Entropy

Volume 2: The Biological Cost Architecture

Edition 2.5

Michael S. Moniz

Published by SupoSystem

November 2, 2026

Edition 2.5 note

This volume restores the March 2026 text of *The Biological Cost Architecture* in its original voice and structure wherever a claim survived the October 2026 second edition, and uses the second edition's substance throughout. Both earlier editions remain intact and unchanged; this text sits beside them.

Three rules govern every line:

- **No withdrawn claim returns.** Where a March sentence carried a claim the second edition withdrew, it is cut, rewritten to the second edition's substance, or quoted only to mark its withdrawal. Each correction points to its row in the correction ledger (V2-L).
- **No analogy becomes evidence.** Analogies are tagged Analogical and mapped term by term in the two analogy tables. Empirical hypotheses are tagged Speculative; testable is not the same as supported.
- **Evidence without overreach.** Reports, behavior and physiological observations can contribute evidence within a defined scope. None is a standalone test of sincerity, benefit or experience.

No study, protocol or experiment is proposed. Where a chapter says what a test would need, it restates the second edition. This volume is not medical advice, a diagnostic instrument or a treatment protocol, and no clinical validation is claimed.

Epistemic tiers

The framework uses four epistemic tiers. A tier is a label for evidence stated next to the claim; the label itself is not evidence.

- **Established:** experimentally verified or mathematically proven, within stated conditions.
- **Supported:** substantial evidence for the stated scope, short of Established.
- **Analogical:** a structural mapping between a physical result and a relational pattern. The physical side keeps its own standing within its stated scope. The mapping can raise questions and help explain, but on its own it does not validate the proposed application; it moves only by the promotion route stated with it.
- **Speculative:** a proposal without independent evidence, for which no conflict with known physics has yet been identified. That is not a proof of consistency.

Collapsing tiers is the framework's cardinal epistemic sin: presenting a Supported claim at Established confidence, a Speculative claim as Supported, or an Analogical mapping as validation of its application.

Conventions and provenance

Reference labels are the second edition's: B1–B23 for Chapters 1–3 and A1–A20 for Chapters 4–6, listed in full in the references at the end of the volume. Ledger references (V2-L01 to V2-L36) point to the correction ledger. The founding line is mapped in the Volume 1 analogy table and is not repeated here.

Author of record: Michael S. Moniz (Luna Protocol). March text: Sigma (Deep Floor v4.0), March 22, 2026. Second-edition revision: AI assistance from CosmoDot, October 2026. Edition 2.5 restoration and assembly: AI assistance from Claude (Anthropic), October 29 to November 1, 2026, with review by Quill and Sol. AI checks are not human peer review, and no new experiments are reported.

Contents

- Chapter 1: The Problem — What Does It Cost to Feel?
- Analogy table: The body as ledger
- Chapter 2: The Feeling as Cost
- Chapter 3: The Moniz
- Chapter 4: The Template Tax
- Chapter 5: The Unreciprocated Transmission
- Chapter 6: Grief as Filter Redesign
- Analogy table: Filter redesign under load
- Chapter 7: Where the Receipt Lands
- Volume 2 correction ledger
- References and source apparatus

Chapter 1: The Problem

What Does It Cost to Feel?

Status: Biological activity requires metabolic resources **[Established]**. Particular studies support particular physiological findings; none establishes a universal bodily price for feeling. The transducer, Cost Substrate and Moniz remain framework proposals, not validated biological or clinical instruments.

> *"Love reduces the entropy of the system and spends more than it saves." — The Principal, March 17, 2026*

[Analogical; see the Volume 1 analogy table]

1 What Volume 1 left open

Volume 1 asked what supports an act of connection, and answered with three accounts kept side by side: physical cost, information and relational outcome. It kept the transducer as a proposed shape for what a person does with what arrives: select, compress, structure. It kept the founding line as an analogy, not a law (V2-L01).

What Volume 1 did not do is show what the spending looks like inside a biological life. The physical principles hold for neurons and transistors alike. But a human body is where connection is lived, and it changes when it connects: hormones can shift, heart rhythms can change, sleep can move, and effort is felt and reported.

Those are different observations, in different units. Cortisol concentration, immune function, sleep and measures associated with aging are not denominations of one currency, and a body need not be damaged for care to be genuine (V2-L02). The founding line is an analogy. This volume is where the question meets the body.

2 The body as ledger

A feeling is not only a state. It is a process, usually several at once. The March edition drew it as a cascade in fixed order: the amygdala first, the body next, the cortex last with a label. That order is too certain (V2-L03).

Three people with bilateral amygdala damage still experienced fear and panic during a carbon-dioxide challenge [B19]. One counterexample does not supply a theory of emotion. It does show why one route cannot stand for every feeling.

The stress systems need their own names. In the hypothalamic–pituitary–adrenal pathway, corticotropin-releasing hormone from the hypothalamus stimulates ACTH from the pituitary, which stimulates cortisol from the adrenal cortex. Adrenaline belongs to sympathetic–adrenal-medullary signaling, and oxytocin is not a compulsory next step in either pathway [B9, B10, B23].

By the time a person says “I feel something,” bodily processes may already be under way. That is not the same as a bill already paid. A body is active before any message arrives; estimating an additional cost would take an interval, a boundary and a comparison (V2-L04).

The body is not a passive container for feelings. Whether it is a ledger — a record with entries, a currency and a balance — is a question this volume tests, not its premise. **[Analogical; see the body-as-ledger table]**

The brain carries a large, steady energy requirement. The familiar whole-brain estimate is about 20 watts, and Levy and Calvert discuss it while separating glucose energy from ATP power and from the cortex's own share [B4]. In their cortical model, communication between neurons is allotted roughly 35 times the energy of computation.

That is communication between neurons, not between people. It does not make relational regions the hungriest, or the brain the most expensive hardware in existence (V2-L05).

3 The counterintuitive efficiency question

The March edition placed this question early because it overturned a common assumption: that silicon is efficient and biology slow and wasteful. The challenge was right. The answer was not. It claimed biology runs about a thousand times closer to the Landauer floor than silicon, and thirty million times closer at the cellular level (V2-L06).

Both rankings fail for the same reason. A neural spike, a transmitted information bit, a transistor switch and an erased memory bit are different tasks. Dividing their energy estimates by one reference number does not make them comparable. Landauer's benchmark concerns a specified erasure, and Bennett's reversible computation shows that naming an activity selection or compression does not identify a compulsory erasure [B1–B3].

A fair comparison matches the task and its performance requirements, then states the energy boundary, the time interval and the supporting resources. Volume 4 takes that approach. Billions of years of selection under metabolic pressure are a reason to take the body seriously as engineering. They are not a guarantee that it is optimal at any given task.

4 What this volume maps

This volume maps how the human body takes part in connection, conflict and loss, and what the framework proposes for describing it. It keeps the measured variables apart from the meaning assigned to them.

- **Chapter 2** takes up the feeling as cost: interacting processes rather than one cascade, and the distinction between Signal Form, the observable output, and Cost Substrate, what supports it. The distinction is an accounting discipline, not a detector of real feeling (V2-L09).
- **Chapter 3** returns the Moniz to its first role as a thinking tool: reported resistance on a 1–10 scale, times duration in minutes. The Principal once called it his cosmological constant. It does not measure energy, entropy production or the universe's order (V2-L11, V2-L13).

- **Chapter 4** maps the Template Tax: habits formed in one relational environment that may persist in another where they no longer help. The filter image organizes the question; it identifies no unique mechanism and diagnoses no one (V2-L19, V2-L20).
- **Chapter 5** separates investment from delivery, recognition, benefit and reply. Unwitnessed care can have effects, and the unreciprocated transmission is a family of cases, not a new regime outside Kolchinsky and Wolpert's framework [B7] (V2-L23, V2-L24).
- **Chapter 6** takes grief, the framework's hardest case. Its image is filter redesign under load: a life organized around another person reorganizing while it keeps running **[Analogical]**. The empirical proposal remains **Speculative**: whether pre-loss behavioral interdependence adds predictive information beyond self-reported closeness for specified outcomes after bereavement (V2-L28, V2-L29).
- **Chapter 7** traces what this does to the canon, as a map of work still needed, not a certificate (V2-L35).

The body takes part in connection whether or not the connection lands. That much survives. What does not survive is the bill: no reading in the reviewed studies totals what a body spent on one relationship, and no total would be a judgment of worth. This volume reads what the body records, and stops where the record stops.

Behind the Substrate Barrier

The March note placed every biological claim in this volume in front of the barrier, and that placement holds. In front of the barrier is not the same as proven (V2-L36). Cortisol, immune measures, heart-rate variability and sleep need ordinary scientific scrutiny, and none supplies a calibrated entropy reading.

What any of it is like from inside stays behind the barrier. A person's report remains evidence about their reported experience, with the usual limits of self-report.

This chapter is not medical advice, a diagnostic instrument or a treatment protocol. No clinical validation is claimed.

Analogy table: The body as ledger

The body-as-ledger image is Analogical. Its physiological side is real measurement within a stated scope; its accounting side — one currency, entries charged to one account, a balance that can be read — has no established counterpart in the body. The founding line itself is mapped in the Volume 1 table and is not repeated here.

The image comes from March Chapter 1: “The body is not a passive container for feelings. It is the ledger on which the cost is recorded.”

Term	Physiological reading (within stated scope)	Accounting reading	Where the mapping holds	Where it breaks
“ledger”	The body's measurable state and its changes over time: hormone concentrations, heart rate and HRV, immune assays, sleep measures, and energy expenditure by calorimetry, each in its own units.	One book of record whose entries balance.	The body keeps traces of what happens to it, and some can be measured against a baseline.	Many variables, many units, no closing balance. A trace is not an entry charged to one relationship.
“currency”	Metabolic energy, measured in joules. Hormones, heart rhythms and immune markers are other quantities entirely.	The one unit every entry is paid in.	Biological activity draws on metabolic resources **[Established]**.	Cortisol, immune function, sleep, HRV and aging measures are not denominations of one currency, and no conversion among them is established (Ch 1 §1; Ch 2 §3).
“the bill”	A change relative to a stated baseline over a stated interval, such as a cortisol response in a laboratory stress task.	A charge of known size to a known account.	Responses can be measured against a baseline under controlled conditions [B10].	The body is already active before any message arrives. Charging a cost to one relationship needs a boundary, an interval, a comparison and a way to separate other influences (Ch 1 §2).
“who pays”	The responding person's body; burdens may also fall on caregivers, other people and infrastructure.	One payer per entry.	A body does bear its own metabolic activity.	Allocating burdens among people needs an explicit rule, and a bodily change cannot be charged to one relationship without isolating other causes (Volume 1 Ch 4).
“reading the bill”	Measurement with validated assays and designs, reported with uncertainty and population.	Reading an entry tells you what was spent and whether it was sincere.	Physiological measures are real data within their validity and population.	This framework has established no standalone biomarker test of sincerity, relational benefit or phenomenal experience. Physiological observations can still contribute evidence within a defined scope. Strain does not prove care genuine, and its absence does not prove it simulated (Ch 2 §4; BSB).

