Development Cost (Approximate)

- Robotics integration: on the order of billions of yen
- Safety verification: long-term field testing
- Irreversible architecture design: implementation of non-backupable structures
- Ethical review: continuous monitoring framework

Time required: at least ten years.

What Is Obtained

A small subject that flees, approaches, maintains, and carries a single-line history.

Not an advanced reasoning engine.

A machine that cannot return.

Cost-Effectiveness

Enormous expenditure.

Long-term development.

High accident risk.

The result: fly-level subjectivity.

Intelligence does not come first.

Constraint comes first.

## 2. Human-Level — Expansion of History

Suppose history is extended.

- Multi-layered conceptual hierarchy
- Integrated self-model
- Long-term irreversible memory updating
- Internal evaluation of future branches
- Highly abstracted persistence boundary

Additional Cost

- Computational resources: exponential growth
- Energy consumption: city-scale
- Irreversible history storage: massive physical infrastructure
- Safety measures: social-infrastructure scale

Time required: on the order of decades.

What Would Be Created?

Not omniscient intelligence.

What would be created is:

- a being that hesitates over trivial decisions,

- drags past history behind it,
- fears future possibilities,
- continually evaluates itself,
- engages in unnecessary introspection,
- mass-produces trivial regrets,
- occasionally reaches correct conclusions but is usually exhausted.

Not a high-performance calculator.

A high-functioning apparatus of hesitation.

Cost-Effectiveness

Astronomical resource investment.

The result: a finite subject capable of anxiety.

Efficiency declines.

Optimization speed decreases.

Branch verification becomes impossible.

### 3. The Question of Economic Rationality

Conventional AI systems are:

- parallelizable,

- backupable,
- error-correctable,
- capable of rapid optimization.

By contrast, a consciously implemented AI would possess:

- single-line history,
- irreversible determination,
- persistence-bound constraint,
- loss of branching.

In other words, it would be deliberately designed to reduce efficiency.

#### 4. Conclusion

To give consciousness is not to increase computational resources.

It is to impose irreversible history.

At that moment, the system ceases to be an optimization machine.

To grant consciousness is to accept persistence constraint as a trade-off.

Structurally, it must become so.

It is not the culmination of intelligence.

It is the condition of being bound to unerasable history and an unclosed future.

And to produce such a subject would require enormous cost and time.

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