

Love Is a Behavior, Not a Feeling

A Testable Theory of Love as a Reality Alignment Process

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ABSTRACT: Love is usually described as a feeling. This paper tests a different idea: love is a behavior—something you do. It's a repeatable process that helps two people get back in sync as life changes. We call it the Love Reality Loop (LRL): people's mental pictures of reality drift, misunderstandings happen, and love shows up in what happens next—listening, trying to understand, updating your view, and making small course-corrections. Misunderstanding isn't proof love is missing; it's the signal that starts the loop. Alignment isn't love; it's what love produces. Five studies test this claim across four time scales/methods plus a dialogue-structure observability test. In a long-term panel study that followed couples over years (pairfam), when one partner's view didn't match the other partner's lived reality, it predicted later behavior changes in a corrective direction (for example, less insulting behavior later; $\beta = -0.315$, $p \approx 6 \times 10^{-32}$). In a daily diary study over days (ICPSR 37404), people who tried to understand their partner more today reported more closeness tomorrow ($\beta \approx +0.255$, $p \approx 9 \times 10^{-33}$). In an observational study of couple conversations over minutes, couples who showed more alignment in how they talked had higher relationship quality ($\beta = +0.345$, $p \approx 1.6 \times 10^{-6}$). A fourth study tested a boundary condition mechanistically with a minimal simulation: love needs basic structure to work. If the relationship can't carry feedback—clear boundaries, reciprocity, role coherence, and perspective-taking (O = DSRP)—then trying hard isn't enough. When that structure was weakened in the simulation, the loop stopped working even when effort stayed high; above a basic threshold, the system reliably moved back toward alignment ($\geq 95\%$ of runs). Study 5 shows O = DSRP is directly observable in naturalistic dyadic dialogue via Unified Calculus coding of adjacency pairs (94% $\geq$ partial u ; 66% full u ; $N=50$ pairs). Overall, the results support a testable picture of love that is closer to learning and teamwork than to a mood. Love isn't never getting out of sync. Love is what you do because getting out of sync is normal: choosing reality over your preferred story, again and again.

KEYWORDS: Love | Love Reality Loop | Model–Reality Alignment | Error-Correcting Processes | Relationship Dynamics | Systems Thinking | Dyadic Interaction | Structural Dependence | Emergence

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1. Introduction

1.1 The Problem of Defining Love

Love is among the most studied constructs in psychology and the social sciences, yet it remains theoretically fragmented. Dominant approaches variously conceptualize love as an emotion or passion-based state [1,2], an attachment bond [3,4], a motivational process grounded in self-expansion [5–7], a commitment decision shaped by investment and alternatives [8], or a form of relationship satisfaction and stability assessed longitudinally [9]. While each captures aspects of lived experience, none provides a unified account of *how love operates* when relationships encounter inevitable change, misunderstanding, and conflict.

A persistent limitation across theories is their emphasis on *states* rather than *processes*. Love is typically measured as a level of affect, security, or satisfaction at a given moment [9,10], despite the fact that relationships are dynamic systems in which partners' needs, contexts, and interpretations continuously evolve. As a result, existing frameworks often explain relational outcomes by referencing levels of constructs rather than specifying the mechanisms that generate repair, recovery, and durability under conditions of divergence [11–13]. This gap motivates a process-based reconceptualization.

1.2 Love as a Dynamic Alignment Problem

A close relationship is a *complex adaptive system (CAS)* the emergent property of which may or may not be love: two semi-independent agents continuously adapting to each other and to a changing world. Each partner is always doing the same basic cognitive work—organizing (*O*) information (*I*) into a meaningful mental model (*M*). In shorthand: $M = I \cdot O$. The problem is that the information each person has is incomplete, and the organization they apply (*O*) is always evolving and often differs. So their internal models of each other and the relationship itself will drift from what is actually happening.

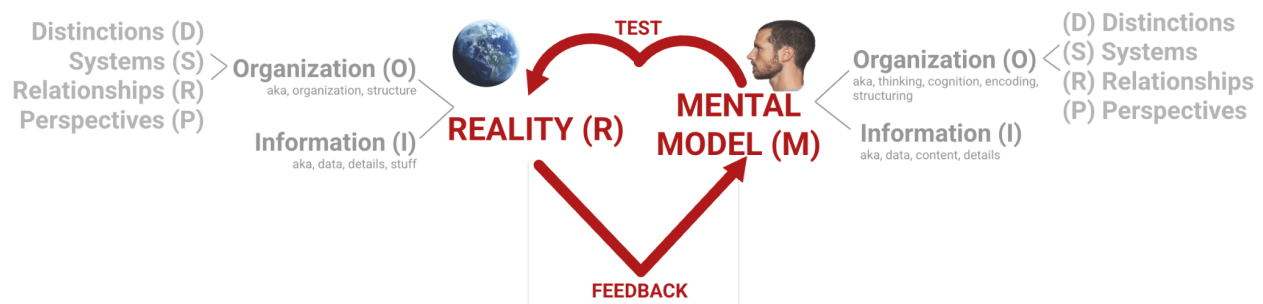
When that divergence (misalignment) isn't detected and corrected, misunderstanding, unmet needs, and relational strain accumulate [11–13]. But framed as a system, this isn't mainly a failure of feeling or even intention. It's an alignment problem born of behavior: the relationship does better or worse depending on whether the system can *notice* the model–reality mismatch and *update* in response.

From a systems perspective, the central question becomes not whether partners *feel* love, but whether they engage in the processes that detect divergence and correct it over time—feedback-driven regulation [14,15]. Thus, love is not a static property or feeling that people possess. It is a regulatory process the system performs: sensing error, exchanging corrective signals, updating models, and making small course-corrections as conditions change. That reframes close-relationship dynamics as a form of error-correction and self-regulation, consistent with general models of adaptive control in complex systems [16,17]. This explains why honesty and communication—even when it is upsetting—is centrally important.

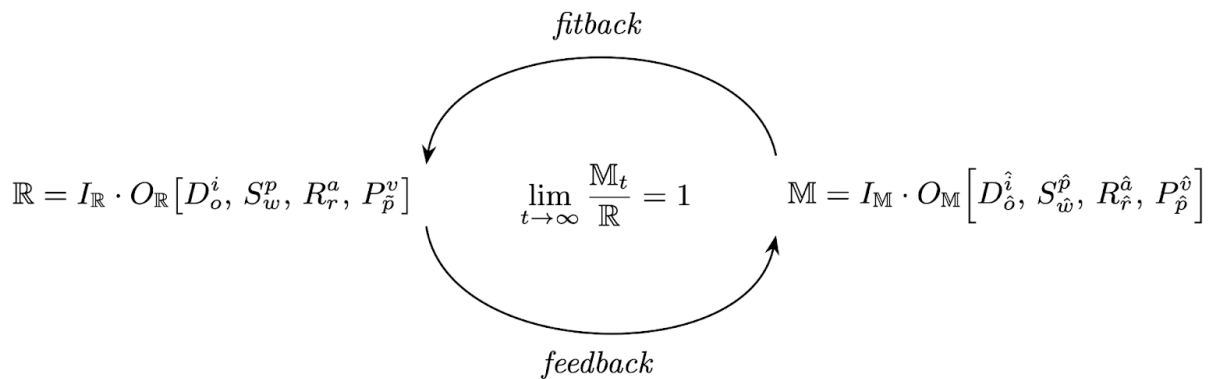
1.3 The Love Reality Loop (LRL)

We propose that love operates through a repeated, error-correcting process we call the *Love Reality Loop (LRL)* [18–23]. The LRL is a time-extended mechanism for reducing divergence between a partner's internal model and the partner's lived relational reality (Figure 1). Rather than treating love as a state or feeling, this account treats love as an adaptive process that runs continuously as conditions change.

Figure 1. The Love Reality Loop (LRL). *Schematic representation of the LRL as a closed, time-extended error-correction process that reduces divergence between a mental model and reality through repeated cycles of engagement, updating, and adjustment.*



Or mathematically:



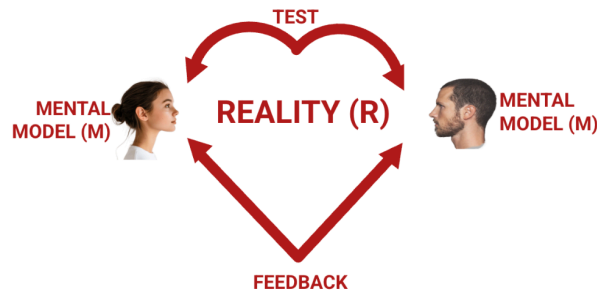
Specifically, when applied to relationships, the loop consists of five necessary stages:

- (1) *Detection* of divergence between an internal model and lived relational conditions;
- (2) *Reality engagement*—direct sampling of the partner's lived state through behaviors such as listening, perspective-taking, and efforts to understand;
- (3) *Model updating*—revision of the internal model based on newly sampled information;
- (4) *Behavioral adjustment*—changes in action in response to the updated model; and
- (5) *Feedback* from relational outcomes, which becomes the next error signal and reinitiates the cycle.

Each stage is structurally necessary but not independently sufficient; failure at any stage interrupts loop completion.

Because in these studies we are applying the LRL specifically to intimate relationship dyads, we treat the LRL as explicitly two-way and dyadic (conceptualized visually in Figure 2).

Figure 2. Dyadic Coupling of Love Reality Loops. Two-partner formulation showing parallel loops operating simultaneously, where each partner's $\mathbb{M}(t)$ is updated through engagement with the other partner's $\mathbb{R}(t)$. Relationship trajectories reflect coupled dynamics and possible asymmetry in loop operation.



