

Regulation Externalization Latency (REL)

A Proposed Dynamic Process Variable
in Emotion Regulation

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Contents

Regulation Externalization Latency (REL)	3
A Proposed Dynamic Process Variable in Emotion Regulation	3
Abstract	3
1. Introduction	3
1.1 The Temporal Gap in Emotion Regulation Research	3
1.2 Why Timing Matters	3
1.3 Scope and Claims	4
2. Definition	4
2.1 Operational Definition	4
Coding Criteria for Regulatory Externalization	4
2.2 Scope Restriction: Interpersonal Regulatory Externalization	5
2.3 What REL Is	5
2.4 What REL Is Not	5
2.5 Boundary Conditions	5
Application Breadth	5
2.6 State-Level Construct With Trait-Like Aggregation	6
2.7 Process Compression Acknowledgment	6
3. Distinction From Adjacent Constructs	7
3.1 REL vs. Distress Tolerance	7
3.2 REL vs. Negative Urgency	7
3.3 REL vs. Attachment Anxiety	8
3.4 REL vs. Reassurance-Seeking	8
3.5 REL vs. Differentiation of Self	8
3.6 Summary of Discriminant Positioning	9
4. Proposed Measurement Paradigms	9
4.1 Paradigm 1: Delayed Response Task	9
4.2 Paradigm 2: Ambiguous Evaluative Feedback	9
4.3 Paradigm 3: Ecological Momentary Assessment (EMA)	10
5. Predictions	10
5.1 Incremental Validity	10
5.2 The Nonlinearity Hypothesis	11
5.3 Moderators	11
5.4 Distinguishing REL From Suppression	11
6. Neurophysiological Considerations	11
7. Theoretical Context	12
8. Limitations	12
8.1 Construct Validity	12
8.2 Overlap Risk	12
8.3 Measurement Challenges	12

8.4 Suppression Confound	12
8.5 Cultural Variation	13
8.6 Terminological Note	13
9. Future Directions	13
9.1 Priority: Discriminant Validity Study	13
9.2 Within-Person Variability	13
9.3 Predictive Validity	13
9.4 Smartphone Behavioral Telemetry	13
9.5 Physiological-Behavioral Integration	13
9.6 Beyond Latency: Regulation Externalization Dynamics	14
10. Conclusion	14
References	14

Regulation Externalization Latency (REL)

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Version 1.0 — Draft

Abstract

This paper introduces Regulation Externalization Latency (REL): the time interval between unresolved emotional activation and initiation of external regulatory behavior. Existing emotion regulation constructs primarily describe what strategies individuals use, how well they tolerate distress, or how frequently they seek reassurance. None directly operationalize *how quickly* unresolved activation transforms into externally directed regulatory behavior.

REL is proposed as a dynamic process variable operating at the state level — distinct from trait distress tolerance, negative urgency, attachment anxiety, and reassurance-seeking frequency. The construct targets a specific temporal gap: the interval between internal activation and the behavioral moment at which regulation shifts from internal to external.

This paper defines REL operationally, distinguishes it from adjacent constructs, proposes three experimental paradigms for measurement, outlines predictions for incremental validity, and acknowledges limitations requiring empirical investigation.

1. Introduction

1.1 The Temporal Gap in Emotion Regulation Research

Emotion regulation research has produced well-validated constructs describing regulatory strategies (Gross, 1998), distress tolerance capacity (Simons & Gaher, 2005), impulsive behavior under negative affect (Whiteside & Lynam, 2001), and attachment-related regulatory patterns (Brennan, Clark, & Shaver, 1998). These constructs capture important dimensions of regulatory functioning.

However, a specific temporal dimension remains underspecified: how rapidly does unresolved activation become externally directed regulatory behavior? Two individuals may report identical distress tolerance, use similar regulatory strategies, and score comparably on attachment anxiety — yet differ dramatically in how quickly they initiate reassurance-seeking, relational monitoring, or communicative discharge following unresolved activation.

This temporal dimension — the latency between activation and externalization — is the focus of the present proposal.

1.2 Why Timing Matters

Regulation timing carries psychological information not captured by strategy selection or tolerance capacity alone. Consider two individuals who both eventually seek reassurance after relational ambiguity. If one initiates reassurance-seeking within 30 seconds and the other after 45 minutes, this temporal difference may reflect meaningful structural variation in regulatory organization — even if both ultimately engage the same behavior.

Existing constructs capture *whether* externalization occurs (reassurance-seeking), *how much* distress is tolerated before action (distress tolerance), or *how impulsively* one acts under negative affect (urgency). None directly measure the temporal interval between activation onset and externalization initiation.

1.3 Scope and Claims

This paper proposes REL as a construct worthy of empirical investigation. It does not claim that REL has been validated, that proposed paradigms have been tested, or that incremental validity has been demonstrated. All claims are hypothetical and require empirical testing.

2. Definition

2.1 Operational Definition

Regulation Externalization Latency (REL) is defined as:

The time interval between a defined activation onset marker and the initiation of external regulatory behavior.

