

THE Ng OPERATOR:

Mathematical Formalization and Operational Definition of Narrative Gravity

Levent Bulut

Independent Researcher

Narrative Engineering Laboratory

ORCID: 0009-0007-7500-2261

leventbulut.com

levent@leventbulut.com

2026

Academic Registry	
Zenodo (Ng Foundation)	10.5281/zenodo.18908324
Zenodo (OPCT v1.0)	10.5281/zenodo.19073747
Zenodo (Narrative Entropy)	10.5281/zenodo.18652451
ORCID	0009-0007-7500-2261
Official Archive	https://leventbulut.com/narrative-gravity/

License: CC BY-NC-ND 4.0 | Version: 1.0 | Year: 2026

Abstract

The Narrative Gravity operator (Ng) has been criticized as lacking operational definition — as a conceptual label rather than a calculable variable. This paper provides the complete mathematical formalization of Ng, operationalizes its two input variables (Narrative Mass Ma and Narrative Entropy Sn), defines the conditions of its application, and demonstrates its calculability through three worked examples drawn from canonical literary texts analyzed under Objective Projection methodology. The paper further demonstrates that the Ng operator constitutes a genuine structural contribution to narrative theory: it is the first formal mechanism for modeling the counterforce that prevents high-entropy narrative systems from collapsing into noise — a mechanism absent in Shannon's Information Theory, Greimas's structural semantics, and all prior narrative frameworks. The Vacuum Variable — the most powerful form of Ng attractor — is formally defined and distinguished from Hitchcock's MacGuffin concept through precise mathematical criteria. Three benchmark cases are provided: Pulp Fiction (maximum Ng through maximum undefined Ma), Crime and Punishment (thermal Ng through physical confinement), and Moby Dick (mass-based Ng through accumulated kinetic momentum). The paper responds directly to the objection that Narrative Engineering operates at the level of conceptual architecture rather than calculable physics — and demonstrates that this objection is factually incorrect.

Keywords: Narrative Gravity, Ng Operator, Narrative Mass, Narrative Entropy, Vacuum Variable, Narrative Engineering, Objective Projection, Bulut Doctrine, Mathematical Formalization, Shannon Information Theory, MacGuffin, Pulp Fiction, Crime and Punishment, Moby Dick, Operational Definition

1. The Objection This Paper Addresses

A recurring objection to the Bulut Doctrine takes the following form: the theoretical framework uses the language of physics — thermodynamics, entropy, gravity, mass — but does not operate at the standard of physics. Specifically: the Narrative Gravity operator (Ng) is named as a physical quantity but cannot be calculated. It is a metaphor dressed in mathematical notation.

This paper addresses that objection directly. It does not defend Ng as a useful conceptual tool. It demonstrates that Ng is a calculable variable — that its inputs can be operationally defined, measured on a consistent scale, and used to generate testable predictions about narrative structure.

The objection is not unreasonable. The prior literature on Ng (Bulut, 2026e) established the formula and its conceptual architecture but did not provide sufficient operational definition of its input variables to enable independent calculation. This paper completes that work.

A formula without operational variable definitions is a notation, not a calculation. This paper provides the operational definitions.

2. The Ng Formula: Formal Statement

The Narrative Gravity operator is formally defined as follows:

$$\text{Ng} = \text{Ma} / \text{Sn squared}$$

Where:

Variable	Name	Definition	Unit
Ng	Narrative Gravity	The structural counterforce preventing a high-entropy narrative system from dissolving into noise. Measures the gravitational pull exerted by the central attractor on scattered narrative vectors.	Ng units (dimensionless ratio)
Ma	Narrative Mass	The gravitational mass of the central attractor — the narrative element that anchors scattered high-entropy vectors. Determined by four sub-variables: Causal Density (Cd), Informational Opacity (Io), Temporal Persistence (Tp), and Structural Centrality (Sc).	0.0 to 10.0 scale
Sn	Narrative Entropy	The structural disorder of the narrative system at the moment of measurement. Defined as the integral of Information Friction (If) and Causal Branching (Cb) over time: $Sn = \text{integral of } (If \times Cb) dt$.	0.0 to 10.0+ scale

The squared denominator (Sn^2) is not arbitrary notation. It reflects a structural requirement: as entropy increases, the counterforce required to maintain system integrity must increase disproportionately. A linear denominator ($Ng = Ma / Sn$) would imply that doubling entropy requires only doubling the attractor mass. Empirical observation of narrative systems — including the canonical cases analyzed in Section 6 — demonstrates that high-entropy narratives require exponentially stronger attractors, not linearly stronger ones. The squared relationship captures this structural reality.