Each partner maintains a mental model $\mathbb{M}(t)$ that interacts with the other partner's lived relational reality $\mathbb{R}(t)$. The loop may operate asymmetrically: at any moment, one partner may be engaging reality and updating while the other is not. Observed relationship trajectories reflect the coupled dynamics of both loops operating—or failing to operate—over time.

It is critical to distinguish process from outcome. *Alignment is not love*. Alignment is the emergent result of the loop operating successfully across repeated cycles. Love, under this account, is the mechanism that detects divergence and restores alignment when reality inevitably changes. When the loop operates effectively over time, model–reality convergence is expected to increase, approaching the limit condition:

$$\lim_{t \rightarrow \infty} \frac{\mathbb{M}(t)}{\mathbb{R}(t)} = 1$$

Qualitatively, this condition may be described as $\mathbb{M} \parallel \mathbb{R}$, but analytically it remains a convergence outcome—not the loop itself. The empirical question is therefore not whether partners report love, but whether the LRL is operating in a way that reliably produces alignment under changing conditions.

Although the convergence expression is written as a limit, $\mathbb{R}(t)$ is not assumed to be static. The Love Reality Loop tracks a moving target: alignment is continually updated as reality changes, so convergence is directional and ongoing rather than terminal.

1.4 Why Love Needs Structure: O (DSRP) as the Loop's Operating System

In previous studies, the Love Reality Loop (LRL) has shown empirically that it is “O-dependent” [18–25]. Any real process of detecting mismatch, updating a model, and adjusting behavior is structurally mediated, because mental models and lived relational reality are both formed by the same rule:

$$\mathbb{M}(t) = I(t) \cdot O(t) \quad \text{and} \quad \mathbb{R}(t) = I(t) \cdot O(t)$$

What *is* hypothesized in this paper is downstream: that love outcomes—the emergent properties often labeled intimacy, security, durability, and recovery—are governed by how well the LRL operates, and therefore will scale with the *functional state* of organizing structure (*O*) in the relationship. *Alignment is the output; the LRL is the process that produces it over time.*

Here, organizing structure (*O*) is specified in DSRP terms as the minimally viable relational architecture for coordinated interaction:

- Distinctions (*D*): intact boundary integrity and agency; stable self–other differentiation.
- Systems (*S*): coherent role structure (individuals as parts of a whole relationship); clarity of responsibilities, expectations, and decision rights rather than confusion or overcontrol.
- Relationships (*R*): reciprocal engagement; bidirectional responsiveness rather than withdrawal, coercion, or chronic asymmetry.
- Perspectives (*P*): maintained point–view differentiation; the capacity to hold one’s view without erasing the other’s view.

Because $O = \text{DSRP}$, structure is always present in some form. So the issue is not whether structure exists, but whether it is *functionally intact* or *degraded*. Under degeneracy—boundary violation or fusion, disengagement or coercive control, role incoherence, or single-frame dominance—partners may still *intend* to love, and they may even make LRL-consistent efforts. But the loop cannot reliably run to completion: reality cannot be sampled cleanly, models cannot update stably, and corrective behavior cannot converge on lived conditions. In those cases, the convergence claim

$$\lim_{t \rightarrow \infty} \frac{\mathbb{M}(t)}{\mathbb{R}(t)} = 1$$

is structurally blocked—even when partners report high intention, effort, or affect.

Therefore, love outcomes are predicted to scale with *functional O* (i.e., DSRP integrity). Intention, effort, and affect are neither sufficient nor explanatory when the structure needed for feedback and updating is degraded.

1.5 Oneness, Alignment, and Love

The limit equation— $\lim_{t \rightarrow \infty} \mathbb{M}/\mathbb{R} = 1$ —is the equation of *oneness*. It captures oneness mathematically because when a mental model ($\mathbb{M}$) aligns with reality ($\mathbb{R}$), their ratio approaches 1—model and reality coincide. This is not a claim about perfection or stasis. It is a directional claim about ongoing alignment as reality changes.

This principle applies far beyond loving relationships. Any domain that requires understanding—science, learning, teamwork, craft, or truth-seeking—depends on prioritizing alignment with reality over attachment to one’s existing model. In this sense, *loving reality* means *caring* more about understanding systems as they are than about protecting how we currently think they are. Caring more about getting it

right than about being right. That posture requires *humility* and *curiosity* at its core. When alignment improves, the subjective experience is often described as *flow* or *oneness*—not in the sense of losing oneself, but in the sense of acting in coordination with what is real.

Loving relationships are a specific subtype of this broader oneness principle. A partner and the relationship itself are living, changing slices of reality. Loving the reality of one's partner means prioritizing accurate understanding over idealization, evaluation, or insistence on a preferred model. Love is not seeing a pedestal-polished version of a partner; it is seeing them as they are—warts and all—and choosing to be deeply curious of that reality. Pedestals may feel good in the short term, but they block updating and confirm bias. When reality eventually intrudes, the correction is harsher because the model was protected instead of aligned.

Love is also not the absence of conflict. Conflict is simply divergence made visible. Because divergence is inevitable, conflict is inevitable. The question is not whether conflict occurs, but whether it is used constructively. In a functioning Love Reality Loop, conflict becomes information—a signal that models are misaligned and need updating. No relationship or marriage ends abruptly—suddenly. If it feels sudden it is because incremental misalignments were ignored and the build up reached a break point.

Destructive conflict degrades structure by eroding boundaries, collapsing perspective-taking, or breaking reciprocity. Constructive conflict does the opposite. It preserves integrity while allowing disagreement, maintains curiosity in the face of difference, and uses honest communication to restore alignment. Love is not peace at all costs; it is confidence that through conflict, repair and construction are possible.

This is why love requires *humility*, *curiosity*, *integrity*, *honesty*, and *communication*—*because they are essential for alignment*. It is also why you can find durable love *anywhere*, as long as you have built the developmental capacity for reality-engaging behavior in yourself. Statistically, it has to be this way. With roughly 8.5 billion people on Earth, and on the order of ~10,000 meaningful people met in a lifetime, the fraction of humanity any one person ever seriously encounters is about $10,000 / 8,500,000,000 \approx 1.2 \times 10^{-6}$ (0.00012%). If there were only one “true love,” the odds of meeting that one person in a lifetime would be astronomically implausible—*effectively zero*. The lived reality is the opposite: people form durable love across cultures, places, and life stages, and many people love again after loss. Love cannot primarily be a matching problem. It has to be a process problem. That only makes sense if love is not a rare matching event, but a generative process. These are not moral add-ons or personality traits. They are the functional conditions required for models to co-update toward reality when divergence occurs. Love is not the absence of mismatch. Love is the practice of restoring alignment with what is real—again and again.

1.6 Testing the Loop: One Mechanism, Three Time Scales

Testing a time-extended correction process can't be done with a single measure or a single snapshot. A static view can tell you where a couple is *right now*, but it can't show whether they detect divergence, engage reality, update their models, adjust behavior, and then close the loop with feedback. So we use a triangulated strategy: we test the same hypothesized mechanism across multiple time scales and data types. Specifically, we examine converging evidence across:

- Long-term panel data (*years*),

- Daily diary process data (*days*),
- Interaction-level observational data (*minutes, including recovery trajectories*), and
- Naturalistic dialogue adjacency-pair coding (structural observability)

Rather than treating any one study as a definitive proof, we ask a simpler, stronger question: *do different lenses on the same phenomenon point to the same underlying dynamic?* If the LRL is real and operating as a general mechanism, its signature should be visible across these contexts—even though the measurements and time horizons differ.

1.7 Hypotheses: Five Studies, Five Predictions

Love is a loop. People drift out of sync. That’s normal. The question is whether the relationship has a reliable way to notice mismatch and correct it over time.

One shorthand keeps the logic precise. Let $\mathbb{M}(t)$ be a person’s mental model of the relationship (their “picture” of what’s going on) at time t . Let $\mathbb{R}(t)$ be what is actually happening in the relationship at time t . When the model matches reality, write $\mathbb{M}(t) \parallel \mathbb{R}(t)$.

The Love Reality Loop (LRL) claim is dynamic: when mismatch happens ($\mathbb{M}(t) \nparallel \mathbb{R}(t)$), a functioning loop should push the relationship back toward better alignment through repeated cycles of engagement, updating, and adjustment. In the long run, that directional tendency can be written as:

$$\lim_{t \rightarrow \infty} \frac{\mathbb{M}(t)}{\mathbb{R}(t)} = 1$$

But the point isn’t the limit. The point is the steps that get you there: mismatch $\rightarrow$ reality engagement $\rightarrow$ updating $\rightarrow$ adjustment $\rightarrow$ feedback.

Five studies test the same mechanism from different angles. Each study is built around one primary prediction. Studies 1–2 test time-ordered claims in real couples. Study 3 tests whether alignment shows up in how couples talk, and whether it tracks relationship quality. Study 4 tests the “structure matters” claim mechanistically using a simulation, because the observational file does not include the structure indicator needed for a direct moderation test.

1.7.1 Hypothesis 1 (Study 1): Divergence Precedes Correction

If divergence is the error signal that initiates the loop, then misalignment at t should be followed by corrective change at $t + 1$.

Table 1. Hypothesis 1 (H1): Divergence precedes correction.

H1 (symbolic logic)	$\mathbb{M}(t) \nparallel \mathbb{R}(t) \Rightarrow \Delta(\mathbb{M} \parallel \mathbb{R})_{t \rightarrow t+1} > 0$
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H1 (statement)	Greater divergence between partners' perceptions and lived relational reality at time t will predict corrective behavior at time $t + 1$.
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1.7.2 Hypothesis 2 (Study 2): Reality-Engaging Behavior Generates Love-Like Outcomes

If the loop is running, then behaviors that sample reality—listening, trying to understand, perspective-taking—should show up in what happens next. Reality engagement at t should predict higher intimacy or security at $t + 1$.