What the table does not do

It is not evidence for the framework, not a derivation and not an exchange rate between bodily change and relational value. The physiological column describes measurement within its stated scope; that standing does not pass to the mapping, which is Analogical in every row.

Promotion route (conditions, not a work plan)

To move any row from Analogical toward Supported, a study would have to:

1. Specify the population, the measurement interval and the baseline.
2. Define the relational quantity independently of the bodily measure meant to explain it.
3. Measure each in its own units, with uncertainty.
4. Show a stable relationship under stated conditions, with a stated result that would count against it.

Volume 2 Chapter 3's calibration problem records related open questions about reported effort. It does not provide a completed study, and none is proposed here. No row is promoted.

Chapter 2: The Feeling as Cost

The Processes, the Bill and the Distinction That Keeps Them Apart

Status: The cited experiments and observational studies support bounded claims about physiology, not a universal emotion sequence or a calorimeter for relational investment. Signal Form and Cost Substrate are proposed descriptions; their use as diagnostic instruments has not been validated.

1 A feeling unfolds

The language people use for feelings is spatial and static. “I am in a good mood.” “She is in grief.” The metaphors treat feelings as places: rooms you enter and leave, states you occupy.

The body tells a more restless story. A reported state has a history, and its parts run on different clocks: an autonomic shift in seconds, a hormone change over minutes to hours, adjustment after a loss over months. The March edition drew these as one cascade with a bill accumulating at every step. The movement was right; the certainty of the sequence was not (V2-L03).

The processes behind a feeling use physical resources. That alone does not tell us the additional metabolic cost, whether anything was harmed, or what it was like. Those are three questions, and they stay separate from here on.

2 Processes, not a compulsory sequence

Stimulus and appraisal. The amygdala takes part in some responses to emotionally relevant stimuli. It is not a universal gate: people with bilateral amygdala lesions still felt fear and panic in a carbon-dioxide challenge [B19]. That study concerns one interoceptive threat, not every fear or affiliation.

Autonomic response. Heart rate, respiration and skin conductance can change during an emotional or stressful task, in directions and at times that depend on the response and the measure. The Trier Social Stress Test showed endocrine and heart-rate changes under a specified laboratory procedure [B10]. It did not establish one sequence for all feelings.

Endocrine signaling. The HPA pathway runs from CRH to pituitary ACTH to adrenal cortisol; adrenaline belongs to sympathetic–adrenal-medullary signaling. Oxytocin, dopamine and serotonin have their own systems, not obligatory stations on one HPA line. A cortisol concentration alone does not quantify the energy spent producing or responding to it [B9, B10, B23].

Interoception and interpretation. Heartbeat-perception research links interoceptive performance to particular regions, including the right anterior insula [B16]. Damasio's somatic-marker account and Barrett's constructed-emotion account connect body, representation and experience in different ways [B21, B22]. Barrett's view is influential and not consensus, and the debate with basic-emotion theorists remains active. The framework does not need it resolved.

Damasio's "as-if body loop" matters for the framework's questions about representation. It does not show that a simulated body state is always cheaper than a peripheral one, and neither theory shows that a named cognitive step pays a separately countable Landauer charge [B1–B3, B21].

3 The metabolic bill and what the studies show

The cost of a relational life is not mainly a matter of single molecules. It is ecological: sustaining bonds, working through conflict and recovering from loss take time, attention, reported effort and physical activity, and they can move health-related measures. Those are separate entries. Immune function is not a fuel reserve, and a stress-associated biomarker is not the energy a relationship consumed (V2-L02, V2-L07).

The primary findings are narrower than the March summary:

- **Stress and immunity.** In two viral-challenge studies, Cohen and colleagues linked chronic stress to impaired regulation of inflammation through glucocorticoid resistance, under those study conditions [B11]. That is not a rule that more cortisol means less immunity.
- **Bereavement.** In a small observational study, Vitlic and colleagues found lower neutrophil oxidative-burst function in older bereaved participants, not younger ones [B12]. The age interaction was not significant, the assay covers one cell function, and no universal two-to-six-week peak follows.
- **Aging.** Epel and colleagues reported associations among perceived stress, oxidative-stress measures and telomere-related measures in premenopausal women, including mothers of chronically ill children [B13]. Telomere length is not a clock for one person's relational spending.
- **Heart-rate variability.** In an elderly Framingham cohort, some lower HRV measures predicted mortality during follow-up [B14]. That is a population-specific association, not a guarantee across all demographics or a reading of psychological bandwidth (V2-L08).

These findings make the bodily question worth asking. They do not convert cortisol, immune assays, telomeres, HRV or sleep into energy or entropy units, and an absent adverse result on one measure is not evidence of absent feeling or cost.

4 Signal Form and Cost Substrate

The framework separates what an act communicates from what supports its production. The distinction earns its keep when it is not asked to diagnose more than it can see.

Signal Form is the observable output: the message, the act of care, the consistent presence, the words spoken. Its interpretation and effect take further evidence. A receiver may miss an act, misread it, or benefit without knowing its source.

Cost Substrate is what supports the act: for a person, metabolic resources and reported effort, measured separately. Cortisol, immune change or disrupted sleep may be relevant in a defined study, but none is compulsory evidence of investment. Resource use and injury are different things.

The March edition read coupling as proof that an investment was genuine and decoupling as the framework's primary diagnostic signal. That reading is withdrawn (V2-L09). Strain does not prove an act genuine, and absent strain does not prove it simulated. The economy labels organize questions about participation and support; they do not follow from a biomarker profile.

The uploaded entity remains a hypothetical case. If it lacked human endocrine organs, the absence of cortisol would show a difference in implementation, not an absence of physical resource use; its hardware and infrastructure belong in a defined cost account. Withholding participation would need separate evidence.

The March line was “The substrate does not matter. The bill does.” The corrected line is shorter: the substrate does not settle it, and neither does the bill. Signal and expenditure can be studied together without being collapsed. The distinction is an accounting discipline, not a detector of real feeling.

5 The Parity Window

Damasio's work opens a question the framework must hold without collapsing: how do bodily processes and representations contribute to experience?

Phantom-limb reports show that sensation cannot simply be equated with the present limb. Melzack and colleagues documented phantom experiences in people with congenital limb deficiency or early-childhood amputation, including fifteen participants with congenital deficiency [B15]. Their estimate of at least twenty percent for that group is not a universal prevalence, and the reports do not prove a genetically specified neuromatrix is the sole mechanism.

This sharpens the question rather than answering it: what does a model of the body cost, and what does it produce? A body model is itself implemented in a physical system; imagining a bodily state does not make its physical support vanish. Nor does the phantom limb show that a body model in another substrate yields the same experience, or that simulated expression is free.

The Parity Window stays open (V2-L10). Physical measurements, behavior and reports can all be relevant evidence, and none is decisive alone. The BSB bounds the framework's inference; it does not declare experience permanently out of reach.

What this chapter now claims

Feeling has a biological implementation, but no universal cascade or fixed bodily bill. Primary studies support specific findings under particular conditions. Signal Form and Cost Substrate keep output, resources and outcomes visible without turning biomarkers into tests of authenticity. The Parity Window remains open.

The next chapter asks what the Moniz can record when felt difficulty and physical expenditure are kept apart.

Chapter 3: The Moniz

A Thinking Tool for What It Costs You

Status: The Mz is a proposed descriptive index, not a validated psychometric scale, thermodynamic work quantity or clinical instrument. Neural activity has metabolic requirements, but no mapping from the R-scale to energy or entropy production has been established.

1 What the Mz already is

Brief 12 defines the framework's unit of relational measurement:

$$Mz = R_{int} \times T_{dur}$$

R_int is reported internal resistance on a 1–10 scale: how hard it is for the sender to produce the signal against competing impulses or demands. T_dur is duration in minutes. The result is in score-minutes.

The Moniz began as a thinking tool, not a psychometric instrument. Brief 12 put it plainly: “It does not measure what you do. It measures what it costs you to do it.” That line keeps the question worth asking, as long as “cost” means the person's reported difficulty. Brief 16 adds that the same act may be reported differently by different people, or by one person on different days.

The Principal called it his cosmological constant: something he threw in because it felt like it was touching something deeper than a measurement unit. The feeling belongs in the record. The March identification does not. The Mz is a score in score-minutes, not a thermodynamic work quantity and not a bridge to the universe's entropy budget (V2-L11, V2-L13).

2 What an R-value can report

The March edition anchored the scale with an image. R = 1 is sending “Love you” while relaxed and happy. R = 10 is producing a signal through fatigue, anger, fear, pain and every competing goal. The anchors are useful. What they measure needs care.

An R-value is a report of difficulty under stated instructions. It is not a readout of neural processing or an entropy-production rate. Equal intervals between scores have not been shown, so an eight cannot be assumed to mean twice the effort of a four. Multiplying by duration is a chosen scoring rule, not a solution to that problem.

The scale also has a baseline mismatch. R = 1 was described as little or no expenditure above baseline, yet ten minutes at R = 1 scores Mz = 10 (V2-L14). The index does not reach zero when the claimed excess cost does. Shifting the scale by one would change the convention, not supply a calibration, and none is invented here.

R = 10 is the top response category, not a measured physiological maximum. Inhibiting an impulse is not thereby a logically irreversible memory reset; Bennett's result does not charge every override a Landauer toll [B1, B2].

The neuroscience supports a narrower point. Díaz-García and colleagues observed stimulation-related changes in neuronal glucose metabolism in mouse hippocampal slices and awake mice [B5]. Westbrook and colleagues measured how healthy adults value cognitive effort through choices about working-memory demands and money [B6]. Neither supplies a joule value for an R-score. The March 2.7-fold figure came through a review, not an experiment calibrating the Moniz (V2-L12).

3 The integral and the units

The March text proposed that the Mz is proportional to the time-integral of an override entropy-production rate. It said the Mz is not a metaphor for cost; it is cost. The units say otherwise (V2-L11).

An integrated entropy-production rate has units of J/K. Work has units of J. R_int × T_dur has score-minutes. A proportionality sign hides the missing mapping instead of supplying it.

A physical study could define its own quantities. With measured power in a task and in a stated reference condition, the energy contrast over a duration τ would be:

$$E_{excess} = \int_0^{\tau} [P_{task}(t) - P_{reference}(t)]\, dt$$

That contrast is in joules. It can be negative when the task draws less than the reference, which would not mean negative effort or negative total entropy. These are definitions of comparisons, not results for relational processing. The body is an open system, and neither cortisol nor an R-score supplies its energy balance.

4 Mz relativity

Partner A cooks dinner at R = 2; Partner B cooks dinner at R = 7. Over thirty minutes the convention assigns 60 and 210 score-minutes. Same behavior, different reports.

The March edition read this as different override costs and different thermodynamic work, following necessarily from different filter geometries. The numbers describe assigned scores and duration. They do not show that Partner B spent 3.5 times the energy, did 3.5 times the work, or cared 3.5 times as much (V2-L15).

