A Structural Interpretation of Transactional Entropic Gravity within Collapse-Selection Frameworks

Stephen Garner

April 26, 2026

Abstract

The Relativistic Transactional Interpretation (RTI), combined with entropic gravity, provides a compelling framework in which spacetime and gravitational structure emerge from quantum-level processes[1]. In this work, we present a structural interpretation of this framework within a broader class of collapse-selection ontologies. Rather than modifying or challenging the RTI approach, we situate it within a generalized generative structure in which observable reality arises through selection under constraint. This perspective clarifies the relationship between generative processes and descriptive structure, distinguishes between mechanism and admissibility, and provides a unified interpretation of spacetime emergence, entropy, and gravitational phenomena.

1 Introduction

Modern physics provides highly successful descriptions of structure across domains, yet often leaves unresolved the question of how such structure arises. Quantum mechanics describes probabilistic evolution, general relativity describes geometric structure, and thermodynamics describes statistical regularities. However, the generative origin of stable structure remains an open problem.

The Relativistic Transactional Interpretation (RTI), combined with entropic gravity, offers a promising approach. In this framework, spacetime is not fundamental, but emerges from interactions among quantum systems.

The goal of this paper is to provide a structural interpretation of this framework within a broader class of collapse-selection models, clarifying its role as a specific realization of a more general generative pattern.

The central claim of this paper is that the transactional framework realizes a specific instance of a more general generative pattern, in which observable structure emerges as invariant residue under selection and constraint.

2 Overview of Transactional Entropic Gravity

The RTI framework proposes:

- A pre-spatiotemporal quantum substratum,
- Offer and confirmation processes between emitters and absorbers,
- Transactions as non-unitary processes that actualize events,

- Spacetime as a structured set of emission and absorption events connected by photon exchange.

In this view, spacetime is not a container, but an emergent relational structure constructed from actualized interactions.

Entropic gravity extends this picture by associating entropy with these interactions, leading to the emergence of gravitational behavior as a consequence of informational structure.

3 Relational Interpretation of Spacetime

Within RTI, spacetime is understood relationally:

> Spacetime does not exist independently, but emerges from interactions among physical systems.

This aligns with a broader relational view in which space and time serve as parameters describing relations among objects rather than independent entities.

RTI identifies the emergence of spacetime from interactions, but does not explicitly formalize the distinction between generative processes and descriptive structure. This motivates a more explicit structural framework.

4 Collapse-Selection Framework

We introduce a minimal structural framework:

- Σ: relational configuration space,
- $A \subset \Sigma$: admissible configurations,
- $\Phi : \Sigma \to \Sigma$: collapse-selection operator,
- $\mathrm{Fix}(\Phi)$: invariant structure,
- $P : \Sigma \to O$: projection to observable structure.

This induces a generative–descriptive hierarchy:

$$\Sigma \to A \xrightarrow{\Phi} \mathrm{Fix}(\Phi) \xrightarrow{P} O \tag{1}$$

Observable structure arises not from generation alone, but from selection under constraint followed by projection.

5 Mapping RTI into Collapse-Selection Structure

The RTI framework maps naturally into this structure:

RTI Concept	Collapse-Selection Interpretation
Quantum substratum	Σ
Offer/confirmation waves	admissible relational possibilities
Transaction	collapse-selection event Φ
Actualized transaction	invariant configuration
Photon exchange	constraint channel
Spacetime event	projected observable residue
Spacetime manifold	$P(\Sigma)$

Thus, transactions may be understood as admissibility-selecting collapse events whose invariant residues constitute spacetime structure.

6 Alignment of Frameworks

The RTI and collapse-selection frameworks share several key features:

- Spacetime is not fundamental,
- Structure emerges from interaction,
- Stability arises through selection,
- Classical structure reflects persistence under constraint.

This alignment supports the interpretation of RTI as a concrete realization of a more general generative principle.

7 Structural Clarifications

The collapse-selection framework makes explicit several distinctions:

7.1 Generation vs Description

RTI identifies transactions as generating spacetime, but does not fully separate generative processes from descriptive structure.

Collapse-selection distinguishes:

- generation (collapse-selection),
- projection (observation),
- description (formal representation).

7.2 Admissibility vs Mechanism

RTI specifies a mechanism (transactions), while collapse-selection emphasizes admissibility:

What structures are allowed to persist under constraint?

7.3 Projection and Information Loss

Projection $P : \Sigma \to O$ is generally non-injective, meaning:

- multiple configurations map to the same observable,
- generative detail is lost,
- inversion is not possible.

This clarifies the limits of observable structure.

This non-injectivity ensures that observable structure cannot uniquely determine the underlying generative configuration.

8 Entropic Gravity Reinterpreted

Within this framework:

- entropy measures structure over invariant configurations,
- gravitational effects arise from statistical organization of these structures,
- entropic gravity reflects post-selection descriptive behavior.