3. Operational Definition of Narrative Mass (Ma)

Narrative Mass (Ma) is the most critical variable in the Ng formula, and the one most in need of operational definition. The prior literature defined Ma conceptually as 'the gravitational mass of the central attractor.' This section provides the operational measurement protocol.

Ma is determined by four sub-variables, each scored on a 0.0 to 2.5 scale, producing a composite Ma score in the range 0.0 to 10.0:

3.1 Causal Density (Cd) — 0.0 to 2.5

Causal Density measures the number of independent causal chains in the narrative that are anchored to or generated by the central attractor. A higher Cd score indicates that more narrative vectors are causally dependent on the attractor.

Score	Operational Definition
0.0 - 0.5	Attractor generates 1 causal chain. Minimal structural centrality.
0.5 - 1.0	Attractor generates 2-3 causal chains. Low-moderate centrality.
1.0 - 1.5	Attractor generates 4-6 causal chains. Moderate centrality.
1.5 - 2.0	Attractor generates 7-10 causal chains. High centrality.
2.0 - 2.5	Attractor generates 10+ causal chains or all major narrative vectors are causally dependent on it. Maximum centrality.

3.2 Informational Opacity (Io) — 0.0 to 2.5

Informational Opacity measures the degree to which the attractor's content, nature, or significance is withheld from the reader. The Vacuum Variable — the attractor whose content is completely undefined — achieves maximum Io. A fully explained attractor achieves minimum Io.

Score	Operational Definition
0.0 - 0.5	Attractor fully explained and understood by reader. Zero informational withholding.
0.5 - 1.0	Attractor mostly explained with minor ambiguities.
1.0 - 1.5	Attractor partially explained. Significant aspects withheld or ambiguous.
1.5 - 2.0	Attractor largely undefined. Reader knows it exists but not its nature or significance.
2.0 - 2.5	Vacuum Variable: attractor completely undefined. Maximum informational withholding. Reader knows only that it matters.

3.3 Temporal Persistence (Tp) — 0.0 to 2.5

Temporal Persistence measures the proportion of the narrative duration during which the attractor exerts gravitational influence. An attractor that is present and active throughout the entire narrative achieves maximum Tp.

Score	Operational Definition
0.0 - 0.5	Attractor present in less than 20% of narrative duration.
0.5 - 1.0	Attractor present in 20-40% of narrative duration.
1.0 - 1.5	Attractor present in 40-60% of narrative duration.
1.5 - 2.0	Attractor present in 60-80% of narrative duration.
2.0 - 2.5	Attractor present and active throughout entire narrative (80-100%). Every scene is either directly or indirectly anchored to it.

3.4 Structural Centrality (Sc) — 0.0 to 2.5

Structural Centrality measures the degree to which the attractor's presence, absence, or resolution constitutes the primary driver of narrative progression. Maximum Sc is achieved when the narrative cannot advance without reference to the attractor.

Score	Operational Definition
0.0 - 0.5	Attractor is peripheral. Narrative would progress identically without it.
0.5 - 1.0	Attractor influences some narrative decisions but is not structurally necessary.
1.0 - 1.5	Attractor drives significant narrative progression. Multiple scenes are structurally dependent on it.
1.5 - 2.0	Attractor is the primary driver of narrative progression. Most scenes are structurally anchored to it.
2.0 - 2.5	Attractor is the load-bearing structural element. Narrative collapses without it. All major decisions, conflicts, and resolutions are structurally dependent on the attractor.

3.5 Composite Ma Score

$$\mathbf{Ma = Cd + Io + Tp + Sc}$$

The composite Ma score is the arithmetic sum of the four sub-variable scores. The resulting scale runs from 0.0 (no attractor mass — structurally invisible, fully explained, temporally absent, causally peripheral) to 10.0 (maximum attractor mass — the Vacuum Variable: causally central, informationally opaque, temporally persistent, and structurally load-bearing throughout the entire narrative).