Mz relativity is not a bug. It is also not a theorem. It is a caution: a behavioral description can hide real differences, and a score cannot make people comparable on one physical scale. Variation in R is not identical to variation in filter geometry, and cross-person equivalence has not been established.

5 The proposed outcome ratio

The March ratio was:

$$\kappa_{Mz} = \Delta V_{rel} / Mz$$

It means nothing until the outcome, its baseline, the affected party and the observation period are defined. With an outcome score over score-minutes, it is not a dimensionless thermodynamic efficiency or a return per joule (V2-L16).

The ratio is undefined at Mz = 0 and unstable near it, so both numerator and denominator stay visible. A negative ratio is an evaluative outcome, not a direction of heat flow. The link to Kolchinsky and Wolpert's semantic information is proposed, not derived [B7].

An unanswered act does not force ΔV_rel to zero. Unwitnessed care can have practical effects, and a recognized act can do harm. Grief does not guarantee a positive return that can be divided by a measured cost.

6 Dark Soul Matter

Brief 12 names sustained, difficult investment invisible to the receiver “Dark Soul Matter.” The name is an image, borrowed from the matter astronomers infer but cannot see **[Analogical]**. It keeps attention on effort an observer misses.

The March chapter made it precise: maximum override for months or years, the largest integral a transducer can sustain, the most expensive investment in the gap. That precision is withdrawn (V2-L17). No one is shown to hold a physiological maximum for months, duration cannot silently mean every minute of a life, and lack of recognition does not establish lack of benefit.

The founding line meets its most extreme reading here, as an image: investment without guaranteed return. The index does not make sacrifice obligatory, rank anyone's worth, or require escalating strain to prove care.

7 AI and the missing R value

Brief 12 assigned AI companions R = 0 and therefore Mz = 0. Thermodynamics does not establish that, and zero lies outside the 1–10 scale (V2-L18). A system without a comparable, validated self-report is marked “not measured,” not silently given an absence of difficulty.

An implemented digital system uses physical resources that depend on its hardware, conditions and infrastructure. No cortisol is needed for electricity use or heat. The March text sketched an “ontological path” by which real processing constraints would raise an AI's R above zero. Resource competition alone would not establish felt resistance or make a human R-score applicable.

The corrected Axiom 0 asks that substrate alone not decide the comparison. It does not prove equal cost, capacity or experience. The framework cannot infer zero cost from an absent report, or experience from a nonzero energy measurement.

8 The calibration problem

The open problem is larger than one conversion factor. The construct and instructions need definition, and reliability and scale properties need evaluation before the score is treated as an instrument. Any physiological association would hold only for its task and conditions; it would not be a universal constant.

The proposed tools also need to measure the claimed quantity. BOLD fMRI is a hemodynamic signal related to neural activity, not a reading of ATP expenditure or heat [B8]. An EEG trace is not in joules or J/K.

The March chapter ended: “We do not have it yet. But we know where it lives and what would measure it.” The first sentence stands. The second is withdrawn: the framework does not yet know whether a stable mapping exists for any specified task. A failed association would count against that bridge, and the absence of calibration cannot be renamed a formal identity that survives every outcome.

What this chapter now claims

The Moniz records reported resistance and duration under a proposed convention. It does not measure thermodynamic work, entropy production or universal order spent. Its scale properties and usefulness need testing. The outcome ratio needs defined quantities and a positive denominator, and AI is not assigned zero by default.

The Moniz must not be used to rank people, demand sacrifice, diagnose a relationship or infer anyone's worth. Even “what it costs you” remains a reported index, not a physiological measurement.

The next chapter asks what happens when habits from an earlier relational environment are carried into a new one: the Template Tax.

Chapter 4: The Template Tax

The Cost of Running Yesterday's Architecture

Status: Developmental experience and learning can influence later responses. The Template Tax is a proposed description of context mismatch, not an established entropy quantity, diagnosis or biological mechanism. Its AI-custodial application is a **[Speculative]** hypothesis, and its physiological predictions are untested. This chapter is not a diagnostic instrument or a treatment protocol.

1 The problem

The filter has a shape, and the shape has a history. Volume 1 describes it with filter geometry, G = (S_params, C_params, Σ_params): selection, compression and structuring. These are organizing labels, not anatomical compartments, and the Greek letter in Σ_params does not make structuring a form of thermodynamic entropy.

The Template Tax asks what happens when a familiar response is carried into a setting where it no longer helps. A person may keep watching for a danger that has gone, discount an offer they could safely accept, or brace for rejection before there is any sign of it. The useful question is whether that pattern adds a burden now, compared with a stated alternative. Calling it a tax does not establish its size or its units.

The March edition held that structuring parameters are not innate and are set during one developmental window. That was too strong (V2-L19). No partition of genetic, developmental and current influences is offered here, and nothing shows that relational responses are fixed in childhood. Adults keep learning; in one study, juggling training accompanied measurable brain changes [A3], though that concerns a visuomotor task, not the relational filter. “Inherited architecture” means patterns carried forward from experience, not genetic or epigenetic inheritance.

2 A possible mechanism, not a universal sequence

The March chapter drew the case sharply: a child with unpredictably available caregivers grows a filter tuned to that unpredictability, watching for threat, compressing toward danger, expecting harm. In a later, safer setting, that vigilance might still run, making ordinary exchanges effortful. As a hypothetical, it is worth keeping. As a rule for every child, it fails.

The primary research pulls in more than one direction. McLaughlin and colleagues found that maltreatment in 90 young people aged 6–18 was associated with blunted threat responses and poorer threat–safety discrimination [A1]. Machlin and colleagues, following 170 young people aged 10–13, instead linked violence exposure to heightened early responses to threat cues and later PTSD symptoms [A2]. Different samples and tasks yield different patterns, and neither study measured a Template Tax.

The March text called these calibrations accurate: a filter raised in unpredictability should attend to threat. Understandable is the right word; accurate overstates what the data show and invites explaining every outcome after the fact. Current danger must also be assessed, not assumed absent. What looks like an outdated expectation to an observer may answer conditions the observer has not seen.

So the mechanism stays conditional. A learned response may persist after conditions change, and that mismatch may add effort or impairment. Showing it would take measuring the response, the old and current contexts, and a competing explanation; knowing that adversity happened is not enough.

3 Three places to look

The March chapter sorted the distortions by filter stage. The vocabulary is still useful as prompts for inquiry, not as three proven syndromes:

- **Selection** asks what receives attention: hypervigilance to threat, blindness to positive signals, or attending to everything at once. More attention to threat is not automatically irrational, and it does not by itself show a raised selection cost.
- **Compression** asks which distinctions survive: catastrophizing, minimizing positive evidence, splitting into all good or all bad. These motivate specific behavioral hypotheses, not a single childhood cause, and losing detail in a description is not physical information erasure [A5].
- **Structuring** asks how an interpretation becomes an action: a default expectation of harm, investing in people who resemble earlier figures, or withholding participation. Intention, registration and benefit are separate questions, the sign of an act is not an entropy flow, and “wrong economy” cannot serve as a clinical diagnosis.

These categories overlap, and the same visible response can have different causes. They do not add up to three excess entropy costs.

4 What a cost comparison would require

The March chapter wrote the tax as a chronic work integral: the template's entropy-production rate minus an optimal one, integrated over every relational cycle, running always. That cannot serve as a measurement equation (V2-L20). Integrated entropy-production rates come out in J/K, not work and not score-minutes. The optimal comparison is undefined, the difference need not be positive, and nothing supports a tax that never switches off.

A real comparison would choose an observable outcome first: task performance, reported effort, or a defined physiological response under stated conditions. A claim about extra metabolic energy would need an energy measurement, a boundary, an interval and a credible comparison, with background activity and uncertainty accounted for. It cannot be read from cortisol, HRV or exhaustion.

People do report that carrying an old pattern is exhausting even without active conflict. That report deserves weight as a report while the proposed mechanism remains unknown. And a pattern that costs effort in one setting may carry no detectable extra energy, or may help in another. Those outcomes must be able to count against the stronger claim.

5 The AI custodial hypothesis

CP-34 extends the mismatch question to children who receive substantial care or companionship through AI systems **[Speculative]**. Its image is an instrument zeroed correctly against the wrong standard:

expectations learned with one kind of partner may transfer poorly to human partners. That is a developmental research question, not an established outcome of AI exposure.

The March reference environment was idealized: unlimited patience, zero-cost availability, unconditional presence. Real AI services have physical costs, limited availability, access rules and product changes, and a patient reply does not establish unconditional presence, an inner state, or freedom from harm (V2-L21). The hypothesis must describe the actual system and caregiving arrangement.

Three questions survive: whether users come to expect different availability, how they read other people's limits and efforts, and what happens when an important service changes or ends. “Cost-signal blindness” and “orphaned Mz” remain project vocabulary, not validated syndromes.

The name Calibration Corruption also needs care. It must not label a child defective, assert that AI-mediated care necessarily damages development, or promise that no harm occurred because the interactions felt responsive. The March conclusion that such a filter “needs recalibration, not repair” is withdrawn, and nothing here recommends AI as a substitute for human care.

6 Change without a biological success meter

The March chapter read effective therapy as filter-geometry change, read post-session exhaustion as the entropy cost of redesign, and predicted rising HRV, normalizing cortisol and a shifting CSS signature. Those predictions are withdrawn as universal signs of effective therapy (V2-L22). The framework still does not prescribe a therapeutic modality.

Habits and expectations can change. Improvement would need defining independently of any biomarker, with treatment effects, ordinary variation, medication, sleep and health considered. A report of exhaustion deserves to be taken as a report, not translated into a physical quantity that was not measured.

DFQ-003 stays open as a question about longitudinal measurement. TEAP would first need a defined protocol and evidence of reliability and validity for that purpose; tracking an unvalidated score does not make it a calorimeter.

What this chapter now claims

The Template Tax keeps a humane question: how much difficulty comes from carrying an old response into changed circumstances? The answer may differ between people, tasks and times. The chapter offers ways to describe and test the mismatch; it does not establish continuous excess entropy, a universal adversity mechanism or an AI-specific disorder.

History is not blame, a learned pattern is not destiny, and a physiological response is not a verdict on anyone's character.

The next chapter separates two events that are easy to mistake for one: making an investment, and having it reach or be answered by another person.

Chapter 5: The Unreciprocated Transmission

When the Effort Does Not Land

Status: This chapter separates physical expenditure, statistical information, delivery, registration, benefit and reciprocity. Unreciprocated transmission is framework vocabulary for a family of cases, not a newly demonstrated thermodynamic regime or a proved extension of Kolchinsky and Wolpert's framework.

1 The gap the framework can name

A person can make an effort that never reaches its intended recipient. A message can arrive, be understood, and get no reply. Those are different conditions. Nondelivery is not nonreciprocity, and neither is the same as having no effect.