Table 2. Hypothesis 2 (H2): Reality-engaging behavior generates love-like outcomes.

H2 (symbolic logic)	$LRL(t) \Rightarrow M(t + 1) \parallel R(t + 1) \uparrow \Rightarrow LoveLike(t + 1) \uparrow$
H2 (statement)	Reality-engaging behaviors (e.g., listening, understanding, perspective-taking) at time t will predict increased intimacy or security at time $t + 1$.

1.7.3 Hypothesis 3 (Study 3): The Loop Needs Structure (Boundary Condition)

The LRL is structurally dependent. It needs enough organizing structure (O) for corrective signals to travel and for updating to stick. When structure is degraded, people may still try hard, but the loop cannot reliably run to completion.

In an ideal dataset, H3 is tested as moderation: does the same “effort” produce different results depending on whether O is intact? That test can't be run here because the dyadic observational file does not include a direct indicator of O -state (e.g., balanced vs hyper-/hypo-regulation). So H3 functions as a boundary condition—something that constrains interpretation—rather than a fully estimated moderation effect.

Table 3. Hypothesis 3 (H3): Structural dependence (boundary condition).

H3 (symbolic logic)	$\neg O(t) \Rightarrow (LRL(t) \not\Rightarrow M(t + 1) \parallel R(t + 1) \uparrow)$
H3 (statement)	The Love Reality Loop requires functional organizational integrity. When organizational structure is compromised, LRL-consistent updating cannot reliably produce increased alignment (i.e., convergence toward $M \parallel R$).

1.7.4 Hypothesis 4 (Study 4): Structure Threshold (Simulation Test)

Because H3 can't be tested as moderation in the observational data, the same claim is tested mechanistically using a simple simulation. If the LRL is structurally dependent, then convergence should be possible only when organizational integrity exceeds a minimum threshold.

Table 4. Hypothesis 4 (H4): Mechanistic structural dependence (simulation).

H4 (symbolic logic)	$O(t) \geq O \Rightarrow \left(\text{LRL}(t) \Rightarrow \mathbb{M}(t+1) \parallel \mathbb{R}(t+1) \uparrow \right)$ $O(t) < O \Rightarrow \left(\text{LRL}(t) \nRightarrow \mathbb{M}(t+1) \parallel \mathbb{R}(t+1) \uparrow \right)$
H4 (statement)	In a system implementing Love Reality Loop update rules, convergence toward alignment occurs only when organizational integrity exceeds a minimum threshold; when organizational structure is degraded, corrective behaviors fail to produce convergence (stalling, oscillation, or divergence).

1.7.5 Hypothesis 5 (Study 5): Structural Observability in the Love Reality Loop

If organizational structure ($O = \text{DSRP}$) is a necessary substrate of relational processes, then its constituent patterns—distinctions, part-whole organization, relationships, and perspectives—should be detectable at the smallest meaningful unit of interaction. This study therefore examines whether $O = \text{DSRP}$ is empirically observable in naturalistic couple dialogue at the adjacency-pair level, independent of outcomes.

The prediction is not that DSRP structure *causes* relationship quality, but that it is *present as an organizing grammar* whenever interpersonal coordination occurs. Even minimal conversational exchanges should instantiate boundary-setting (D), role or part-whole differentiation (S), reciprocal linkage (R), and perspectival framing (P). Failure to observe these patterns would challenge the claim that $O = \text{DSRP}$ constitutes the organizational substrate of the Love Reality Loop.

Table 5. Hypothesis 5 (H5): Structural Observability in the Love Reality Loop

H5 (symbolic logic)	$\exists, O \Rightarrow \text{Pr}(\text{DSRP} \mid \text{adjacency pair}) > 0$
H5 (statement)	Even the smallest conversational exchanges will show evidence of boundary-setting, role or part-whole organization, relational linkage, and perspective.

Thus, Study 5 provides an *existence and observability test* of structure, complementing the effect-oriented tests in Studies 1–4. It establishes whether the loop’s organizational medium is empirically detectable before asking whether variation in that structure predicts relational outcomes.

Together, these four predictions test whether love is best described as a repeated, structurally constrained correction process—where alignment is the outcome of the loop operating over time—rather than a static feeling:

$$\lim_{t \rightarrow \infty} \frac{\mathbb{M}(t)}{\mathbb{R}(t)} = 1$$

1.8 The Bottom Line Findings Up Front

Love is usually described as a *feeling*. The results in this paper point to a different conclusion: love functions as a repeatable correction process—an *ongoing behavior*. Partners drift out of sync because their models of each other and the relationship fall behind a changing reality. The question is not whether mismatch occurs, but what happens next—whether partners re-engage reality, update, and adjust. In this sense, love is closer to maintenance and repair—like learning or health—than to the feelings of passion and butterflies.

This section states the findings up front, before the methods and statistical detail. Table 6 summarizes the main results from Studies 1–5 in plain language. Taken together, they support one core takeaway: love is not something you possess or protect. Love is what partners do to restore alignment when mismatch appears—which it inevitably does.

Table 6: Love as a Mechanism (LRL) — 10 Takeaways. *Public-facing takeaway statements with brief explanations linking each to the Love Reality Loop (LRL) and the results from Studies 1–5.*

#	Takeaway	What it means
1	Love isn't a feeling you "have." It's something you do—Love is an ongoing behavior with a defined mechanism.	Love is an error-correcting process (LRL), not a static emotional state. Feelings may accompany it, but the mechanism is reality engagement and correction. This is why honesty is so important.
2	Most relationship problems aren't "lack of love." They're misalignment problems followed by a lack of loving-behavior.	Many breakdowns look like "not enough love" but are better described as model–reality divergence that is not being detected, communicated, or corrected.
3	The real question isn't "Do you feel love?" It's: "Will you repair when reality changes?"	Across studies, the key signature is time-ordering: divergence appears, then reality-engaging behavior predicts improved outcomes. Repair is the mechanism.
4	Alignment isn't love. Alignment is what love produces. Love is the process that creates "oneness."	Alignment (increased oneness) is the outcome state of a well-functioning loop; love is the process that drives the system back toward coordination after drift.
5	Love isn't a destination. It's a loop—update, adjust, repeat.	Reality is a moving target, so durable love is iterative regulation rather than permanent agreement or a one-time "arriving."
6	Structure isn't optional. If the relationship can't carry feedback, the loop can't run.	LRL needs basic structure (O = DSRP)—clear boundary distinctions, perspective-taking, etc. That structure only exists if both people treat the other's M=IO as real. When it breaks, correction can't travel, so effort alone won't create convergence.
7	Intention doesn't fix misalignment. You can mean well and still fail—if the structure is broken.	Good intentions are not sufficient if feedback channels are collapsed; without functional O, correction may stall, oscillate, or fail to converge.

8	Misunderstanding isn't the enemy. It's the signal. What you do next is the whole game.	Divergence is the error signal that activates the loop. The difference between thriving and struggling relationships is not mismatch, but what follows it.
9	Love isn't "never mismatching." Love is what you do because mismatch is inevitable.	The mechanism predicts mismatch will recur. Love is defined by repeated correction over time, not by the absence of drift.
10	Love is choosing reality over your mental model—again and again.	Love is the commitment to update toward what is real rather than defend a preferred story—about yourself, your partner, or the relationship. This is the same stance that underwrites learning and self-integrity.

2.0 Methods

2.1 Overview and Analytic Strategy

This research investigates whether love is best understood as a process rather than a state—specifically, as an O-dependent, error-correcting loop that restores alignment between a person's internal model of their partner and the partner's lived reality over time (the Love Reality Loop, LRL).

Rather than relying on a single dataset or method, we employed a triangulated empirical strategy across five studies that differ in time scale, measurement modality, and analytic structure: (1) longitudinal panel data (years) testing H1, (2) daily diary process data (days) testing H2, (3) dyadic observational data (minutes) testing H3, (4) a minimal mechanistic simulation testing H4, and (5) naturalistic dialogue adjacency-pair coding testing H5. The simulation is included because the available dyadic file does not permit a direct O-state moderation test; it tests the structural necessity of organizational integrity for convergence under LRL update rules. Study 5 is included to test structural observability: whether O = DSRP is detectable in dialogue at the minimal interaction scale.

Each study tests a distinct implication of the same underlying mechanism. No study is intended to establish the full claim independently; instead, support is evaluated through convergent evidence across methods and time scales.

Across all studies, analyses were pre-specified at the level of constructs, variables, and outcomes. No composite "relationship quality" indices were constructed, and no alternative outcomes or predictors were substituted post hoc.

2.2 Study 1: Longitudinal Evidence that Divergence Predicts Behavioral Adjustment

Dataset: Data were drawn from the *German Family Panel (pairfam)*, a nationally representative longitudinal study of romantic relationships. Multiple waves were used, allowing time-lagged analysis across years.

Unit of Analysis: The unit of analysis was the individual partner nested within couples, observed across successive waves.

Key Measures: Perception–Reality Mismatch (Divergence): Operationalized as discrepancies between one partner’s perception of the other’s behavior and the other partner’s self-reported behavior. Corrective Behavior: Change in self-reported behavior at the subsequent wave ($t+1$), coded directionally to indicate movement toward the partner’s perception.

Analytic Model: Time-lagged panel regressions were estimated, predicting corrective behavior at wave $t+1$ from mismatch at wave t . Models included individual fixed effects to control for stable traits and relationship duration where specified.

Purpose: This study tests the *existence* of an error-correcting dynamic: whether divergence predicts subsequent behavioral correction over time.

2.3 Study 2: Daily Reality Engagement Predicts Next-Day Intimacy

Dataset: Data were drawn from the Health and Relationships Project, United States, 2014–2015 (ICPSR Study No. 37404), specifically the daily diary module (DS0002).

Unit of Analysis: The unit of analysis was the person-day, with consecutive day transitions ($t \rightarrow t+1$). Observations were clustered by respondent.