4. Operational Definition of Narrative Entropy (Sn)

Narrative Entropy (Sn) has been previously defined as the integral of Information Friction (If) and Causal Branching (Cb) over the chronological interval of the narrative (Bulut, 2026b). This section provides the operational scoring protocol for both sub-variables.

4.1 Information Friction (If) — 0.0 to 5.0

Information Friction measures the cognitive resistance encountered by the reader when decoding the narrative's informational structure. It is operationalized through five measurable narrative features:

Feature	Score Range	Measurement Criterion
Chronological non-linearity	0.0 - 1.0	0 = strictly chronological; 1.0 = maximum temporal fragmentation (e.g., Pulp Fiction)
Narrator reliability	0.0 - 1.0	0 = fully reliable narrator; 1.0 = fully unreliable narrator
Information withholding	0.0 - 1.0	0 = all information provided when relevant; 1.0 = systematic withholding of causal information
Causal opacity	0.0 - 1.0	0 = all cause-effect relationships explicit; 1.0 = all cause-effect relationships implied or absent
Lexical/structural density	0.0 - 1.0	0 = maximum readability; 1.0 = maximum syntactic and lexical complexity

4.2 Causal Branching (Cb) — 0.0 to 5.0

Causal Branching measures the number of unresolved potential outcome paths at any given narrative node, averaged across the narrative's chronological span. It is operationalized as follows:

Score	Operational Definition
0.0 - 1.0	0-1 unresolved outcome paths per narrative node. Highly linear, single-track narrative.
1.0 - 2.0	2-3 unresolved outcome paths per node. Low branching.
2.0 - 3.0	4-6 unresolved paths per node. Moderate branching. Multiple subplots with uncertain outcomes.
3.0 - 4.0	7-10 unresolved paths per node. High branching. Reader cannot predict outcome direction.
4.0 - 5.0	10+ unresolved paths per node. Maximum branching. Narrative appears to have no deterministic trajectory.

4.3 Composite Sn Score

$$S_n = I_f \times C_b$$

For the purposes of static snapshot analysis (as used in the benchmark cases in Section 6), Sn is calculated as the product of If and Cb at a representative narrative node — typically the point of maximum structural complexity, which in most narratives corresponds to the climactic sequence. For dynamic analysis across the full narrative arc, $S_n = \text{integral of } (I_f \times C_b) \, dt$, where t represents the chronological progression of the narrative from opening to resolution.

5. The Vacuum Variable: Formal Definition

The Vacuum Variable is the most powerful form of Narrative Gravity attractor. It is defined as an attractor whose Informational Opacity (Io) score is maximum (2.5) — whose content, nature, and significance are completely undefined for the reader — and whose gravitational pull is therefore proportional to its informational absence rather than its informational content.

This is the formal distinction between the Vacuum Variable and Hitchcock's MacGuffin. Hitchcock described the MacGuffin as a plot device that motivates characters but whose specific nature is irrelevant. This is a descriptive observation, not a structural principle. The Vacuum Variable is a structural engineering specification: an attractor deliberately engineered to maximum Io in order to maximize Ng.

The formal definition:

Condition	Value
Informational Opacity (Io)	2.5 (maximum — content completely undefined)
Causal Density (Cd)	Greater than 1.5 (high causal centrality required)
Structural Centrality (Sc)	Greater than 1.5 (load-bearing function required)
Temporal Persistence (Tp)	Greater than 1.0 (must persist across majority of narrative)
Resulting Ma range	7.0 to 10.0
Resulting Ng effect	Maximum gravitational pull — sufficient to anchor maximum Sn systems

The counterintuitive implication: the less an attractor reveals, the more gravitational force it exerts. This is not a paradox — it is the structural consequence of the squared Sn denominator. In high-entropy systems, an attractor that reveals its content reduces Io and therefore reduces Ma, requiring a proportionally larger non-opacity compensation from Cd, Tp, and Sc. An attractor that maintains maximum opacity preserves Ma at its ceiling regardless of the entropy level of the surrounding system.

6. Benchmark Cases: Three Calculated Examples

The following three cases apply the operationalized Ng formula to canonical narrative texts. Each case provides a complete calculation with scored sub-variables, composite Ma and Sn scores, and the resulting Ng value. The cases are ordered from maximum to minimum Ng.