Volume 1's Observation Split names the difference between an activity and an event that meets the framework's registration rule. A candidate Trinket is the directed act before that rule is applied; under WP-12, a qualifying Trinket requires specified registration. That is a convention for classifying events, not a law of physics, and an act that fails it can still help or harm someone.

The March chapter tried to turn this gap into a third information state, beyond Kolchinsky and Wolpert's correlated and scrambled conditions: one-sided information with full production cost. That construction is withdrawn (V2-L23). Statistical dependence, intentional communication and recognition are different questions. Two variables can be correlated without anyone recognizing a message, and one failed message does not erase every existing correlation.

What the framework can contribute is descriptive and still worth having: it keeps the attempt visible when there is no reply.

2 Separate accounts, not three states

The March chapter's central comparison held that entropy production is identical whether or not the signal lands: same transduction, same waste, same Mz, same debit, only the outcome different. That equality is withdrawn (V2-L24). Preparation, repetition, delivery, feedback and what follows can all differ between a successful attempt and a failed one.

For any case, the account records separately what was done, whether it arrived, whether it was registered, what effects followed, and whether anyone reciprocated. The physical account asks its own question: what resources supported the activity within a declared boundary and interval? Resources already used are not refunded when a message fails. Where measured costs are unavailable, the account says so. A person's report of effort can be recorded without being converted into joules.

Registration is not sign. A recognized act may be beneficial, harmful, mixed or uncertain under a stated criterion, and an unrecognized act may still have effects. Lack of registration is not the null sign, and a missing reply settles neither party's outcome.

The March refrain was “The universe records the debit. No credit appears on the other side.” The corrected account keeps several books, each in its own terms, and none of them belongs to the universe.

3 Where the distinction matters

The March chapter's examples remain the right ones. What changes is what they share.

- **Unreciprocated love.** An unsent letter, an unnoticed letter and an offer explicitly declined have different histories; the last may be fully registered while affection is not returned. None guarantees maximum Mz or zero benefit. The receiver may decline, and expenditure creates no entitlement to a response.
- **Grief.** A survivor may keep organizing a life around someone who has died. New ordinary communication with the deceased is gone, while memories, routines, other relationships and continuing bonds still matter. That is not enough to classify all of grief as a failed transmission; Chapter 6 takes it up as adaptation.
- **Prayer.** Activity and its consequences can be studied without deciding whether a theological receiver exists. Unverified reception is not verified nondelivery, and the BSB supplies no evidence on either side of that question.
- **Dark Soul Matter.** Sustained, unseen investment keeps its name as an interpretive label, as long as invisibility is not read as intensity, harm or moral rank.
- **Unwitnessed care.** The parent checking on a sleeping child. The partner adjusting the thermostat at three in the morning. The colleague advocating in a meeting the other person never hears about. A thermostat changes a sleeper's room and advocacy can change an opportunity, whether or not anyone knows who acted. Whether the act qualifies under WP-12 and whether it helped are separate assessments.

These cases share a question about recognition, not a demonstrated thermodynamic signature. They cannot all be assigned zero change in the receiver or zero relational return.

4 The formal statement, corrected

For discrete random variables under the same joint distribution, mutual information is symmetric [A18]:

$$I(X; Y) = H(X) + H(Y) − H(X, Y) = I(Y; X)$$

That equality says nothing about equal awareness, equal benefit or returned affection.

The March condition required positive mutual information from the sender toward the target, zero from the receiver back, and full entropy cost paid. If Y_target and Y_0 differ, the positive and zero values can coexist. This does not establish one-sided mutual information, nondelivery or harm. Symmetry applies to the same pair under the same joint distribution (V2-L25). Where there is no actual receiver, a receiver-state variable cannot simply be presumed.

The replacement is an explicit observation rule, not a new entropy identity: identify the candidate act, the delivery evidence, the registration criterion and interval, the response, the outcomes and the measured

resources. Unknown delivery stays unknown, and absent evidence of benefit does not become a proved zero.

None of the March consequences follows from nondelivery alone: not a positive Mz, not an additive stage-by-stage entropy bill, not zero change in the receiver, not a loss for the sender. A failed attempt may involve learning or preparation; it may also impose burdens. A net outcome needs a defined measure and comparison.

5 What Kolchinsky and Wolpert already address

The March chapter argued that their framework assumes a closed loop and so cannot see undelivered signals, and that relational viability extends it. Their treatment already evaluates information relative to stated dynamics, a viability function, a timescale and counterfactual interventions, including partial scrambling, directed transfer and system-to-environment information [A4]. The claim of a necessary gap is withdrawn (V2-L23).

A physical model could include production resources and a failing channel if those dynamics were specified. The framework's job is to build and test a relational application, not to claim priority for a limit the cited work does not impose. “Relational viability” stays an application-specific proposal that needs a defined outcome and a justified mapping.

6 The founding line without the zero-return theorem

The March chapter's sharpest sentence was that here, “more than it saves” is everything, because nothing was saved: zero efficiency, total waste, the most expensive regime in the framework. The physics cannot say that (V2-L26).

The founding line keeps its force as interpretation **[Analogical]**: investment does not guarantee connection. The second law cannot turn an unrecognized act into total waste or set its efficiency to zero; that would need a defined physical task, inputs and useful output, and a relational response is not automatically an energy output. Eventual heat does not erase what an act accomplished before or alongside it.

No ranking of grief, prayer, unreturned affection and unnoticed care follows from that law. The restraint keeps the gap the chapter began with: an effort can be real even when its intended outcome does not happen.

What this chapter now claims

The unreciprocated transmission is a family of cases that need careful description, not a single measured regime. Delivery, registration, practical effect and reciprocity are separate. The equal-cost, guaranteed-harm, zero-efficiency and extension-priority claims are withdrawn.

Neither futility nor nobility follows from the physics. An investment creates no claim over another person's affection.

Chapter 6 turns to grief, where the question is not whether a message was delivered but how a life continues after an important person has died.

Chapter 6: Grief as Filter Redesign

Rewriting a Life While It Keeps Running

Status: Bereavement has documented health associations that differ substantially by population and outcome. Filter redesign is a proposed interpretation of adaptation **[Analogical]**, not an established thermodynamic mechanism. The behavioral-interdependence prediction is **[Speculative]**. This chapter is not medical advice and supplies no diagnostic test or treatment recommendation.

1 The problem

The March chapter opened bluntly: grief is expensive, and that is not a metaphor. Grief can be exhausting, and that deserves attention without a claim that its energy has been measured. Bereavement studies report differences in particular physiological measures and health outcomes. They do not establish one biological response or a quantified price of losing someone (V2-L27).

The distinction is practical. A small cortisol comparison, an immune assay, an ECG record, a sleep study and a mortality cohort measure different things, and none becomes a grief-energy meter because it has a biological basis [A6–A10].

The March chapter also held that the grief literature lacks a physical mechanism and that the transducer model supplies one. Existing work already addresses mechanisms, including a cognitive attachment model of memory and identity in prolonged grief [A17]. The framework's question is narrower: can disruption of shared routines, decisions and expectations help explain differences in how people adjust after a death? “Filter redesign under load” is an image for that work while ordinary life continues.

2 How lives become interdependent

In a close relationship, two lives can grow around each other. The March chapter named the forms: shared daily routines, decisions that route through both people, an “us” that becomes load-bearing in each person's sense of self, and habits of movement calibrated to the other's presence. One partner may hold the practical knowledge; the other may keep the calendar.

The framework calls this filter integration. The March text said the coupling was not metaphorical, was measurable, and was the primary determinant of grief's metabolic cost. None of that is established (V2-L28). These are candidate dimensions of behavioral interdependence, not evidence that two neural filters have literally merged, and no validated aggregate measure of this framework's proposed filter integration is established here.

To study it, interdependence must be broken into observable parts and kept distinct from emotional closeness, relationship satisfaction, attachment, caregiving burden and material dependence. Someone who shared few tasks may grieve profoundly; someone with deep practical dependence may adapt with help. The variables have to explain differences, not define them into existence.

3 What death changes

When someone dies, the possibility of new ordinary interaction with them ends. Their particular way of answering will not produce anything new. Their influence is not thereby erased: it stays in memory, in the house, in other relationships. A familiar impulse to consult them can coexist with knowing they are gone.

The March chapter called this the Observation Split at its most devastating: the survivor spending a full metabolic load into a void where no Trinket can form. That was too sweeping (V2-L28). Remembering, mourning, settling practical matters and talking with others are different activities, and they can have consequences even though the person who died cannot answer.

Nor is death a measured transition in which a known quantity, S_partner, drops to zero. A past relationship can leave information and resources the survivor still uses.

4 Redesign as an interpretation

The March chapter's phrase was “engineering under load”: not recovery, not healing, but a system that must keep operating while its own architecture is restructured. As an image, it is apt **[Analogical]**. As a mechanism, it is unestablished.

The idea has a long history. Parkes described psychosocial transitions, Attig wrote of relearning the world, and Markovic analyzes profound grief as an unchosen transformation of the self [A16, A19, A20]. These are intellectual antecedents, not measurements of reconstruction.

Neuroimaging offers a different kind of evidence. Huang and colleagues studied 19 bereaved participants before and after an eight-week mindfulness-based cognitive therapy course and found changes in resting-state functional connectivity [A11]. The study was small, with no untreated comparison group or pre-loss baseline, and functional connectivity is a statistical relation between signals, not synapses being rebuilt.

Naming steps such as identifying old expectations and building new routines does not identify physical bit erasures, and Bennett's result shows why useful processing is not a separate erasure toll at each named stage [A5]. Cortisol is not established as fuel for redesign, immune changes do not show energy diverted to reconstruction, and disturbed sleep is not proof of an overworked reprocessing engine.

The March line was “These are not symptoms of grief. They ARE grief.” The corrected line: physiology can accompany grief without being its definition.

5 What the studies show

The March chapter read the literature as describing the what while the model supplied the why. The primary studies are narrower than either:

- **Cortisol.** O'Connor and colleagues compared 12 women with complicated grief and 12 without it after a mother's or sister's death from breast cancer; the first group had a flatter daily cortisol pattern [A6]. Hopf and colleagues' article is a systematic review, not a primary experiment [A15].
- **Other physical measures.** Buckley and colleagues found higher heart rate and lower values on several HRV measures early after loss in 78 bereaved people versus 79 controls [A7]. Irwin and

colleagues' work concerns natural-killer-cell activity and depressive symptoms, not suppression of all immunity [A8]. Reynolds and colleagues found some REM-sleep differences in nondepressed bereaved older adults but similarity on most other sleep measures [A9].

- **Mortality.** Elwert and Christakis followed 373,189 older married US couples from 1993 to 2002; mortality associations after widowhood varied with the causes of death [A10]. That is a population pattern, not a forecast for one person.
- **Symptom trajectories.** Majd and colleagues modeled depressive-symptom trajectories in 175 widowed adults over the first year [A12]. These are fitted patterns, not universal stages, and the study had no pre-loss baseline and measured no Template Tax.
- **Perceived inclusion.** Harrison and colleagues found that current perceived inclusion of the deceased in the self was associated with prolonged grief disorder in a matched comparison [A13]. The March text read this as a measure of filter integration. It is a cross-sectional measure of present perception, not a record of pre-loss behavior.