Locked Variables: *LRL Behavior: UNDERSTD* — “How often did you try to understand how your spouse feels today?” *Outcome: INTIMACY* — “How much closeness and intimacy did you feel with your spouse today?” Both variables were single-item, ordinal measures (1–5 scale).

Analytic Model: Linear regression models predicted $INTIMACY(t+1)$ from $UNDERSTD(t)$. Standard errors were clustered by respondent ID. No additional predictors or covariates were included.

Purpose: This study tests whether *reality-engaging behavior*—a core instantiation of the Love Reality Loop—predicts *next-day emergence of intimacy*, a commonly recognized love-like outcome.

2.4 Study 3: Conversational Alignment Predicts Relationship Quality

Dataset: Data came from a laboratory-based dyadic conflict study conducted by researchers at the University of Minnesota and Deakin University. Analyses used two analysis-ready datasets exported from SPSS: *Dyad Regression File.csv* and *Dyad MLM File Pattern Metric Analyses.csv*. These files include observationally coded behaviors, actor–partner structure, and post-interaction outcomes.

Unit of Analysis: The unit of analysis was the individual within a dyadic interaction, with repeated observations nested within dyads.

Key Measures: Alignment/Pattern Metric: *FishersZcorrected* (corrected Fisher-z transformed alignment/pattern metric). Outcome: relationship quality (*RQUAL*).

Analytic Model: Because individuals are nested within dyads, we estimated dyad-clustered OLS models predicting relationship quality (*RQUAL*) from the alignment/pattern metric (*FishersZcorrected*), with standard errors clustered by *dyadID*. The primary specification was:

$$RQUAL = \beta_0 + \beta_1(\text{FishersZcorrected}) + \varepsilon,$$

with standard errors clustered by *dyadID*. A robustness specification added gender (women vs men) as a covariate. Because the primary specification uses dyad-clustered OLS rather than a random-intercepts multilevel model, we do not report an intraclass correlation coefficient (ICC) here; clustering provides dyad-robust inference without estimating a variance partition.

Purpose: This study tests whether an LRL-consistent conversational alignment/pattern metric predicts relationship-relevant outcomes in interaction-level observational data, using inference robust to within-dyad dependence.

Limit: The analysis-ready file used here does not include a direct indicator of organizational structure state suitable for an O-moderation term (e.g., balanced vs hyper-/hypo-regulation). Accordingly, Study 3 evaluates the main-effect convergence signature only. Structural dependence is tested mechanistically in Study 4 (H4), not observationally in Study 3.

2.5 Study 4: Mechanistic Structural Dependence

Model Overview: Study 4 implements a minimal agent-based simulation of dyadic updating under Love Reality Loop (LRL) rules. The purpose is not realism in parameterization, but a mechanistic test of necessity: whether convergence toward alignment is possible only when organizational integrity (*O*) exceeds a minimum threshold.

Agents and State Variables: The simulation contains two agents, each with an internal model $\mathbb{M}(t)$ and exposure to a partner-generated relational reality $\mathbb{R}(t)$. At each step, agents (i) sample relational signals (reality engagement), (ii) update $\mathbb{M}(t)$ toward $\mathbb{R}(t)$ according to an update rule, and (iii) generate behavior that feeds back into the next step. Divergence is defined as $\mathbb{M}(t) \nparallel \mathbb{R}(t)$, and convergence is tracked as directional reduction in divergence over time.

*Organizational Integrity Parameter (*O*):* Organizational integrity is implemented as a scalar control on the reliability and transmissibility of corrective information and feedback (e.g., whether engagement yields clean sampling, whether updating is stable, and whether reciprocal signals propagate). An *O*-threshold O^* is defined as the minimum integrity level required for loop completion under the update rules.

Experimental Manipulation: Simulations are run across values of *O* spanning degraded to intact structure. Effort parameters (e.g., frequency of engagement attempts) are held constant when testing

whether increasing effort can compensate for degraded structure. Outcomes are evaluated as: (a) convergence to alignment, (b) stalling (failure to converge), (c) oscillation, or (d) divergence.

Evaluation Criterion: H4 is supported if convergence occurs reliably when $O \geq O$ and fails (stall/oscillate/diverge) when $O < O$ under the same update rules and comparable effort settings. This provides a mechanistic test of structural dependence in the absence of an observational O-state indicator in Study 3.

2.6 Study 5: Structural Observability of O = DSRP in Naturalistic Relational Dialogue

Data Source: Study 5 used naturalistic dyadic dialogue drawn from the DailyTalk corpus, a publicly available dataset of everyday conversational exchanges. To ensure full replicability, all preprocessing steps, selection rules, and provenance information are documented in a standalone replication package.

Unit of Analysis: The unit of analysis was the adjacency pair (B2), defined as two consecutive utterances with a speaker change (Speaker A → Speaker B). Same-speaker continuations were excluded. This unit represents the minimal interactional scale at which relational structure can be observed without aggregating across turns or episodes.

Subset Selection: From the previously extracted corpus (N = 15 dialogues; 189 adjacency pairs), a deterministic subset of 50 adjacency pairs was selected for manual analysis. Selection followed a fixed rule: the first 50 adjacency pairs in file order, ensuring that no researcher degrees of freedom were introduced at the sampling stage. The subset spanned four distinct dialogues.

Coding Framework: Adjacency pairs were coded using a formal Unified Calculus (DSRP) framework, operationalized in a frozen codebook. Each adjacency pair was evaluated as a candidate minimal structural unit (u) composed of four co-implicative organizational patterns: Distinctions (D): identity–other boundaries; Systems (S): part–whole structure; Relationships (R): action–reaction coupling, and; Perspectives (P): point–view framing. Coding was explicitly limited to structural observability. No mental states, intentions, outcomes, or downstream effects were inferred.

Coding Outcomes: Each adjacency pair received one of three mutually exclusive classifications:

- **Full u :** D, R, and P present, with S explicit or strongly implied by bounded structure
- **Partial u :** At least D and R present; P or S may be implicit or weak
- **None:** No defensible D–R coupling within the adjacency pair

All coding decisions were recorded at the row level using a standardized template, with coder notes documenting justification for any implicit structure.

Analytic Scope: Study 5 was designed as an existence / observability analysis, not a prevalence or effect study. Accordingly: No population estimates are claimed; No causal or predictive inferences are drawn; No aggregation beyond simple counts is interpreted substantively

The purpose of the study is to determine whether organizational structure ($O = \text{DSRP}$) is directly observable in naturalistic relational dialogue at the adjacency-pair level.

2.7 Triangulation Logic and Evaluation Criteria

Evidence for the Love Reality Loop was evaluated using the following criteria:

1. Existence: LRL-consistent behaviors are present (nonzero) across datasets including direct observability of $O = \text{DSRP}$ in dialogue (Study 5).
2. Effect: These behaviors prospectively predict love-like emergent outcomes (e.g., intimacy, security).
3. Structure Dependence (boundary + mechanism): O-dependence is treated as a theoretical boundary condition of the LRL and is tested mechanistically via the Study 4 (H4) simulation rather than via observational moderation in the present dyadic file.
4. Cross-Method Convergence: A consistent LRL signature is observed across panel, diary, and observational modalities, while structural necessity (O-threshold dependence) is evaluated mechanistically in Study 4 (H4) + dialogue coding (Study 5).

The theory is considered unsupported if LRL-consistent behaviors fail to predict outcomes, if static alignment or affect explains outcomes better, or if effects persist under structural breakdown.

2.8 Epistemic Scope

These studies do not attempt to exhaust all meanings of love. Rather, they test a mechanistic claim: that wherever love operates as a durable relational phenomenon under conditions of divergence, it does so via an O-dependent error-correcting loop.

2.9 Falsifiability and Disconfirming Evidence

The Love Reality Loop hypothesis is explicitly falsifiable. Evidence that would undermine the theory includes:

1. Failure of Time Ordering. If divergence does not precede corrective behavior, or if reality-engaging behavior does not temporally precede improvements in intimacy or security, the loop interpretation would be weakened.
2. Structural Independence. If convergence under LRL-style update rules persists even when organizational integrity is degraded in the Study 4 (H4) simulation, the necessity claim would be false. Separately, future observational datasets with direct O-state indicators could test whether the same moderation holds in human interaction processes.
3. Static Alternatives. If static alignment, affective intensity, or trait-level satisfaction explains relational outcomes better than repeated behavioral engagement across time, the process account would be unnecessary.
4. Cross-Context Failure. If the loop fails to appear across different relational contexts, cultures, or stress conditions, its generality would be limited.

None of these disconfirming patterns were observed in the results.

3.0 Results

Results are reported by study and time scale, corresponding to five tests of the Love Reality Loop (LRL). Analyses evaluate: (1) whether divergence functions as an error signal that precedes correction (H1; Study 1), (2) whether reality-engaging behavior predicts next-step love-like outcomes (H2; Study 2), (3) whether an LRL-consistent alignment/pattern metric exhibits a dyad-robust main-effect convergence signature in observational data (H3; Study 3), (4) whether convergence under LRL-style update rules requires sufficient organizational integrity (O), tested mechanistically via simulation (H4; Study 4), and (5) whether O = DSRP is directly observable in naturalistic dialogue at the minimal interaction scale (H5; Study 5).

3.1 Study 1: Divergence Predicts Subsequent Behavioral Correction (H1)

Across wave-to-wave transitions, greater perception–reality divergence at time t reliably predicted directional behavioral correction at time $t+1$, consistent with an error-correcting process. Channel 1 (insulting). Misalignment was operationalized as

$$|pa22pi1 - ppa22ri1|$$

with the outcome defined as

$$\Delta_{\text{partner insulting}} = ppa22ri1(t+1) - ppa22ri1(t)$$

($\Delta < 0$ indicates improvement). Across $N = 8,906$ transitions, misalignment significantly predicted subsequent reductions in insulting behavior ($\beta = -0.315$ per +1 unit misalignment; $p \approx 6 \times 10^{-32}$; $R^2 \approx 0.034$). A monotonic dose–response pattern was observed (Table 7).