Thus, entropic gravity is interpreted as:

> A statistical description of collapse-stable structure under constraint.

9 Interpretive Consequences

9.1 Spacetime

Spacetime is not generated directly by interaction, but emerges as:

> The projected structure of collapse-stable configurations.

9.2 Gravity

Gravity reflects:

> Statistical structure over admissible relational configurations.

9.3 Measurement

Measurement corresponds to identification of invariant structure rather than generation of outcomes.

10 Positioning and Scope

This work does not propose a replacement for RTI or entropic gravity. Instead, it provides a structural interpretation situating these frameworks within a broader generative ontology.

The goal is clarification, not competition.

11 Worked Examples

11.1 Decoherence Within the Transactional Framework

To illustrate the structural interpretation developed above, we consider decoherence within the RTI framework and examine its role under collapse-selection.

11.1.1 Standard RTI Interpretation

Within RTI, decoherence is associated with the establishment of transactions between emitters and absorbers. These transactions lead to:

- localization of events,
- suppression of incompatible superpositions,
- emergence of classical spacetime structure.

Decoherence is therefore closely tied to the process by which quantum possibilities give rise to actualized spacetime events.

11.1.2 Collapse-Selection Interpretation

Within the collapse-selection framework, decoherence is interpreted as a constraint-mediated selection process operating on relational configurations.

Specifically:

- The relational configuration space Σ contains multiple admissible possibilities.
- Collapse-selection Φ determines which configurations persist.
- Environmental interaction acts as a constraint channel, shaping admissibility.

Under this interpretation:

- decoherence does not generate collapse,
- it selects among configurations already constrained by admissibility,
- it stabilizes invariant structure rather than producing it.

11.1.3 Structural Clarification

The apparent identification:

$$\text{decoherence} = \text{collapse mechanism} \tag{2}$$

arises from collapsing two layers:

- generative layer: collapse-selection,
- descriptive layer: environment-induced stabilization.

The correct interpretation distinguishes these roles:

- collapse-selection determines what configurations can persist,
- decoherence determines which of these configurations remain stable under environmental constraint.

11.1.4 Interpretive Consequence

This distinction clarifies the role of decoherence within RTI:

- transactions provide a concrete realization of collapse-selection,
- decoherence reflects the stabilization of these selected structures,
- classical spacetime emerges as the projected residue of this stabilized structure.

Thus:

> Decoherence does not generate spacetime structure. It stabilizes the observable residue of collapse-selected configurations within the transactional framework.

11.2 Measurement Within the Transactional Framework

We consider measurement within RTI and examine its interpretation under collapse-selection.

11.2.1 Standard RTI Interpretation

In RTI, measurement corresponds to the actualization of a transaction between an emitter and an absorber. This process results in:

- transfer of conserved quantities (e.g., energy, momentum),
- establishment of emission and absorption events,
- formation of a spacetime interval connecting these events.

Measurement is therefore associated with the realization of a specific outcome among possible quantum interactions.

11.2.2 Collapse-Selection Interpretation

Within the collapse-selection framework:

- the configuration space Σ contains relational possibilities corresponding to potential transactions,
- collapse-selection Φ determines which configurations become admissible and persist,
- projection P maps these invariant configurations to observable outcomes.

Under this interpretation:

- the transaction corresponds to a collapse-selection event,
- the measurement outcome corresponds to the projected invariant configuration,
- the act of measurement identifies, rather than generates, the selected structure.

11.2.3 Structural Clarification

The apparent identification:

$$\text{measurement} = \text{generation of outcome} \tag{3}$$

arises from conflating:

- generative selection (collapse-selection),
- descriptive identification (measurement).

Within QCG:

- collapse-selection determines which configurations exist as stable outcomes,
- measurement identifies which of these configurations is accessible under a given projection.

11.2.4 Interpretive Consequence

This interpretation yields:

- measurement is not the source of outcome generation,
- transactions provide a concrete physical realization of collapse-selection,
- observable outcomes reflect invariant structure rather than measurement-induced change.

Thus:

> Measurement within RTI does not create outcomes; it identifies collapse-stable structure already selected under constraint.

11.3 Synthesis

Together, decoherence and measurement illustrate that RTI provides a concrete realization of collapse-selection, while the collapse-selection framework clarifies the distinct structural roles of stabilization and identification within that realization.

12 Conclusion

The transactional interpretation provides a compelling account of spacetime emergence through quantum interaction. Within a collapse-selection framework, this process can be understood as a specific instance of a more general generative principle:

> Observable structure arises not from interaction alone, but from the invariant residue of relational configurations selected under constraint.

This perspective clarifies the role of transactions, entropy, and spacetime, and provides a unified framework for understanding structure across physical domains.

References

[1] Andreas Schlatter and Ruth E Kastner. "Gravity from transactions: fulfilling the entropic gravity program". In: *Journal of Physics Communications* 7.6 (2023), p. 065009.