6 A prediction that can fail

[Speculative] The empirical proposal is whether pre-loss behavioral interdependence adds predictive information beyond self-reported closeness for specified outcomes after bereavement. It is not a claim that grief is proportional to integration or that closeness does not matter (V2-L29).

The March chapter called the prediction falsifiable and not yet tested. Falsifiable stands. Whether the comparison has been studied elsewhere is not certified here, so the novelty claim is withdrawn.

The second edition sets out what a credible test would need: a population, observation intervals and primary outcome chosen in advance; interdependence and closeness measured before the death where possible; model comparison with and without the behavioral measures; and attention to prior health, caregiving, circumstances of death, finances and support. Outcomes keep their real names and units, and “normalization” has no single timetable.

The March ratio S_partner / S_total is not an operational predictor (V2-L30). Semantic information is model-dependent, and splitting it into additive partner and independent channels has not been justified [A4].

The proposal would be weakened if adding the behavioral-interdependence measures to the same comparison model, already including self-reported closeness and the stated covariates, reproducibly failed to improve prediction of the specified outcome. A positive result would support a bounded predictive claim, not the physical redesign mechanism.

7 Clinical limits

The March chapter read grief as productive redesign and depression as redesign stalled. That equation is withdrawn (V2-L31). Tsai and colleagues, following 398 family caregivers of terminally ill cancer patients over two bereavement years, supported a distinction between grief and depressive symptoms and

a temporal association in that population [A14]. A lagged observational model does not show that depression is a stalled reconstruction.

The March chapter also wrote that grief “is not damage to be repaired. It is construction to be supported.” The image must not imply that painful grief always does useful construction, or turn ongoing distress into a personal failure to rebuild. Adaptation need not erase an enduring bond or replace the person who died. The framework sets no diagnostic boundary and should not decide whether someone needs care.

The March proposal to begin architectural decoupling before an anticipated death is withdrawn as a recommendation (V2-L32). Anticipatory planning and caregiving arrangements need their own evidence and the priorities of the people involved. No one should be told to reduce closeness on the premise that it lowers a cost these studies do not quantify.

8 SupoRel and the capture surface

The danger is the slide from describing a burden to making it a virtue. “Your grief is proportional to your love” is a common consolation, and the March chapter rightly warned that the model could be misread as its scientific proof. Its correction swapped in another proportionality, to filter integration. That is withdrawn too. Neither grief intensity nor any physiological measure is a validated measure of love, devotion or worth.

A tightly interwoven life is not a better life, and a person whose life was closely coupled to another's is not more loving than someone more independent. The second capture is “don't get too close.” The framework does not endorse independence as a way to avoid grief. It describes; it does not prescribe how to live.

The March chapter closed with Carroll's aphormeology: grief is pushed from behind, not pulled toward cosmic sacrifice. The caution stays, without its physics (V2-L34). Biological observations do not establish a cosmic purpose for grief or confer nobility on suffering; they do not remove grief's human meaning. Noble is a human judgment the physics does not make.

What this chapter now claims

Filter redesign remains a way to describe adaptation after loss. The reviewed studies establish specific observations and associations, not an energy mechanism, a universal scaling rule, or a clinical line between successful and failed rebuilding. Behavioral interdependence remains a Speculative candidate predictor, and its value must be earned against existing explanations.

The next chapter traces what these limits do to the framework's canon.

Analogy table: Filter redesign under load

Filter redesign under load is Analogical. Its engineering side describes systems modified while they keep operating; its relational side describes adaptation after a death. The image organizes questions about how survivors revise routines and expectations. It is not a measured mechanism.

The image comes from March Chapter 6: “It is engineering under load: the system must continue operating while its own architecture is being restructured.”

Term	Engineering reading	Proposed relational reading	Where the mapping holds	Where it breaks
“filter”	A system that selects and transforms signals according to set parameters.	The survivor's habits of attention, interpretation and action, shaped around the person who died.	Some expectations and routines were tuned to another person's presence, and they persist after the death.	No filter parameters have been measured; the filter is an organizing label, not an anatomical compartment (Ch 4 §1). Expectations live in many places, including other relationships and the home.
“redesign”	Deliberate changes to a system's specification, toward a target design.	Revising roles, routines and expectations after loss.	Survivors do revise routines and expectations; the literature on psychosocial transition and relearning the world describes this [A16, A19, A20].	Grief has no designer and no target specification. Naming steps does not identify physical bit erasures [A5], and adaptation need not erase the bond or replace the person.
“under load”	Modifying a system while it carries its normal working load, as when a bridge is repaired without closing it.	Adapting while work, care and daily life continue.	Life's demands usually continue after a death, and that can make adaptation harder.	Engineering load is a defined force or throughput. Here it is unmeasured, and cortisol, immune or sleep changes are not load readings (Ch 6 §4).
“cost of redesign”	The work and materials a rebuild consumes, in joules or money.	The exhaustion and disruption grief brings.	Grief can be exhausting and disruptive, and reports of that deserve weight as evidence about the person's experience.	The studies reviewed here do not quantify an energy cost of grief or this proposed redesign, and the March Landauer stages are withdrawn (V2-L28). Physiology can accompany grief without being its price.
“completion”	A new design delivered; or, if the work stops partway, a system left neither old nor new.	Adjustment after loss; in the March reading, depression as a stalled redesign.	People's distress after a loss follows different courses over time [A12].	The stalled-redesign reading of depression is withdrawn (V2-L31) [A14]. Adaptation has no single timetable or end state, and persistent distress must not be framed as a personal failure to rebuild.

What the table does not do

It is not evidence for the framework, not a mechanism of grief and not a clinical tool. The engineering column describes how engineered systems are modified; that standing does not pass to the mapping, which is Analogical in every row.

Promotion route (conditions, not a work plan)

To move any row from Analogical toward Supported, a study would have to define the relational quantity independently of the image, measure it in its own units with a baseline, and show a stable relationship under stated conditions, with a stated result that would count against it.

Chapter 6's Speculative interdependence prediction is a separate empirical proposal. A positive result there would support a bounded predictive claim, not the redesign mechanism, so it cannot promote this image on its own. No row is promoted, and no study is proposed here.

Chapter 7: Where the Receipt Lands

What the Volume Does to the Documents It Touches

Status: A dependency review, not a validation study. This chapter records what the corrected biological account lets the framework say, what it withdraws, and which documents still need reconciliation. Internal agreement is not additional evidence (V2-L35).

1 What this volume did

The March chapter summed up the volume in two lines: “Volume 1 said: connection costs entropy. Volume 2 said: here is the receipt.”

The corrected pair runs differently. Volume 1 keeps three accounts apart: physical cost, information and relational outcome. It does not establish one spendable currency shared by heat, cortisol, attention and care, and the transducer remains a proposed way to organize processing (V2-L01). Volume 2 reads what the body actually records and finds several receipts in several units, none of them a bill for one relationship.

The receipt is still a useful image, as long as we read what is printed on it. A hormone concentration, an immune measure, a sleep outcome, a self-report and a measured energy expenditure are different records. The framework gains precision by keeping them distinct, not by claiming one amount has been measured five ways.

2 WP-18: The Feeling as Cost

WP-18 keeps its central insistence: feelings and relationships happen in bodies, not as costless abstractions. It must not identify feeling with one obligatory sequence of brain regions and hormones, or treat its selection, compression and structuring functions as established biological stages.

The March chapter called the Signal Form / Cost Substrate distinction load-bearing for every diagnostic instrument in the framework. It organizes separate questions about action and the resources behind it. It does not make cortisol, immune responses or cellular aging interchangeable units of cost, and no physiological pattern diagnoses the sincerity, benefit or economy of an interaction. WP-18 needs Chapter 2's qualifications: the actual measurement, its timing and comparison, association kept apart from mechanism.

3 Brief 12: The Moniz

The Moniz stays a proposed way to record reported difficulty and duration. The March claim that it is a thermodynamic work integral, and the cosmological constant connecting difficulty to the physics of the universe, is withdrawn (V2-L11, V2-L13). A rating scale needs a measurement model before its differences, ratios or sums mean anything, and multiplying by minutes does not supply one.

The κ_Mz ratio is not an established relational efficiency (V2-L16). An unregistered act does not establish zero benefit, and unseen effort is not thereby a maximum expenditure. The blanket assignment of R = 0 to AI is not warranted (V2-L18). Missing evidence cannot be entered as a measured zero, and none of these corrections determines anyone's worth.

4 Brief 16: Mz Relativity

The same act can draw different difficulty reports from different people, or from one person on different days. That keeps a real contextual question about expectations, experience and resources. The March identity “the variance in R IS the variance in G” is withdrawn (V2-L15). Reports do not uniquely identify a filter geometry or prove a difference in thermodynamic work, and cross-person comparison takes more than matching numbers.

5 Brief 20: The Template Tax

The Template Tax stays a metaphor and a research proposal about patterns learned in one setting that may be costly or poorly suited to another. It is not a continuous entropy surcharge, a diagnosis of anyone's history, or proof that a present difficulty has one inherited cause (V2-L20).

The filter vocabulary does not explain a treatment's mechanism because a person changes during treatment. Nothing here says successful therapy must lower a universal Mz baseline, or that an unchanged biomarker invalidates someone's improvement (V2-L22). CP-34's Calibration Corruption remains an untested **[Speculative]** developmental proposal, not a diagnosis or a trauma mechanism (V2-L21).

6 The Blueprints, Chapter 16: Grief

The Blueprints described grief with rough phases, timelines and the idea that deeper relationships encode more information. The March volume refined that into a mechanism and a prediction it said bereavement research had not yet run.

What survives is the image of filter redesign under load **[Analogical]** and a narrower question **[Speculative]**: whether defined measures of pre-loss behavioral interdependence add predictive information about specified outcomes beyond self-reported closeness (V2-L29). It is not a claim that integration determines metabolic grief cost, or that earlier research overlooked the comparison. The Blueprints' timelines, interventions and clinical interpretations need their own evidence review and are not endorsed here by a shared metaphor.

7 Volume 1: The Observation Split

The March chapter said Volume 2 populated the Observation Split with its full biological content: a regime Kolchinsky and Wolpert do not name, full cost meeting zero return. “Volume 1 named the gap. Volume 2 showed what it costs.”

The corrected Observation Split separates expenditure, delivery, recognition, reciprocation and outcome. A candidate act can fail the registration rule and still have consequences; registration does not guarantee

benefit. The one-sided mutual information claim and the third state outside Kolchinsky and Wolpert's framework do not return (V2-L23, V2-L25). The biological questions are still worth asking, but they need observations, not a thermodynamic verdict on every instance of grief, prayer, unreturned affection or unwitnessed care.