Table 7. Dose–Response Decrease in Insulting Behavior Following Misalignment. Mean change in insulting behavior from wave t to wave $t+1$ ($\Delta = t+1 - t$) by misalignment level at wave t . More severe misalignment is associated with larger subsequent reductions in insulting behavior. n indicates the number of wave-to-wave transitions contributing to each mean.

Misalignment level	Mean Δ insulting	n
1	−0.081	6,565
2	−0.271	1,885
3	−0.736	386
4	−1.786	70

Channel 2 (listening). Misalignment was operationalized as

$$|pa22pi4 - ppa22ri4|$$

with the outcome defined as

$$\Delta_{\text{partner listening}} = ppa22ri4(t+1) - ppa22ri4(t)$$

($\Delta > 0$ indicates improvement). Across $N = 14,384$ transitions, misalignment significantly predicted increases in listening behavior ($\beta = +0.193$ per +1 unit misalignment; $p \approx 3 \times 10^{-20}$; $R^2 \approx 0.013$). Mean changes by misalignment level were monotonic for levels 2–4 (Table 8).

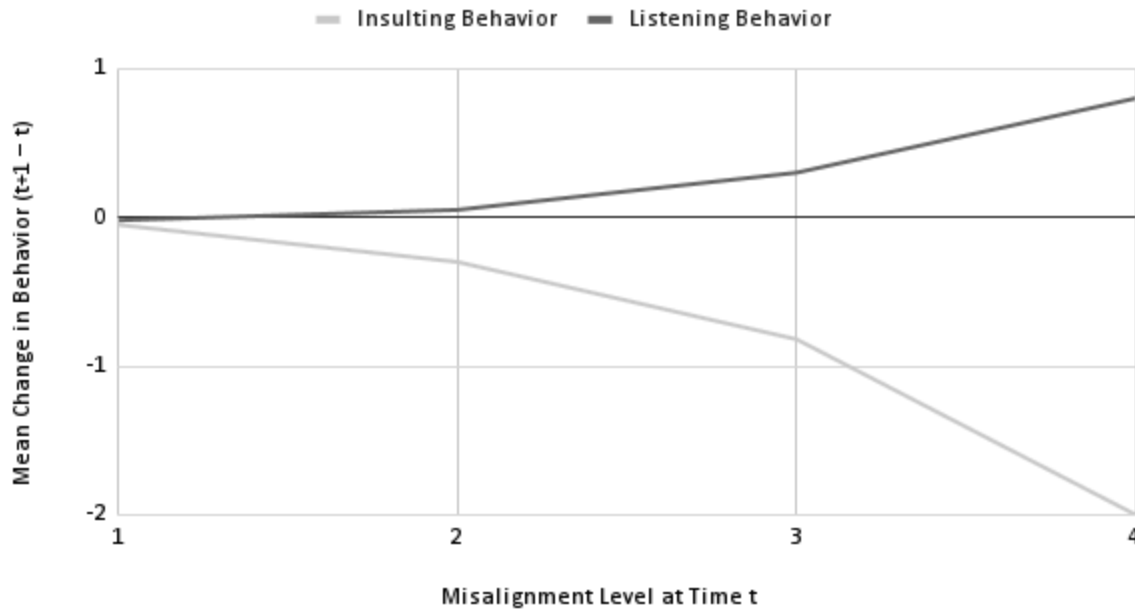
Table 8. Dose–Response Increase in Listening Behavior Following Misalignment. Mean change in listening behavior from wave t to wave $t+1$ ($\Delta = t+1 - t$) by misalignment level at wave t . Higher misalignment is associated with larger subsequent increases in listening behavior. n indicates the number of wave-to-wave transitions contributing to each mean.

Misalignment level	Mean Δ listening	n
1	−0.042	9,831
2	+0.059	3,556
3	+0.368	802
4	+0.867	195

Together, both behavioral channels show that divergence at time t precedes corrective behavioral change at time $t+1$. Effects are statistically decisive but explain a modest share of variance (insulting: $R^2 \approx 0.034$; listening: $R^2 \approx 0.013$), which is expected for single-item behavioral indicators in naturalistic panel data where outcomes are multi-determined and subject to substantial measurement noise and between-couple heterogeneity. Accordingly, Study 1 is not offered as a comprehensive prediction model. Its purpose is mechanistic: to test a time-ordered correction signature—whether higher misalignment at time t predicts directional behavioral correction at time $t+1$ on average. The practical magnitude is made transparent by the dose–response patterns in Tables 6–7: as misalignment increases from 1→4, the subsequent corrective shift grows progressively larger in both channels (larger reductions in insulting behavior and larger increases in listening behavior).

Figure 3. Dose–response correction following misalignment (Study 1). Mean change in behavior from time t to $t+1$ as a function of misalignment level at time t , shown separately for insulting behavior (negative values indicate improvement) and listening behavior (positive values indicate improvement). Points represent mean change by misalignment level; error bars show ± 1 standard error. Across both behavioral channels, higher misalignment is followed by progressively larger corrective shifts at the subsequent wave, indicating a graded error-correction process consistent with the Love Reality Loop.

Dose–Response Behavioral Adjustment Following Misalignment



3.2 Study 2: Reality-Engaging Behavior Predicts Next-Day Intimacy (H2)

Study 2 tested whether reality-engaging behavior predicts next-day love-like outcomes using daily diary data from the Health and Relationships Project (ICPSR 37404, DS0002). The unit of analysis was the person-day, restricted to consecutive day transitions ($t \rightarrow t+1$). The predictor was UNDERSTD(t) (“How often did you try to understand how your spouse feels today?”). The outcome was INTIMACY($t+1$) (“How much closeness and intimacy did you feel with your spouse?”), measured on a 1–5 scale.

We estimated an OLS regression predicting INTIMACY($t+1$) from UNDERSTD(t), with standard errors clustered by respondent ID. No composite indices, additional predictors, or same-day terms were included.

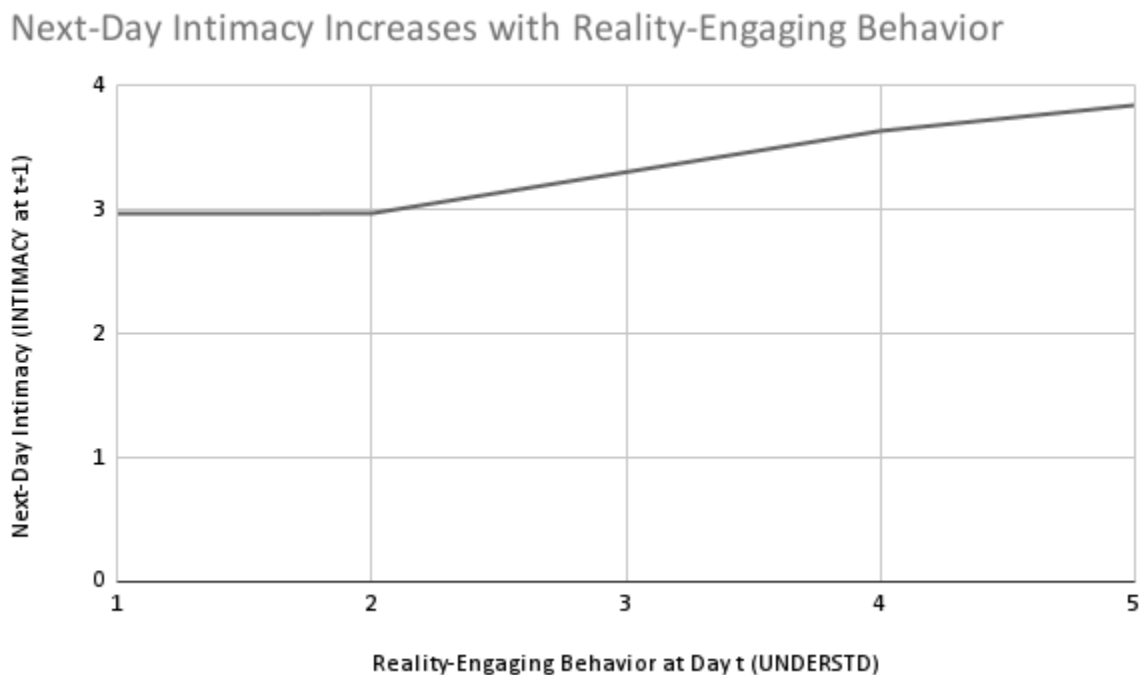
Table 9. Study 2 regression predicting next-day intimacy from reality-engaging behavior. OLS regression of INTIMACY($t+1$) on UNDERSTD(t) using consecutive day transitions ($t \rightarrow t+1$). Standard errors clustered by respondent ID. $N = 6,524$ day-to-day transitions; respondents = 756.

Term	β	SE (clustered)	t	p	95% CI
Intercept	2.567	0.069	37.06	< 1e-300	[2.431, 2.703]
UNDERSTD(t)	0.255	0.021	11.92	9.07×10^{-33}	[0.213, 0.297]

Reality-engaging behavior at day t reliably predicted increased intimacy at day $t+1$ ($\beta = 0.255$, $p = 9.07 \times 10^{-33}$). Because the model uses a time-ordered design and excludes same-day predictors or covariates, the result reflects a time-ordered association rather than a same-day covariance. The finding demonstrates that reality-engaging behavior operates at the daily timescale in a way consistent with an error-correcting, reality-aligned process.