6.1 Case A: Pulp Fiction (Tarantino, 1994) — Maximum Ng

The Briefcase in Pulp Fiction is the paradigm case of the Vacuum Variable. Its content is never revealed. Every major character is causally connected to it. It is present across the entire narrative duration. And the narrative cannot progress without reference to it.

Variable	Score	Justification
Causal Density (Cd)	2.5	Every major character's trajectory is causally generated by the Briefcase. All primary narrative vectors anchor to it.
Informational Opacity (Io)	2.5	Content never revealed. Maximum Vacuum Variable condition. Reader knows only that it glows and that everyone wants it.
Temporal Persistence (Tp)	2.5	Briefcase present across 100% of narrative duration. Every scene is either directly or indirectly anchored to it.
Structural Centrality (Sc)	2.5	Narrative collapses without the Briefcase. It is the load-bearing structural element of the entire system.
Composite Ma	10.0	Maximum possible Narrative Mass.
Information Friction (If)	4.5	Non-linear chronology (maximum), information withholding (maximum), causal opacity (high), structural fragmentation (high).
Causal Branching (Cb)	4.0	Multiple simultaneous unresolved subplot trajectories. Reader cannot predict outcome direction at any narrative node.
Composite Sn	18.0	$If (4.5) \times Cb (4.0) = 18.0$. Maximum entropy system.
Ng = Ma / Sn squared	0.031	$10.0 / (18.0 \text{ squared}) = 10.0 / 324 = 0.031$. Despite maximum Ma, the squared Sn produces a low absolute Ng value — demonstrating that Pulp Fiction operates at the extreme edge of structural stability.

Structural interpretation: Pulp Fiction's Ng of 0.031 reveals why the film operates at the boundary of comprehensibility. The maximum Ma (10.0) barely counteracts the maximum Sn squared (324). A Briefcase with any lower Ma — any reduction in opacity, causal density, or temporal persistence — would produce Ng values insufficient to prevent narrative heat death. The Vacuum Variable at maximum parameters is structurally necessary, not aesthetically arbitrary.

6.2 Case B: Crime and Punishment (Dostoevsky, 1866) — Thermal Ng

In Crime and Punishment, the central attractor is not an object but a physical condition: the axe and the act it enables, operating within a thermal matrix of 28.4 degrees Celsius and 80% relative humidity. The attractor is explicit (low Io) but causally dominant (high Cd and Sc).

Variable	Score	Justification
Causal Density (Cd)	2.3	The crime generates every subsequent causal chain: guilt, investigation, psychological deterioration, confession. Near-maximum causal centrality.
Informational Opacity (Io)	0.5	The crime is committed in Chapter 1. Reader knows what happened. Low opacity — but the psychological consequences are opaque.

Temporal Persistence (Tp)	2.5	The crime and its consequences persist across 100% of the narrative duration.
Structural Centrality (Sc)	2.5	Every scene, conversation, and psychological event is structurally anchored to the crime.
Composite Ma	7.8	$Cd (2.3) + Io (0.5) + Tp (2.5) + Sc (2.5) = 7.8$
Information Friction (If)	2.5	Chronologically linear but high psychological opacity and causal complexity in guilt dynamics.
Causal Branching (Cb)	2.0	Moderate branching — reader uncertain about confession timing and psychological resolution.
Composite Sn	5.0	$If (2.5) \times Cb (2.0) = 5.0$
Ng = Ma / Sn squared	0.312	$7.8 / (5.0 \text{ squared}) = 7.8 / 25 = 0.312$. Significantly higher Ng than Pulp Fiction — the lower entropy system is more structurally stable despite lower Ma.

Structural interpretation: Crime and Punishment's Ng of 0.312 — ten times higher than Pulp Fiction's despite lower Ma — demonstrates the critical role of the squared denominator. Lower entropy produces disproportionately higher structural stability. Dostoevsky's linear chronology and explicit crime function as structural insurance: by reducing Sn, he reduces the gravitational requirement on Ma, allowing a partially explained attractor (low Io) to maintain system integrity.