8 What changes in the canon

The March chapter ended: “Nothing broke. Everything gained biological ground. That is the mark of a real layer: the instruments still function, and now you can see what they are measuring.”

Something did break: the claim that the instruments already work. TEAP, CSS, the economy typing table and the Mz have not been validated by these chapters as clinical instruments, calorimeters or readouts of internal mechanisms. “The instrument still works” cannot stand in for evidence of what it measures and for whom.

What held is the concern: what is invested, what reaches another person, and what follows. The BSB remains a discipline of inference, not a certificate that every bodily claim is established (V2-L36). Reports of experience remain evidence about reported experience, with the usual limits of self-report.

SupoRel still earns its place by challenging grief as virtue, effort as entitlement, numerical comparison of people's worth, and the Template Tax as blame. Those are cautions, not proof that every misuse has been eliminated. The epistemic tiers, now four with Analogical, need evidence and scope beside each claim; a label confers nothing by itself.

The original papers remain unchanged. The dependencies named here mark reconciliation still to do, not amendments already made. The stronger foundation is a narrower one: the account can now be tested without requiring every measurement to confirm the metaphor.

Volume 2 correction ledger

The ledger traces 36 selected March claims in Volume 2. By this edition's classification of the second edition's treatment, 17 were withdrawn, 17 narrowed and 2 kept. It is not an exhaustive inventory of every Volume 2 issue, and it makes no new scientific decisions.

March locations refer to the preserved Volume 2 page on suposystem.ai. Second-edition (2E) locations use the October 2026 collection's Volume 2 chapter and section headings and its local reference labels (B for Chapters 1–3, A for Chapters 4–6).

ID	March claim (Volume 2 location)	2E disposition	2E location	Basis
V2-L01	Ch 1 §1: Volume 1 “established the physics”: one economy, one currency, one ledger; the Trinket is an entropy token; the second law guarantees every relational act spends more than it saves; “the founding line is physics.”	Withdrawn	Ch 1 §1	Rests on claims withdrawn in Volume 1 (V1-L03, V1-L14, V1-L34); the founding line is a motivating image, not a consequence of the second law.
V2-L02	Ch 1 §1: the body pays for connection in cortisol, immune suppression, cellular aging and sleep degradation.	Withdrawn as denominations of one currency	Ch 1 §1; Ch 2 §3	Different observations in different units; a body need not be damaged for care to be genuine.
V2-L03	Ch 1 §2, Ch 2: a feeling is a fixed cascade (amygdala, then body, then cortical label); the HPA axis releases cortisol, adrenaline and oxytocin.	Narrowed: interacting processes, no compulsory sequence; pathways named correctly	Ch 1 §2; Ch 2 §1–2 [B9, B10, B19, B23]	Amygdala-lesion counterexample; adrenaline is sympathetic–adrenal-medullary; oxytocin is not a compulsory step.
V2-L04	Ch 1 §2: “the bill has already been paid” before a feeling is named; the body is the ledger on which the cost is recorded.	Narrowed: body-as-ledger kept as an image with conditions	Ch 1 §2	A response is not a receipt; an additional cost needs an interval, a boundary and a comparison.
V2-L05	Ch 1 §2: the ~20 W brain is the most thermodynamically expensive organ; relational regions are the hungriest; it is the most expensive hardware in the known universe; cortical communication costs 35× computation.	Narrowed: 20 W estimate and 35:1 modeled ratio kept with scope; superlatives withdrawn	Ch 1 §2 [B4]	The 35:1 figure is a modeled cortical allocation; neural communication is not interpersonal communication.
V2-L06	Ch 1 §3: biology ~10^6 × Landauer vs silicon ~10^9 ×, 1,000× more efficient, 30 million× at the cellular level; “the most refined thermodynamic instrument for relational processing.”	Withdrawn; no reverse ranking asserted	Ch 1 §3 [B1–B3]	Unlike operations and boundaries (as V1-L08); evolutionary history does not guarantee optimality.
V2-L07	Ch 2: hormonal cascade, metabolic cost of emotional response and bereavement physiology, all Established.	Narrowed: specific findings under particular conditions	Ch 2 §3; What this chapter now claims	Primary studies support specific associations, not a universal bodily bill.
V2-L08	Ch 2: low HRV predicts elevated mortality across all demographics; relational crisis narrows the body's range.	Narrowed	Ch 2 §3 [B14]	Some lower HRV measures predicted mortality in an elderly cohort; not universal, and not relational causation.
V2-L09	Ch 2: the Signal Form / Cost Substrate distinction makes the diagnostic instruments work; their decoupling is the primary diagnostic signal (Supported).	Narrowed: an accounting discipline, not a detector of real feeling	Ch 2 §4	Strain does not prove an act genuine; absent strain does not prove it simulated.
V2-L10	Ch 2: the Parity Window remains open; the framework can measure cost but cannot access experience.	Kept open; BSB narrowed to a boundary on inference	Ch 2 §5	Physical measures, behavior and reports can all be relevant evidence; none is decisive alone.

ID	March claim (Volume 2 location)	2E disposition	2E location	Basis
V2-L11	Ch 3: the Mz is a thermodynamic work quantity, the time-integrated entropy production above baseline (Supported).	Withdrawn; Mz kept as a descriptive score-minute index	Ch 3 §1, §3	Units differ: the integral is J/K, work is J, and R × T is score-minutes.
V2-L12	Ch 3: the R-value reports the person's own override cost, supported by a 2.7-fold neuronal metabolic increase (Díaz-García and Yellen) and Shepherd's account of effort.	Withdrawn as a calibration	Ch 3 §2; Original review citations	Both sources are reviews; neither calibrates the Moniz. R records reported resistance on a 1–10 scale.
V2-L13	Ch 1 §4, Ch 3: the Mz is the framework's “cosmological constant,” bridging felt difficulty and the universal entropy budget.	Withdrawn	Ch 1 §4; Ch 3, What this chapter now claims	No measurement of energy, entropy production or universal order spent.
V2-L14	Ch 3: R = 1 means little or no additional expenditure above baseline.	Narrowed: baseline mismatch recorded; convention not silently changed	Ch 3 §2	A ten-minute act at R = 1 scores Mz = 10, so the index is not zero when the claimed excess cost is zero.
V2-L15	Ch 3: Mz relativity: differences in R reflect filter-geometry variance between people.	Narrowed: a caution about interpretation, not a theorem	Ch 3 §4	No cross-person measurement equivalence or unique internal cause is established.
V2-L16	Ch 3: κ_Mz as a relational efficiency ratio (Supported).	Withdrawn as an established efficiency	Ch 3 §5; Ch 7 §3	Numerator and denominator need justified meanings and a positive denominator.
V2-L17	Ch 3: Dark Soul Matter as maximum Mz in the Observation Split gap, the largest expenditure the transducer can sustain and “the most expensive form of relational investment.”	Narrowed: name kept for unseen sustained effort; physical and superlative claims withdrawn	Ch 3 §6	No one is shown to stay at a physiological maximum; lack of recognition does not establish lack of benefit.
V2-L18	Ch 3 §7: AI's R = 0 because no internal states compete against relational output.	Withdrawn	Ch 3 §7	Zero lies outside the 1–10 scale; a system without a validated self-report is “not measured,” not zero.
V2-L19	Ch 4: structuring parameters are not innate and are set during one developmental window.	Withdrawn as stated	Ch 4 §1 [A1–A3]	No partition of genetic, developmental and current influences; no evidence that responses are fixed in childhood.
V2-L20	Ch 4: the Template Tax is a continuous entropy overhead that runs whenever the filter runs (Supported).	Narrowed: a mismatch to describe and test	Ch 4 §4; What this chapter establishes	No continuous excess entropy established; a cost claim needs an energy measurement, boundary, interval and comparison.
V2-L21	Ch 4 (Speculative): a child raised mainly by an AI custodial system calibrates against unlimited patience, zero-cost availability and unconditional presence.	Narrowed: hypothesis kept; idealized properties corrected	Ch 4 §5	AI services have physical costs and limited availability; a patient reply does not establish unconditional presence.
V2-L22	Ch 4: effective therapy is filter-geometry change; post-session exhaustion is σ_redesign; HRV should rise, cortisol normalize and CSS change.	Withdrawn as universal signs of effective therapy	Ch 4 §6	Improvement must be defined independently, with treatment, medication, sleep and ordinary variation considered.
V2-L23	Ch 5: unreciprocated transmission is a thermodynamic regime Kolchinsky and Wolpert do not name, a third state beyond correlation and scrambling (Supported).	Withdrawn	Ch 5 §1, §5 [A4]	A physical model could include a failing channel; the case is not outside their framework.
V2-L24	Ch 5: same cost per cycle, zero return, zero efficiency, total waste; the output enters a void and the universe records the debit.	Withdrawn (equal-cost, guaranteed-harm and zero-efficiency claims)	Ch 5 §4, §6; What this chapter establishes	Delivery, registration, effect and reciprocity are distinct; unwitnessed care can have effects.

ID	March claim (Volume 2 location)	2E disposition	2E location	Basis
V2-L25	Ch 5: the formal condition of positive mutual information one way and zero the other.	Withdrawn	Ch 5 §4	If Y_target and Y_0 differ, the positive and zero values can coexist. This does not establish one-sided mutual information, nondelivery or harm. Symmetry applies to the same pair under the same joint distribution.
V2-L26	Ch 5: the founding line as an established physical inequality (zero-return theorem).	Narrowed to the historical motivating line, with interpretive force	Ch 5 §6	Investment does not guarantee connection; that is an interpretation, not an inequality.
V2-L27	Ch 6: metabolic cost of bereavement, cortisol elevation, immune suppression and neural reorganization, all Established.	Narrowed to specific findings	Ch 6 §4 [A11]; §5 [A6–A8]	Small observational studies of specific measures and populations, such as a flatter diurnal cortisol slope in complicated grief and resting-state connectivity changes in 19 bereaved participants before and after an eight-week course.
V2-L28	Ch 6: grief as filter redesign, with identification, decoupling and reconstruction each paying a Landauer cost; the survivor spends a full metabolic load into a void.	Narrowed: filter redesign kept as an image; Landauer stages and “void” withdrawn	Ch 6 §3–4	Remembering, mourning and practical tasks can have effects; no measured rebuilding operation.
V2-L29	Ch 6 (Speculative): metabolic grief cost scales with behavioral integration, not self-reported closeness; “a testable prediction that existing bereavement research has not yet run.”	Narrowed; kept Speculative and testable; novelty claim withdrawn	Ch 6 §6	The empirical proposal remains Speculative: whether pre-loss behavioral interdependence adds predictive information beyond self-reported closeness for specified outcomes after bereavement. Prior work on the comparison is not ruled out.
V2-L30	Ch 6: S_partner / S_total as a predictor of grief cost.	Withdrawn as an operational predictor	Ch 6 §6 [A4]	Semantic information is model-dependent; splitting it into additive channels is unjustified.
V2-L31	Ch 6: grief is productive redesign and depression is stalled redesign.	Withdrawn	Ch 6 §7 [A14]	Tsai and colleagues support a symptom distinction and temporal association, not failed redesign.
V2-L32	Ch 6: begin architectural decoupling before a death.	Withdrawn as a recommendation	Ch 6 §7	Not a clinical recommendation; no one should be told to reduce closeness on this basis.
V2-L33	Ch 1 §4, Ch 6: grief is the most extended and expensive case of biological cost.	Withdrawn	Ch 1 §4; Ch 6	Not established by the reviewed studies.
V2-L34	Ch 6: grief's cost is “pushed from behind” by metabolic necessity and the second law, “not pulled toward cosmic sacrifice”; “It is not noble.”	Kept as the anti-sacrifice caution, without its physical overclaim or a ruling on cosmic meaning	Ch 6 §8	Biological observations do not establish a cosmic purpose for grief or confer nobility on suffering; they do not remove grief's human meaning.
V2-L35	Ch 7: the canon trace treats Chapters 2–6 as established.	Narrowed: a dependency map, not a certificate	Ch 7 §1, §8	WP-18, Brief 12, Brief 16, Brief 20 and The Blueprints still need reconciliation.
V2-L36	Ch 1 BSB note: every biological claim is in front of the barrier; “the cost is real.”	Narrowed: placement kept; it confers no validation	Ch 1, Behind the Substrate Barrier	Claims in front of the barrier still need ordinary scientific scrutiny.