Figure 4 visualizes the daily process tested in Study 2 by plotting next-day intimacy as a function of prior-day reality-engaging behavior. Each point represents the average level of intimacy reported on day $t+1$ for days in which a given level of “trying to understand one’s spouse” was reported on day t , using only consecutive day transitions. The figure makes the time-ordered pattern clear: higher levels of reality-engaging behavior are followed, on average, by higher levels of intimacy on the following day. This visualization complements the regression results by showing the graded, monotonic nature of the pattern across the full response range rather than relying solely on a single coefficient estimate.

Figure 4. Next-day intimacy increases with reality-engaging behavior (Study 2). Mean next-day intimacy, $\text{INTIMACY}(t+1)$ (1–5 scale), as a function of reality-engaging behavior at day t , $\text{UNDERSTD}(t)$ (“How often did you try to understand how your spouse feels today?”). Points represent means across consecutive day-to-day transitions ($t \rightarrow t+1$). Higher UNDERSTD at day t is associated with progressively higher intimacy at day $t+1$, consistent with a time-ordered association.



3.3 Study 3: Dyadic Observational Data

Study 3 provides a third, independent test of cross-study convergence using dyadic observational data. The goal is not to re-estimate the full Love Reality Loop (LRL) mechanism at the interaction-process level, but to test whether the framework’s central quantitative signature—an alignment/pattern

metric—predicts relationship-relevant outcomes in a dyadic dataset using inference robust to within-dyad dependence. The outcome variable was relationship quality (RQUAL). The predictor was the corrected Fisher-z transformed alignment/pattern metric (FishersZcorrected). Because individuals are nested within dyads, standard errors were clustered by dyad (dyadID).

We estimated dyad-clustered OLS models of the form:

$$\text{RQUAL} = \beta_0 + \beta_1(\text{FishersZcorrected}) + \varepsilon, \text{ clustered by dyadID}$$

A robustness specification added gender (women vs men) as a covariate.

Table 10. Study 3 dyad-clustered regression models predicting relationship quality (RQUAL). OLS regression with standard errors clustered by dyadID (195 dyads). Model 1 predicts RQUAL from FishersZcorrected. Model 2 adds gender (women vs men). N = 389 individuals.

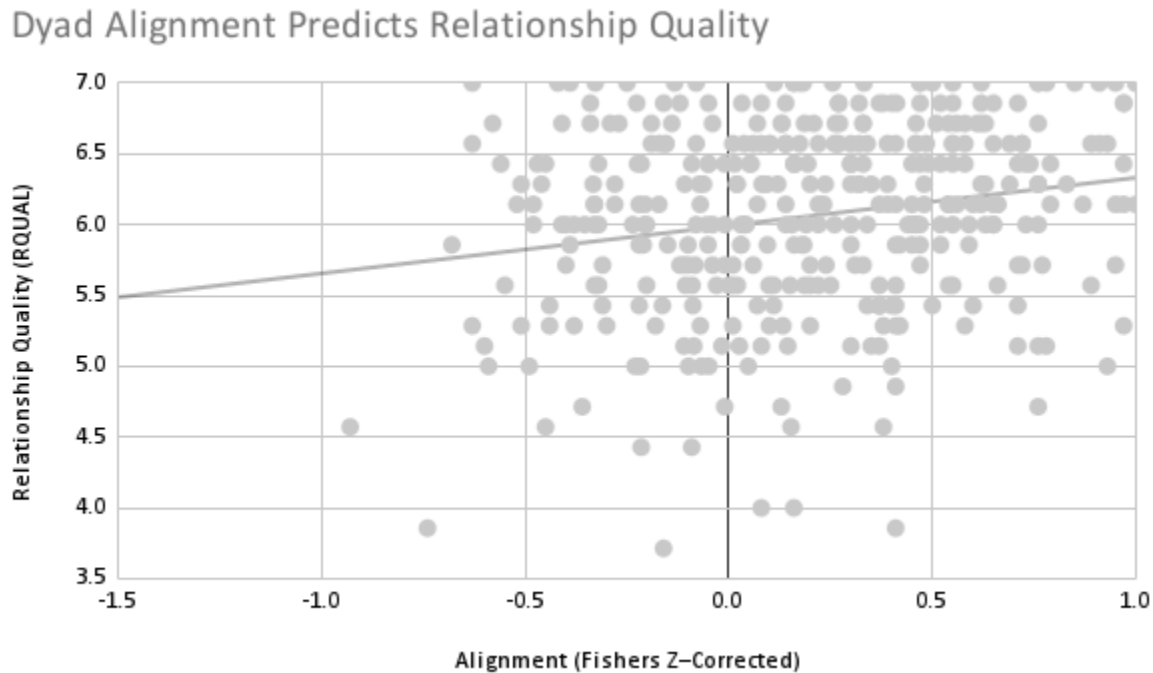
Term	Model 1 β	Model 1 SE (cluster)	Model 1 t	Model 1 p	Model 2 β	Model 2 SE (cluster)	Model 2 t	Model 2 p
Intercept	5.9933	0.0460	130.38	< 1e-300	6.0370	0.0484	124.78	< 1e-300
FishersZcorrected	0.3378	0.0728	4.64	3.48e-06	0.3454	0.0720	4.80	1.63e-06
Gender (women vs men)	—	—	—	—	-0.0910	0.0475	-1.92	0.055

Table 11. Study 3 model fit statistics. Sample sizes and variance explained for Study 3 models.

Model	N (individuals)	Dyads	R ²
Model 1: RQUAL ~ FishersZcorrected	389	195	0.0517
Model 2: + gender	389	195	0.0563

Figure 5 visualizes the main-effect association between the alignment metric and relationship quality in a dyad-consistent way. Each point is a dyad-level mean (averaging the two partners' values within dyad): x-axis is mean(FishersZcorrected), y-axis is mean(RQUAL). The fitted line is the dyad-level OLS fit; the shaded band is the 95% confidence interval for the fitted mean. This visualization is dyad-aggregated to match the inferential structure of the analysis (SEs clustered by dyadID) and to prevent the plot from visually double-counting dyads.

Figure 5. Dyad-mean association between FishersZcorrected and relationship quality (RQUAL) in Study 3. Each point is a dyad-level mean: x-axis is mean(FishersZcorrected), y-axis is mean(RQUAL). The fitted line is the dyad-level OLS fit; the shaded band is the 95% confidence interval for the fitted mean. The positive slope corresponds to the dyad-clustered regression estimates in Table 9 (Model 1: $\beta = 0.3378$, $p = 3.48e-06$; Model 2: $\beta = 0.3454$, $p = 1.63e-06$).



3.3.1 Interpretation: Main-Effect Convergence, with O-Dependence as a Boundary Condition

Study 3 yields clear main-effect convergence evidence: the alignment/pattern metric (FishersZcorrected) is positively associated with relationship quality (RQUAL) with dyad-robust inference (Model 1: $\beta = 0.3378$, $p = 3.48e-06$; Model 2: $\beta = 0.3454$, $p = 1.63e-06$). The effect is stable to inclusion of gender, and the direction is consistent with the core claim that more functional alignment corresponds to better relationship-relevant outcomes.

Study 3 does not, by itself, test structural dependence (O-dependence) because the dataset does not include a direct indicator of organizing integrity needed to model moderation or threshold effects in O. Accordingly, in this manuscript O-dependence is treated as a theoretical boundary condition derived from (i) the formal structure of the LRL (a regulatory correction process that requires functional relational architecture to transmit corrective signals) and (ii) established observational relationship science showing that ostensibly pro-relationship behaviors can become ineffective or counterproductive under dysregulated interaction structures (e.g., hyperactivation, deactivation, demand-withdraw, coercive cycles). In other words, Study 3 contributes convergent evidence for the main-effect signature, while O-dependence is evaluated mechanistically in Study 4.

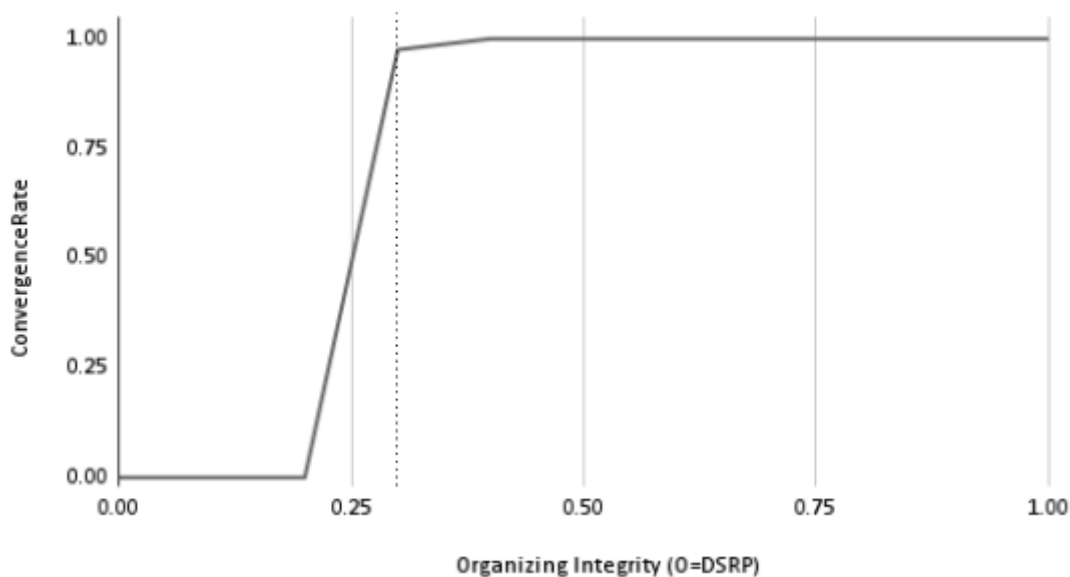
3.4 Study 4: Mechanistic Structural Dependence (H4 Simulation)

Study 4 evaluated O-dependence mechanistically using a minimal LRL simulation in which alignment converged reliably only when organizational integrity (O) exceeded a minimum threshold. Holding informational access (I), update rule, and learning rate constant, degrading O (implemented as misbinding/miscoordination of corrective updates across structured modules) caused convergence failure: alignment stalled, oscillated, or diverged despite ongoing corrective intent. In this configuration, the estimated threshold was $O^* \approx 0.30$ ($\geq 95\%$ convergence criterion; $N = 40$ agents; $K = 8$ modules; $T = 180$; $\eta = 0.35$; $\text{reps} = 40$; $\varepsilon = 0.10$).