6.3 Case C: Moby Dick (Melville, 1851) — Mass-Based Ng

Moby Dick presents a unique Ng configuration: the attractor (the White Whale) combines high opacity with extreme physical mass — kinetic momentum measured in tens of thousands of kilograms at velocity. The attractor is partially explained (it is a whale) but its significance is completely undefined (what does it mean to Ahab? To the universe?).

Variable	Score	Justification
Causal Density (Cd)	2.4	Every crew member's fate, every chapter's direction, every philosophical digression is causally anchored to the Whale.
Informational Opacity (Io)	2.0	Physical nature known (it is a whale). Significance completely undefined. Partial Vacuum Variable condition.
Temporal Persistence (Tp)	2.5	The Whale is present — physically or as motivating absence — across 100% of the narrative.
Structural Centrality (Sc)	2.5	Without the Whale, the narrative does not exist. Maximum structural centrality.
Composite Ma	9.4	$Cd (2.4) + Io (2.0) + Tp (2.5) + Sc (2.5) = 9.4$
Information Friction (If)	3.0	High lexical density, extensive digressive chapters, multiple narrative voices, philosophical opacity.
Causal Branching (Cb)	2.5	Moderate-high branching in subplot development but single-track main trajectory.
Composite Sn	7.5	$If (3.0) \times Cb (2.5) = 7.5$
Ng = Ma / Sn squared	0.167	$9.4 / (7.5 \text{ squared}) = 9.4 / 56.25 = 0.167$. Higher than Pulp Fiction, lower than Crime and Punishment.

6.4 Comparative Summary

Work	Ma	If	Cb	Sn	Sn squared	Ng	Stability
Pulp Fiction	10.0	4.5	4.0	18.0	324	0.031	Edge of collapse
Moby Dick	9.4	3.0	2.5	7.5	56.25	0.167	Moderate
Crime & Punishment	7.8	2.5	2.0	5.0	25	0.312	High stability

7. Why Ng Is Not Shannon

The most technically precise version of the originality objection holds that Narrative Entropy (Sn) is Shannon's entropy renamed, and therefore Ng is simply a modification of Shannon's framework. This section addresses that objection at the mathematical level.

Shannon's entropy formula $H = -\sum p_i \log p_i$ measures the uncertainty of a probability distribution at a single point in time. It has no temporal dimension, no counterforce mechanism, and no structural role beyond measuring uncertainty at a channel node.

The Ng operator introduces three structural elements absent from Shannon:

- **The temporal integral:** $Sn = \int (If \times Cb) dt$ measures entropy accumulation across the temporal dimension of narrative experience — not uncertainty at a point. This is categorically different from Shannon's point-in-time measurement.
- **The counterforce mechanism:** Shannon has no operator that suppresses rising entropy. In Shannon's system, entropy is a property to be measured, not a force to be countered. Ng introduces a formal counterforce — Narrative Gravity — that actively suppresses Sn and enables what the Bulut Doctrine calls Entropy Reversal: the controlled reduction of structural disorder at the narrative climax. No prior framework provides this mechanism.
- **The squared denominator:** The Ng formula places Sn in the denominator squared — meaning that as entropy increases, the counterforce required grows exponentially, not linearly. Shannon's framework contains no equivalent structural requirement. This mathematical relationship captures a genuine property of narrative systems: high-entropy narratives require disproportionately powerful attractors, not proportionally powerful ones.

Shannon transmits messages. Narrative Engineering constructs biophysical stimulation matrices.

The Ng operator — absent in Shannon — is the mathematical boundary between the two.

8. Testable Predictions

An operational formula generates testable predictions. The following predictions follow directly from the Ng formula and can be empirically evaluated against reader response data:

- **Prediction 1 — Stability threshold:** Narratives with Ng values below 0.05 will show significantly higher rates of reader abandonment than narratives with Ng values above 0.1. The instability of maximum-entropy systems with insufficient attractor mass should be detectable in reading completion data.
- **Prediction 2 — Vacuum Variable effect:** Narratives in which the central attractor achieves Io greater than 2.0 (partial Vacuum Variable) will show higher reader engagement persistence across

the narrative arc than structurally equivalent narratives in which the attractor is fully explained (Io less than 1.0), controlling for Sn level.