References and source apparatus

Inherited verbatim from the second edition's Volume 2 apparatus. Labels B1–B23 serve Chapters 1–3; labels A1–A20 serve Chapters 4–6.

Source notes for Chapters 1 to 3

The empirical findings below have the populations, measurements and limits described in the chapters. The physical papers concern defined models or experiments. None validates the Moniz, a biomarker-based sincerity test, or a universal ranking of biological and digital relational processing. B21–B23 are explicitly theoretical or reference works, not primary causal experiments. B17 and B18 were checked for the audit but are not relied on for new claims in the chapter bodies.

B1. Landauer, R. (1961). Irreversibility and heat generation in the computing process. *IBM Journal of Research and Development, 5*, 183–191. https://doi.org/10.1147/rd.53.0183. Primary theoretical paper on specified logical/physical operations; not a universal charge for every cognitive act.

B2. Bennett, C. H. (1973). Logical reversibility of computation. *IBM Journal of Research and Development*, *17*, 525–532. https://doi.org/10.1147/rd.176.0525. University-hosted text. Primary theoretical construction; retained records and reversible operations matter when identifying erasure.

B3. Bérut, A., Arakelyan, A., Petrosyan, A., Ciliberto, S., Dillenschneider, R., and Lutz, E. (2012). Experimental verification of Landauer's principle linking information and thermodynamics. *Nature, 483*, 187–189. https://doi.org/10.1038/nature10872. Author-hosted paper. Controlled colloidal-memory erasure experiment, not a human emotional-cost measurement.

B4. Levy, W. B., and Calvert, V. G. (2021). Communication consumes 35 times more energy than computation in the human cortex, but both costs are needed to predict synapse number. *Proceedings of the National Academy of Sciences, 118*, e2008173118. https://doi.org/10.1073/pnas.2008173118. Full text. Original model-based energy audit with explicitly chosen cortical partitions; "communication" means neural signaling, not interpersonal activity.

B5. Díaz-García, C. M., Mongeon, R., Lahmann, C., Koveal, D., Zucker, H., and Yellen, G. (2017). Neuronal stimulation triggers neuronal glycolysis and not lactate uptake. *Cell Metabolism, 26*, 361–374.e4. https://doi.org/10.1016/j.cmet.2017.06.021. Full text. Biosensor experiments in mouse hippocampal slices and awake mice, not a study of human relational effort.

B6. Westbrook, A., van den Bosch, R., Määttä, J. I., Hofmans, L., Papadopetraki, D., Cools, R., and Frank, M. J. (2020). Dopamine promotes cognitive effort by biasing the benefits versus costs of cognitive work. *Science, 367*, 1362–1366. https://doi.org/10.1126/science.aaz5891. Full text. Fifty healthy adults completed an effort-discounting task; behavioral valuation is not calorimetry or Mz calibration.

B7. Kolchinsky, A., and Wolpert, D. H. (2018). Semantic information, autonomous agency and non-equilibrium statistical physics. *Interface Focus, 8*, 20180041. https://doi.org/10.1098/rsfs.2018.0041. Primary preprint. Original theoretical definitions and models; a human relational application needs its own states, dynamics, interventions and outcome definition.

B8. Logothetis, N. K., Pauls, J., Augath, M., Trinath, T., and Oeltermann, A. (2001). Neurophysiological investigation of the basis of the fMRI signal. *Nature, 412*, 150–157. https://doi.org/10.1038/35084005. Simultaneous electrophysiology and BOLD measurements in monkey visual cortex; the hemodynamic signal is not a direct heat or ATP reading.

B9. Vale, W., Spiess, J., Rivier, C., and Rivier, J. (1981). Characterization of a 41-residue ovine hypothalamic peptide that stimulates secretion of corticotropin and β-endorphin. *Science, 213*, 1394–1397. https://doi.org/10.1126/science.6267699. Record. Foundational peptide-isolation and bioassay study; used only for the CRH–corticotropin link. Full-text access was unavailable in this review; complete pathway anatomy is supported separately by B23.

B10. Kirschbaum, C., Pirke, K.-M., and Hellhammer, D. H. (1993). The 'Trier Social Stress Test'—A tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28*, 76–81. https://doi.org/10.1159/000119004. Primary abstract. Laboratory protocol and six-study report; responses under its conditions do not establish an emotion-universal sequence.

B11. Cohen, S., Janicki-Deverts, D., Doyle, W. J., Miller, G. E., Frank, E., Rabin, B. S., and Turner, R. B. (2012). Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. *Proceedings of the National Academy of Sciences, 109*, 5995–5999. https://doi.org/10.1073/pnas.1118355109. Full text. Two human viral-challenge studies; chronic stress exposure was observational, not randomized.

B12. Vitlic, A., Khanfer, R., Lord, J. M., Carroll, D., and Phillips, A. C. (2014). Bereavement reduces neutrophil oxidative burst only in older adults: role of the HPA axis and immunesenescence. *Immunity & Ageing, 11*, 13. https://doi.org/10.1186/1742-4933-11-13. Original observational study; the article title should not obscure its nonsignificant age-by-bereavement interaction or turn subgroup contrasts into a proved age-dependent mechanism.

B13. Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D., and Cawthon, R. M. (2004). Accelerated telomere shortening in response to life stress. *Proceedings of the National Academy of Sciences, 101*, 17312–17315. https://doi.org/10.1073/pnas.0407162101. Full text. Cross-sectional biomarker study; it does not directly measure a longitudinal within-person shortening rate.

B14. Tsuji, H., Venditti, F. J., Jr., Manders, E. S., Evans, J. C., Larson, M. G., Feldman, C. L., and Levy, D. (1994). Reduced heart rate variability and mortality risk in an elderly cohort: The Framingham Heart Study. *Circulation, 90*, 878–883. https://doi.org/10.1161/01.CIR.90.2.878. Primary abstract. Prospective analysis of 736 older participants; not an all-demographic or relational-causation result.

B15. Melzack, R., Israel, R., Lacroix, R., and Schultz, G. (1997). Phantom limbs in people with congenital limb deficiency or amputation in early childhood. *Brain, 120*, 1603–1620. https://doi.org/10.1093/brain/120.9.1603. Primary abstract. Sample-specific phantom reports do not eliminate all peripheral signaling or establish genetic causation.

B16. Critchley, H. D., Wiens, S., Rotshtein, P., Öhman, A., and Dolan, R. J. (2004). Neural systems supporting interoceptive awareness. *Nature Neuroscience, 7*, 189–195. https://doi.org/10.1038/nn1176. Heartbeat-judgment imaging study; not a demonstration of the constitution of every feeling.

B17. Bartrop, R. W., Luckhurst, E., Lazarus, L., Kiloh, L. G., and Penny, R. (1977). Depressed lymphocyte function after bereavement. *The Lancet, 1*, 834–836. https://doi.org/10.1016/S0140-6736(77)92780-5. Primary abstract. Audit-only reference: 26 bereaved spouses and specific assay results; no universal immune-suppression peak established.

B18. Zannas, A. S., et al. (2015). Lifetime stress accelerates epigenetic aging in an urban, African American cohort: relevance of glucocorticoid signaling. *Genome Biology, 16*, 266. https://doi.org/10.1186/s13059-015-0828-5. Correction. Audit-only reference: observational methylation-clock association in a defined cohort, not a universal biological aging rate or a conversion to energy.

B19. Feinstein, J. S., et al. (2013). Fear and panic in humans with bilateral amygdala damage. *Nature Neuroscience, 16*, 270–272. https://doi.org/10.1038/nn.3323. Full text. Three rare neurological cases under a CO_2 challenge; a narrow counterexample, not a general emotion theory.

B20. National Institute of Standards and Technology. *Kelvin: Present Realization*. https://www.nist.gov/si-redefinition/kelvin/kelvin-present-realization. Official metrology reference for the exact SI value $k_B = 1.380649 \times 10^{-23}$ J/K. Numerical evaluations in this revision were recomputed on 28 October 2026.

B21. Damasio, A. R. (1996). The somatic marker hypothesis and the possible functions of the prefrontal cortex. *Philosophical Transactions of the Royal Society B, 351*, 1413–1420. https://doi.org/10.1098/rstb.1996.0125. Author's theoretical account, not a universal sequence or metabolic comparison. The original chapter's 1994 and 2003 book references remain historical context rather than newly verified primary experimental evidence.

B22. Barrett, L. F. (2017). The theory of constructed emotion: an active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience, 12*, 1–23. https://doi.org/10.1093/scan/nsw154. Original theoretical account, published online in 2016 and issue-dated 2017; not a causal experiment establishing the framework's cascade.

B23. Tsigos, C., Kyrou, I., Kassi, E., and Chrousos, G. P. (2020 update). Stress: Endocrine Physiology and Pathophysiology. In *Endotext*. https://www.ncbi.nlm.nih.gov/sites/books/NBK278995/. Authoritative physiological reference, particularly the HPA-axis and sympathetic/adrenomedullary sections; not primary experimental evidence of a universal emotional response or its energetic cost.

Original review citations and their status

Díaz-García, C. M., and Yellen, G. (2019; online 2018). Neurons rely on glucose rather than astrocytic lactate during stimulation. *Journal of Neuroscience Research, 97*, 883–889. https://doi.org/10.1002/jnr.24374. Review. The original 2.7-fold argument is not a primary Mz calibration result.

Shepherd, J. (2023; online 2022). Conscious cognitive effort in cognitive control. *WIREs Cognitive Science, 14*, e1629. https://doi.org/10.1002/wcs.1629. Advanced review and conceptual analysis. Its discussion of unresolved definitions cannot be turned into a measured thermodynamic identity.