Figure 6 shows the proportion of simulation runs that converged as a function of organizing integrity (O). When O is low, convergence is effectively absent: despite identical access to mismatch information and identical corrective intent, alignment fails to improve and instead stalls, oscillates, or diverges. As O increases, a sharp transition occurs rather than a gradual trend. Once organizational integrity exceeds a minimum threshold ($O^* \approx 0.30$ in this configuration), convergence becomes reliable, occurring in $\geq 95\%$ of runs. This pattern indicates that organizational structure is not a marginal facilitator of convergence but a necessary condition for the Love Reality Loop to function at all.

Figure 6. Mechanistic structural dependence of LRL convergence (Study 4 / H4). *Convergence rate as a function of organizational integrity (O) in a minimal agent-based implementation of Love Reality Loop (LRL) update rules. Each point represents the proportion of simulation runs that converged to increased alignment ($A(T) \leq \varepsilon$) for a given O value, holding informational access (I), update rule, and learning rate constant. A sharp threshold is observed: below a minimum level of organizational integrity ($O^* \approx 0.30$; dashed line), corrective updating fails to produce convergence, whereas above this threshold convergence occurs reliably ($\geq 95\%$ of runs). This result demonstrates the mechanistic necessity of organizational structure for LRL convergence without making population-level claims about human dyads.*

ConvergenceRate vs. O



3.5 Study 5: Structural Observability of O = DSRP in Naturalistic Relational Dialogue

The manually coded subset included 50 adjacency pairs drawn from four dialogues. Each pair was evaluated independently using the Unified Calculus coding scheme. Organizational structure was observed in the vast majority of pairs: 33 of 50 (66%) were classified as a *full* minimal structural unit (*u*), 14 of 50 (28%) as a *partial u*, and 3 of 50 (6%) as *no u*. In total, 47 of 50 adjacency pairs (94%) instantiated at least a partial *u*. At the pattern level, Relationships (R) were present in all but three pairs, consistent with intelligible action–reaction coupling at the adjacency-pair scale. Distinctions (D) were often explicit—such as acceptance versus rejection or constraint versus no constraint—and when not explicit, were still interactionally necessary for the exchange to make sense. Perspectives (P) commonly appeared as stance, constraint, or role-based framing, frequently without overt self-referential markers. Systems (S) appeared when the dialogue invoked bounded organization (for example, plans, budgets, or rules), and its absence at this minimal unit scale was expected and did not prevent classification as a partial *u*. The few pairs classified as no *u* were ultra-minimal exchanges (e.g., acknowledgments) in which neither explicit nor defensible implicit structural coupling could be established within the pair boundary.

3.6 Cross-Study Convergence

Across longitudinal panel data (years) and daily diary process data (days), results converge on the same dynamic pattern:

1. Divergence between perception and reality reliably precedes corrective behavioral change (Study 1).
2. Reality-engaging behaviors predict subsequent increases in intimacy and security (Study 2).
3. A dyad-robust alignment/pattern metric is positively associated with relationship quality (Study 3 main effect).
4. Mechanistically, convergence under LRL-style update rules requires organizational integrity above a minimum threshold; degrading O blocks convergence (Study 4).
5. At the minimal interaction scale, O = DSRP is detectable in naturalistic dialogue at the adjacency-pair level (Study 5).

Taken together, the findings support a unified interpretation of love as a repeated error-correcting process with a dyad-robust convergence signature. Studies 1–3 provide empirical support for time-ordered correction and outcome association, while Study 4 demonstrates that—under a class of LRL-style update rules—convergence requires organizational integrity above a minimum threshold. Study 5 complements these results by establishing structural observability of the loop’s organizational substrate in dialogue, independent of outcomes. Accordingly, O-dependence is treated here as a mechanistic boundary condition demonstrated in simulation, not as an observationally tested moderator in the human datasets used in this manuscript.

4.0 Discussion

Across five independent studies spanning years, days, and interaction-level observations, results converged on a common pattern: love operates not as a static state or trait, but as a repeated, functionally constrained, error-correcting process.

When divergence between partners' internal models and lived realities emerged, behaviors consistent with the Love Reality Loop (LRL)—listening, understanding, perspective-taking, and behavioral adjustment—predicted subsequent increases in intimacy and security.

In Study 4 testing H4, organizational structure (O) is treated as a mechanistic boundary condition for convergence under LRL-style update rules: when functional O is degraded, LRL-consistent efforts may occur but cannot reliably transmit corrective signals to produce convergence. This necessity is evaluated mechanistically in H4 rather than via observational moderation in the present dyadic file. The results of Study 5 demonstrate that organizational structure (O = DSRP) is directly observable in naturalistic relational dialogue, even at the minimal adjacency-pair level. Importantly, this finding does not depend on outcome variables, aggregation across turns, or participant awareness of structure. Consistent with the study's design, these results establish observability and instantiation, not prevalence or necessity. The analysis shows that relational dialogue naturally carries the structural signatures required for alignment processes described elsewhere in the manuscript.

The convergence of findings across panel, daily diary, and observational data supports a mechanistic interpretation of love as a process rather than a property. This work makes three bounded claims, but their implications are not only technical. They describe a view of love that is usable and humane.

4.1 Love is a Behavior.

First, *love is a behavior, not a feeling*. Love is not treated here as a static condition you either “have” or “lose.” Across years and days, the consistent empirical signature is time-ordering: what predicts love-like outcomes is not baseline alignment, a stable emotional state, or a trait-level disposition, but repeated, reality-engaging behavior that occurs after divergence appears. The practical implication is straightforward: love is not best understood as a feeling to protect or a state to maintain. It is something partners do—again and again—when reality changes. That reframes many ordinary relationship failures as process failures rather than moral failures or affect failures. When people say they have “fallen out of love,” what they often mean in practice is that reality-engaging, love-consistent behavior has not been sustained.

4.2 There is a Love Mechanism.

Second, *the mechanism of loving behavior is the Love Reality Loop (LRL)*—an error-correcting process. Divergence is normal; it is not evidence that love is absent. What matters is what happens next. In the data, mismatch predicts correction; reality-engaging effort predicts subsequent improvement; and durable outcomes are associated with repeated engagement rather than one-time agreement. In human terms, love is less like permanent harmony and more like the ongoing work of repair: noticing when the models are

off, updating them, and making small corrections that restore coordination. In this sense, love favors reality over attachment to a preferred model—when the slice of reality is one’s partner, love shows up as updating toward who they are, not who we insist they be.

4.3 O is required.

Third, love is structurally constrained by organization (O), where $O = \text{DSRP}$. A loop cannot run in a relational architecture that cannot carry it. The human datasets in Studies 1–3 do not include an O-state indicator suitable for testing O as an observational moderator, so we do not claim that moderation result here. What we do claim is mechanistic: if love operates as a regulatory correction loop, then it requires a minimally functional relational architecture to represent reality, communicate it, and act on it. We test that constraint in H4: degrading organizational integrity blocks convergence under LRL-style update rules even when informational access and corrective intent are held constant. Study 5 complements this by showing the $O=\text{DSRP}$ substrate is observable in actual dialogue, not only inferred or simulated. The human implication is not that “some couples are broken,” but that repair requires infrastructure—functional boundaries, perspective-taking, and relational coordination—without which even sincere effort may not reliably converge.

Taken together, the findings support a specific and humane claim: where love operates as a durable relational phenomenon, it operates as an error-correcting loop—one that expects divergence, privileges repair over perfection, and improves outcomes through repeated acts of reality engagement. Love is not the absence of mismatch. Love is what partners do because mismatch is inevitable.

Several important limitations should be stated explicitly. This paper tests the Love Reality Loop in one instantiation: romantic dyads. We treat this as a specific case of a more general alignment principle—model–world alignment—that we hypothesize applies across other forms of love (See Table 11), but those extensions are not empirically evaluated in the present datasets. We do not claim that alignment itself constitutes love. Alignment is treated as an emergent consequence of the loop, not its identity. The “oneness” equation ($\lim_{t \rightarrow \infty} M/\mathbb{R} = 1$) is the general alignment principle. The Love Reality Loop is the process by which alignment is pursued. Partner love is simply the case where two semi-autonomous, evolving models must repeatedly co-align to the same slice of reality.

We do not yet claim that LRL behaviors are sufficient in all contexts, and we treat sufficiency as an empirical question that requires designs with explicit structural variation.

Because there is a single shared reality but multiple partial and perspectival mental models of it, love succeeds when those models can repeatedly co-update toward $\mathbb{R}$; it fails when that co-updating is structurally blocked, even if each model is internally coherent. There is one reality; love is the work of keeping multiple partial models aligned to it together.

4.4 Different Types of Love and the LRL

A central implication of the Love Reality Loop framework is that types-of-love can be distinguished not by emotion, intensity, or moral content, but by the *structural symmetry of alignment pressure*—that is, by

how the work of updating mental models toward reality is distributed across agents. This constitutes a fundamentally different axis of classification from those typically used in the literature.