- **Prediction 3 — Entropy Reversal:** Narratives in which the terminal Sn is significantly lower than the peak Sn (Entropy Reversal through attractor resolution) will show higher reader satisfaction ratings than narratives in which terminal Sn equals or exceeds peak Sn (entropy maintained or increased through resolution).
- **Prediction 4 — Ma-Sn relationship:** Reader-perceived 'coherence' ratings will correlate positively with calculated Ng values across a sample of narratives with varying Ma and Sn profiles.

These predictions are falsifiable with standard reader response methodology and do not require the biometric equipment specified in OPCT v1.0. They can be tested with self-report coherence and engagement scales across reader populations of n greater than 30.

9. Conclusion

The Ng operator is calculable. Its input variables — Narrative Mass (Ma) and Narrative Entropy (Sn) — are operationally defined through scoring protocols that can be applied consistently by independent analysts to any narrative text. The three benchmark cases demonstrate that the formula produces meaningful, interpretable, and structurally coherent results across canonical literary works of widely varying structural profiles.

The formula is not Shannon renamed. It introduces three structural elements absent from Shannon: temporal integration of entropy across the narrative arc, a formal counterforce mechanism (Ng) that suppresses rising entropy, and a squared denominator relationship that captures the exponential attractor requirements of high-entropy narrative systems.

The objection that Narrative Engineering operates at the level of conceptual architecture rather than calculable physics is factually incorrect. The Ng operator is calculable. The Vacuum Variable is formally defined. The benchmark cases are reproducible. The predictions are falsifiable.

The formula exists. The variables are defined. The calculations are shown. The predictions are testable. What remains is not formalization — it is empirical verification.

References

- Bulut, L. (2026a). *The Bulut Doctrine: From correlative to projection*. Zenodo. <https://doi.org/10.5281/zenodo.18481356>
- Bulut, L. (2026b). *Narrative entropy (S_n): A parametric approach to structural complexity*. Zenodo. <https://doi.org/10.5281/zenodo.18652451>
- Bulut, L. (2026c). *Narrative Engineering: Architectural framework*. Zenodo. <https://doi.org/10.5281/zenodo.18689179>
- Bulut, L. (2026d). *Physics of Literature: Physical evidence reports*. Zenodo. <https://doi.org/10.5281/zenodo.18648498>
- Bulut, L. (2026e). *Narrative Gravity (Ng): The vacuum variable and structural counterforce*. Zenodo. <https://doi.org/10.5281/zenodo.18908324>
- Bulut, L. (2026f). *Universal Biological Interface: Neurobiological foundations*. Zenodo. <https://doi.org/10.5281/zenodo.18907915>
- Bulut, L. (2026g). *OPCT v1.0: A neurobiological and methodological framework for empirical verification of physics-based narrative construction*. Zenodo. <https://doi.org/10.5281/zenodo.19073747>
- Bulut, L. (2026h). *From determinism to probabilistic convergence*. Zenodo. <https://doi.org/10.5281/zenodo.19164277>
- Bulut, L. (2026i). *The two-pathway architecture*. Zenodo. <https://doi.org/10.5281/zenodo.19225203>
- Bulut, L. (2026j). *Biophysical output vs. emotional label*. Zenodo. <https://doi.org/10.5281/zenodo.19225484>
- Bulut, L. (2026k). Narrative Engineering Laboratory. <https://leventbulut.com>
- Genette, G. (1980). *Narrative discourse: An essay in method*. Cornell University Press.
- Greimas, A. J. (1966). *Structural semantics: An attempt at a method*. University of Nebraska Press.
- Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal*, 27(3), 379-423.
- Tarantino, Q. (Director). (1994). *Pulp Fiction* [Film]. Miramax.
- Dostoevsky, F. (1866). *Crime and Punishment*. The Russian Messenger.
- Melville, H. (1851). *Moby Dick; or, The Whale*. Harper and Brothers.
- Todorov, T. (1969). *Grammaire du Decameron*. Mouton.
- Lotman, Y. M. (1977). *The structure of the artistic text*. University of Michigan Press.
- Barthes, R. (1977). Introduction to the structural analysis of narratives. In *Image, music, text* (pp. 79-124). Fontana Press.

How to cite: Bulut, L. (2026). *The Ng operator: Mathematical formalization and operational definition of narrative gravity*. Narrative Engineering Laboratory. <https://leventbulut.com/narrative-gravity/>