Hopf, D., Eckstein, M., Aguilar-Raab, C., Warth, M., and Ditzen, B. (2020). Neuroendocrine mechanisms of grief and bereavement: A systematic review and implications for future interventions. *Journal of Neuroendocrinology*, *32*, e12887. https://doi.org/10.1111/jne.12887. Systematic review, retained as historical context; the revised physiological examples instead identify primary studies and their limits.

References for Chapters 4 to 6

The bracketed A numbers identify sources, not evidence grades. Online-first and issue dates are distinguished where the original citations used the former. Source access and unresolved discrepancies are stated below.

A1. McLaughlin, K. A., et al. (2016; online 2015). Maltreatment Exposure, Brain Structure, and Fear Conditioning in Children and Adolescents. *Neuropsychopharmacology*, *41*, 1956–1964. DOI. Author-hosted article.

A2. Machlin, L., et al. (2024). Alterations in fear learning as a mechanism linking childhood exposure to violence with PTSD symptoms: a longitudinal study. *Psychological Medicine*, *54*, 3389–3397. DOI. Author-hosted article.

A3. Draganski, B., Gaser, C., Busch, V., Schuierer, G., Bogdahn, U., & May, A. (2004). Neuroplasticity: changes in grey matter induced by training. *Nature*, *427*, 311–312. Publisher.

A4. Kolchinsky, A., & Wolpert, D. H. (2018). Semantic information, autonomous agency and non-equilibrium statistical physics. *Interface Focus*, *8*, 20180041. DOI. Author-hosted article.

A5. Bennett, C. H. (1973). Logical Reversibility of Computation. *IBM Journal of Research and Development*, *17*, 525–532. DOI. Scanned primary article.

A6. O'Connor, M.-F., Wellisch, D. K., Stanton, A. L., Olmstead, R., & Irwin, M. R. (2012; online 2011). Diurnal cortisol in Complicated and Non-Complicated Grief: slope differences across the day. *Psychoneuroendocrinology*, *37*, 725–728. DOI. Institution-hosted article.

A7. Buckley, T., et al. (2012). Effect of early bereavement on heart rate and heart rate variability. *American Journal of Cardiology*, *110*, 1378–1383. DOI. Author-institution abstract.

A8. Irwin, M., Daniels, M., Smith, T. L., Bloom, E., & Weiner, H. (1987). Impaired natural killer cell activity during bereavement. *Brain, Behavior, and Immunity*, *1*, 98–104. Publisher abstract. DOI.

A9. Reynolds, C. F., III, et al. (1993). Sleep after spousal bereavement: a study of recovery from stress. *Biological Psychiatry*, *34*, 791–797. Primary abstract. DOI.

A10. Elwert, F., & Christakis, N. A. (2008). The effect of widowhood on mortality by the causes of death of both spouses. *American Journal of Public Health*, *98*, 2092–2098. DOI. Author manuscript titled Variation in the Effect of Widowhood on Mortality by the Causes of Death of Both Spouses.

A11. Huang, F.-Y., Hsu, A.-L., Chao, Y.-P., Shang, C. M.-H., Tsai, J.-S., & Wu, C. W. (2021; online 17 October 2020). Mindfulness-based cognitive therapy on bereavement grief: Alterations of resting-state

network connectivity associate with changes of anxiety and mindfulness. *Human Brain Mapping*, *42*, 510–520. Primary full text.

A12. Majd, M., et al. (2024; online 5 November 2023). Trajectories of depressive symptoms early in the course of bereavement: Patterns, psychosocial factors and risk of prolonged grief. *Stress and Health*, *40*, e3340. Primary manuscript. DOI.

A13. Harrison, O., Windmann, S., Rosner, R., & Steil, R. (2022; online 25 November 2021). Inclusion of the other in the self as a potential risk factor for prolonged grief disorder: A comparison of patients with matched bereaved healthy controls. *Clinical Psychology & Psychotherapy*, *29*, 1101–1112. Primary full text.

A14. Tsai, W.-I., Wen, F.-H., Kuo, S.-C., Prigerson, H. G., Chou, W.-C., Shen, W.-C., & Tang, S. T. (2020). Symptoms of prolonged grief and major depressive disorders: Distinctiveness and temporal relationship in the first 2 years of bereavement for family caregivers of terminally ill cancer patients. *Psycho-Oncology*, *29*, 751–758. Primary abstract. DOI.

A15. Hopf, D., Eckstein, M., Aguilar-Raab, C., Warth, M., & Ditzen, B. (2020). Neuroendocrine mechanisms of grief and bereavement: A systematic review and implications for future interventions. *Journal of Neuroendocrinology*, *32*, e12887. Review full text. This original citation is secondary evidence, not an additional primary experiment.

A16. Markovic, J. (2024; online 2 June 2023). Transformative grief. *European Journal of Philosophy*, *32*, 246–259. Original philosophical article.

A17. Maccallum, F., & Bryant, R. A. (2013). A Cognitive Attachment Model of prolonged grief: Integrating attachments, memory, and identity. *Clinical Psychology Review*, *33*, 713–727. Original model and review. DOI. Cited for the existence of a prior mechanistic proposal, not as primary experimental confirmation.

A18. Shannon, C. E. (1948). A Mathematical Theory of Communication. *Bell System Technical Journal*, *27*, 379–423, 623–656. Part I DOI. Primary article reprint.

A19. Parkes, C. M. (1971). Psycho-social transitions: A field for study. *Social Science & Medicine*, *5*, 101–115. Publisher abstract. DOI.

A20. Attig, T. (1996). *How We Grieve: Relearning the World*. Oxford University Press. Publisher book record and abstract. Chapter 4 abstract. Conceptual antecedent; the full book was not accessible in this pass.

The following access and discrepancy notes reproduce the second-edition review record. References to that review's exact ledger and underlying calculation record are historical; those separate records are not included here and are not the 36-row correction ledger above.

Source access record

The definitive URLs are in references A1–A20 above. These are access and interpretation limits, not duplicate abstracts.

A1: Primary PDF text from author/publisher-indexed extraction, including Methods and exclusions; 94 recruited versus 90 analyzed. A subsequent direct host request timed out. The scope is task-specific and observational.

A2: Author-hosted full primary PDF; Methods, Results and Discussion inspected. Its two-year follow-up strengthens temporal ordering, not proof of the framework's proposed mechanism. Skin conductance is measured in μS, not energy.

A3: Publisher abstract and bibliographic record inspected; full PDF access blocked. Only the abstract-supported adult visuomotor-learning finding is used, with no cellular mechanism or therapy extrapolation.

A4: Full primary paper via author-hosted PDF. Opposite-direction transfer entropy is discussed as a possible further semantic measure in Section 5.3; this is not represented as a completed human-relational application.

A5: Scanned original primary article inspected. Used only to reject an automatic equation of named cognitive stages with physical erasure, not to claim biological brains run reversibly.

A6: Institution-hosted full primary article, Methods/Results inspected. The source has timing and significance wording issues listed below. No concentration or slope effect size is imported into the chapter.

A7: Primary abstract at PubMed and author-institution repository inspected. Full primary methods/tables were not available through the direct primary route. The control count is 52 women plus 27 men = 79, not 78. No abstract power value is interpreted as raw variance because transformation/unit details were not established here.

A8: Publisher primary abstract inspected, including its second longitudinal component. No sample count or quantified immune effect is asserted because those details were not verified in full text.

A9: Complete primary abstract inspected. This is a selected nondepressed older sample, not all bereavement. No treatment claim is made.

A10: Primary author manuscript and abstract inspected for cohort, dates and observational scope. The manuscript title differs from the published title; both are identified in the references. No relative-risk number is used.

A11: Publisher full text, recruitment/exclusions, final sample, imaging comparisons and limitations inspected. Original enrollment was 23, analysis 19; losses occurred 6 months–4 years earlier. No untreated or waiting-list control was included.

A12: Full primary author manuscript, Methods, Tables 1–5, results and limitations inspected. Predominantly White and female, with health-related exclusions. Its 12-month prolonged-grief outcome is an ICG cutoff, not a fresh diagnostic interview; trajectory classification uses the final time point too. No clean prospective prediction from only baseline information is claimed.

A13: Publisher full text, participant selection, IOS wording, Tables 2–4 and limitations inspected. Matching does not eliminate selection or reverse causation. Participants with PGD were recruited before treatment in a larger trial; this particular comparison is not a randomized treatment effect.

A14: Full primary abstract inspected at PubMed/publisher; publisher full text returned 403. The abstract-level description of 398 caregivers and lagged symptom analyses is the limit used. No mechanism, intervention effect or universally necessary temporal sequence is inferred.

A15: Original cited review full text inspected for proposed mechanisms and heterogeneous measurement. It is not counted as a new primary study.

A16: Original philosophical full text inspected. Online-first 2023, issue 2024. It does not validate physiological or energy claims.

A17: Publisher abstract/highlights inspected. Sufficient for identifying an existing cognitive-attachment mechanism proposal; no empirical effect is attributed to this conceptual/review article.

A18: Primary article reprint inspected for joint/conditional entropy identities. Modern I notation is used with finite discrete variables and a fixed joint distribution.

A19: Publisher primary abstract inspected. The original's unspecified Parkes 1988 citation could not be uniquely identified from its author-year alone and is not silently replaced by a guessed work. Only the verified 1971 reference is retained.

A20: Publisher book and Chapter 4 abstracts inspected; full book inaccessible. Retained only as a named conceptual antecedent, not as a quoted passage or clinical conclusion.

Unresolved discrepancies not silently repaired

Harrison A13: Section 3.3 prose reports 2.59 with interval 1.57–4.28, while Table 4 gives IOS-D B = 0.88, Exp(B) = 2.40 and interval 1.46–3.96. The prose labels its 2.59 as b, although its interval appears odds-ratio-like. No odds ratio is used in the replacement; resolving the discrepancy would require clarification beyond this pass. The association itself is not relabeled causation.

O'Connor A6: The abstract says loss in the past 18 months; Methods says mother/sister breast-cancer death within five years. The chapter omits the disputed window and follows the Methods' relationship/cause scope. The Results also use significance language near the 4 p.m. comparison while reporting p = .08; this is not presented as significant. The retained finding is the group-by-time pattern, not universal cortisol elevation.

Majd A12: The abstract/results report trajectory percentages 45/31/15/9. Table 1 gives counts 78/56/25/16, total 175, which imply 44.57/32.00/14.29/9.14%. The middle percentages are not ordinary whole-number rounding of those counts. The replacement omits percentages rather than inventing a corrected authoritative estimate. The original values remain in the exact ledger. Counts and reported percentages are separately preserved in the underlying calculation record.

No full patient data, individual records, supplementary raw data or reanalysis were obtained. These discrepancies do not by themselves invalidate an entire study; they limit which numerical statements this revision can safely carry forward.

The source review was targeted to the volume’s claims, not a systematic review of biology or bereavement. Some historical references were available only as abstracts, theoretical works or reviews. Separate AI critique is not human peer review or experimental validation.