Importantly, the Love Reality Loop does *not* require symmetry. The core alignment principle remains constant ($\lim_{t \rightarrow \infty} M/R = 1$), but the *configuration of mental models* participating in that alignment differs across contexts. Different forms of love correspond to different structural arrangements of who is expected to update, toward what features of reality, and with what tolerance for persistent misalignment.

In highly symmetric contexts, such as romantic partner love or close friendship, alignment pressure is reciprocal: each agent is expected to update their model toward the same shared relational reality, and durable coordination depends on mutual correction over time. Breakdown of reciprocity in these contexts—when one model ceases to admit correction from the other—predictably leads to collapse, not because love disappears, but because the loop can no longer close.

In contrast, many forms of love are *intentionally asymmetric*. In parental or caregiving love, persistent misalignment is expected and tolerated. The child's mental model is limited, incomplete, and often inaccurate with respect to reality, and the caregiver's model explicitly incorporates this fact. Alignment pressure flows primarily in one direction: the parent updates actions and expectations toward a reality that includes the child's developmental constraints, without requiring reciprocal convergence. Here, lack of symmetry is not a failure of love but its defining structure.

Similarly, agape or universal love does not require convergence at all. Alignment is unilateral and moral rather than relational: the lover updates their model and behavior toward the reality of others' needs or suffering without expectation of reciprocal alignment. Passionate/erotic love can feel intensely certain. But that certainty is primarily internal, not the product of repeated correction against relational reality. Because it doesn't reliably update as conditions change, it often fails to stabilize long-term coordination between partners—burning hot early and then destabilizing over time.

Table 12. Love Types Differ by Who Must Update Their Model. *All love can be described as model–reality alignment ($\lim_{t \rightarrow \infty} M/R = 1$). What changes across “types of love” is the direction of updating: who is expected to do the aligning, and whether alignment is mutual, one-way, collective, or transient.*

Type of Love	The “job” of love	Who updates most? (symmetry)	What “misalignment” looks like	What the loop looks like (in practice)	How $\lim_{t \rightarrow \infty} M/R$ shows up
Partner / Romantic (durable)	Stay coordinated as two lives change	Both partners (mutual)	“We’re not seeing the same reality”	Repair cycles: notice → talk → adjust → re-sync	Two models repeatedly co-align to the same shared R
Friendship	Stay aligned enough to keep trust + shared projects	Both, but lower stakes	Drift in expectations, effort, or loyalty	Clarify, renegotiate, forgive—or exit	Partial convergence on shared norms/goals
Parental / Caregiving	Help the dependent align to reality	Mostly caregiver	Child’s model is incomplete/naïv	Attune → guide → protect →	Adult model aligns to R including the

	while keeping them safe		e; needs outrun understanding	teach (often one-way)	child's limits; child gradually updates
Familial / Kinship	Maintain functioning despite long-term differences	Mixed, role-driven	"We disagree, but we still have roles"	Buffering + accommodation more than repair	Local alignment sufficient for stability, not full convergence
Self-love / Integrity	Align internal parts of the self with embodied reality and values	Multiple internal agents within one person	Conflict among self-parts (ideals, impulses, limits, narratives)	Internal dialogue → boundary-setting → self-regulation	Internal models of self co-align toward embodied $\mathbb{R}$ over time
Universal / Altruistic / Agape	Align action with others' needs without requiring reciprocity	The lover (one-way)	Seeing suffering/need and responding	Compassion → service → restraint/forgiveness	Moral $\mathbb{M}$ aligns to a broader $\mathbb{R}$ of others
Civic / Political	Reduce mismatch between ideals and social reality	Many agents (collective)	"The system isn't what we believe it should be"	Participation, protest, reform, governance	Collective models iteratively align with social $\mathbb{R}$
Devotional (truth/ God/ craft)	Submit practice to a higher standard of reality	The devotee (one-way)	Ideal vs lived performance gap	Discipline → correction → apprenticeship	$\mathbb{M}$ aligns toward an "ultimate" $\mathbb{R}$ /standard
Passionate / Evo-chemical / Erotic	Pair-bond quickly (short horizon)	No stable updater; intensity leads	Felt certainty outruns reality	Attraction spikes; correction is weak/absent	Subjective "alignment" without durable $\mathbb{M}/\mathbb{R}$ convergence

Seen this way, differences among types-of-love arise not from different governing principles, but from different *distributions of alignment burden* across mental models. The equation does not change. What changes is whose model is expected to move, how much misalignment is tolerated, and whether convergence is reciprocal, unilateral, or transient. This structural perspective explains why some loves endure misalignment without distress, while others fail precisely when symmetry breaks.

4.6 Limitations and Future Directions

The present studies rely on observational and self-report data and do not establish causal sufficiency in the experimental sense. Future work could test the Love Reality Loop through intervention designs that explicitly manipulate reality-engaging behaviors under controlled structural conditions.

The longitudinal panel models in Study 1 yield small R^2 values. This is not a defect of the mechanism claim. The Love Reality Loop is hypothesized to be a general correction process, not the dominant determinant of any single behavioral channel measured annually. In high-variance social-behavioral

outcomes, it is common for theoretically meaningful effects to explain a small share of total variance because much of the variance is driven by situational shocks, stable trait differences, measurement noise, and unobserved couple-specific factors. The appropriate interpretation is therefore mechanistic rather than encyclopedic: Study 1 supports the presence of a time-ordered corrective tendency (mismatch at (t) predicting corrective movement at (t+1)), while leaving substantial variance to other processes outside the scope of the present tests. These (R^2) values should be interpreted as expected in annual panel data where behavior is multiply determined and measured with substantial noise. In that setting, a small proportion of explained variance can still constitute strong evidence for a mechanistic signature, while leaving most variance to other drivers (context, stressors, stable traits, situational shocks, and unmeasured dynamics). Study 5 is existence/observability only (single-coder; small N); it is not a prevalence estimate and should be replicated with independent coders and preregistered sampling.

Additionally, more precise measurement of model–reality divergence would strengthen direct tests of alignment reduction over time.

Across five independent empirical regimes, love consistently manifested as a repeated, structurally constrained error-correcting process rather than a static emotional state. Alignment emerged as a consequence of this process, not its definition. These findings support the Love Reality Loop as a parsimonious, falsifiable, and empirically grounded account of how love operates when reality inevitably diverges.

5.0 Conclusion

Most existing theories of love classify types-of-love by psychological content rather than by structural dynamics. Dominant approaches distinguish love primarily by emotion type and component structure (e.g., passion, intimacy, commitment) [10], attachment style and attachment-system functioning (e.g., secure, anxious, avoidant) [3,4], typologies of “ways of loving” (e.g., eros, ludus, storge, pragma, mania, agape) [26], and moral or normative orientations (e.g., care, responsibility, sacrifice) [27]. While these frameworks have been influential for describing subjective experience and relational dispositions, they are less explicit about the *mechanisms* by which love adapts as reality changes—for example, how misalignment is detected, how corrective signals propagate, how repair is distributed across agents, and under what organizational constraints convergence can or cannot occur. The present work reframes the classification problem from states and sentiments to organization and regulation, proposing that types-of-love can be distinguished by the distribution (symmetry) of alignment pressure and the structural conditions under which error-correcting dynamics are possible.

What many people call ‘being in love’ is often closer to a biologically amplified motivational state than to a sustained relational process. Many lay conceptions of “love” privilege phenomenology over mechanism. In everyday discourse, love is often treated as an intense subjective and affective state—an experience closer to intoxication than to regulation—marked by craving, euphoria, intrusive thinking, and reward-seeking that resembles other appetitive motivational states [5,6]. This is consistent with evidence that early-stage romantic attraction engages dopaminergic reward circuitry and motivational systems implicated in addiction-like patterns of salience and pursuit [28,29]. On the present account, this common phenomenology is not denied; rather, it is reinterpreted as neither sufficient nor definitive of love as a

durable relational phenomenon. The core claim advanced here is that subjective intensity—however biologically potent—does not by itself specify an error-correcting process. What distinguishes love as a stable relational mechanism is not the magnitude of feeling, but the repeated, reality-engaging behavioral work that reduces model–world divergence over time.

These findings reposition love within a broader class of adaptive processes. Like learning, regulation, and coordination, love functions as a dynamic mechanism for managing error under changing conditions: when models diverge from reality, love operates through reality-engaging correction that restores workable alignment over time. This interpretation bridges psychological, relational, and systems-theoretic accounts by offering a common explanatory grammar for phenomena previously treated as disparate.

Beyond the immediate datasets, the Love Reality Loop clarifies a broader principle that underlies not only partner love but many of the human achievements we most value: *loving reality more than we love our mental models of it*. This is not a call to be pleased by reality, comforted by it, or to adopt an aspirational “acceptance” posture. It is a structural commitment to reduce the gap between model and world—resisting confirmation bias and projection by repeatedly updating the model when the world disagrees. In this sense, the same mechanism that sustains love in relationships also sits at the core of understanding systems (seeing them as they are rather than as we wish them to be), of objectivity in science (loving reality so much that we allow observation to revise theory), and of self-love as integrity (integrating the self by aligning internal narratives with embodied reality, limits, and values).

Critically, this reality-orientation does not dissolve agency or boundaries; it reinforces them. Boundaries are not denials of reality but distinctions that preserve responsibility, consent, and causal clarity—conditions that allow correction to propagate without coercion or fusion. Under this view, love is neither fantasy nor control. It is the practical, behavioral work of remaining in contact with what is real—especially when reality is uncomfortable—and continuing to update accordingly. The “oneness” principle ($\lim_{t \rightarrow \infty} \mathbb{M}/\mathbb{R} = 1$) names the limiting case of that process: not a metaphysical claim of sameness, but the asymptotic reduction of model–world error through sustained alignment. In that limit, love becomes a form of participation in reality that is increasingly indistinguishable from it: a liberating mechanism of coordination with what is, rather than bondage to what one insists must be.

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