Key terms: - **Activation onset marker:** An operationally defined event that serves as a *candidate* activation trigger. In experimental paradigms, this is the stimulus event (e.g., message sent without response, ambiguous feedback delivered). In naturalistic measurement, this is the self-reported or physiologically detected moment of activation awareness. The marker must be specified for each paradigm — REL is only meaningful relative to a defined onset point. Importantly, the marker indicates a *probable* activation event, not certainty that activation occurred. Not all unanswered messages produce distress; not all ambiguous feedback generates activation. Paradigms should include manipulation checks confirming that activation occurred. - **External regulatory behavior:** Behavior directed toward another person for the purpose of internal state regulation. Behavior is classified as regulatory externalization when it meets two criteria: (a) it is directed toward another person (interpersonal target), and (b) its primary function is affect regulation rather than instrumental problem-solving or routine communication. - **Initiation:** The behavioral onset point — the moment at which externally directed regulatory action begins, not the moment at which it succeeds.

Coding Criteria for Regulatory Externalization

To distinguish regulatory externalization from instrumental communication:

Criterion	Regulatory externalization	Instrumental communication
Primary function	Stabilize internal state	Solve external problem
Triggered by	Unresolved activation	Information need
Content	Seeks reassurance, validation, or emotional response	Seeks factual information or action
Urgency source	Internal distress	External deadline or task
Example	“Are we okay?” after ambiguity	“What time is the meeting?”

Ambiguous cases (e.g., “Can we talk?”) should be coded based on context: if preceded by unresolved activation and no instrumental need, classify as regulatory.

2.2 Scope Restriction: Interpersonal Regulatory Externalization

REL is restricted to **interpersonal regulatory externalization** — behavior directed toward another person (or perceived social agent) for the purpose of internal state regulation.

This scope restriction excludes: - Self-directed coping (drinking, exercise, distraction) - Information-seeking from impersonal sources (Googling symptoms, reading articles) - Parasocial regulation (posting on social media without directed recipient) - AI interaction (ChatGPT reassurance, chatbot use)

These exclusions are deliberate. While broader externalization phenomena exist, restricting REL to interpersonal behavior provides: - Clearer operational boundaries - Stronger connection to attachment and relational regulation literature - More tractable measurement (interpersonal behavior has identifiable recipients and timestamps) - Reduced construct bloat

Future work may investigate whether non-interpersonal externalization latencies (e.g., time to substance use, time to doomscrolling) follow similar dynamics, but these are outside REL's current definitional scope.

2.3 What REL Is

- A temporal process variable (measured in time units)
- State-level (varies across situations within individuals, though individuals may show characteristic patterns — see Section 2.6)
- Specific to interpersonal regulatory externalization
- Measurable through behavioral paradigms, telemetry, and ecological momentary assessment

2.4 What REL Is Not

- Not a trait (though trait-like tendencies may emerge from aggregation — see Section 2.6)
- Not distress tolerance (tolerance describes capacity; REL describes timing of a specific behavioral class)
- Not impulsivity (impulsivity is domain-general; REL is specific to interpersonal regulatory externalization)
- Not reassurance-seeking frequency (frequency counts events; REL measures latency to each event)
- Not suppression (long REL may reflect either genuine internal processing or defensive inhibition — these must be distinguished through additional measures)

2.5 Boundary Conditions

REL applies specifically to: - Situations involving unresolved activation (not routine communication) - Behavior directed toward another person whose primary function is regulatory (not instrumental problem-solving) - Interpersonal regulatory behavior (not internal strategies like reappraisal or distraction)

REL does not apply to: - Planned communication (e.g., scheduling a conversation about a known issue) - Instrumental help-seeking (e.g., asking for directions) - Social behavior without regulatory function (e.g., casual conversation) - Non-interpersonal coping (substance use, distraction, self-soothing)

Application Breadth

While REL is most naturally studied in attachment/relational contexts, it applies across activation domains:

Context	Activation trigger	REL-relevant behavior
Attachment ambiguity	Unanswered message, partner withdrawal	Reassurance-seeking, follow-up messaging
Performance evaluation	Ambiguous feedback, uncertain outcome	Seeking clarification from evaluator, validation from peers
Medical uncertainty	Awaiting test results, ambiguous symptoms	Contacting doctor, seeking reassurance from family
Social exclusion	Perceived rejection, group ambiguity	Reaching out to confirm standing, seeking inclusion signals
Authority conflict	Unclear feedback from supervisor	Checking with colleagues, seeking validation

This breadth prevents REL from collapsing into “attachment communication latency.”

2.6 State-Level Construct With Trait-Like Aggregation

REL is defined at the state level — it varies across events within individuals. However, aggregated across many events, individuals may show characteristic REL profiles (typically short, typically long, context-dependent). This parallels how momentary affect is state-level but aggregated affect constitutes mood or temperament.

The framework does not currently propose a formal “trait REL” construct. Whether stable individual differences in aggregated REL emerge, and whether they add predictive value beyond existing trait measures, is an empirical question.

2.7 Process Compression Acknowledgment

REL as operationally defined compresses multiple internal sub-processes into a single observable latency:

1. **Activation** → **urge emergence**: How quickly does the desire to externalize arise?
2. **Urge** → **behavioral execution**: How long is the urge resisted before action?

These are conceptually distinct. Two individuals with identical REL may arrive there through different internal routes: - Person A: immediate urge, immediate action (short REL via rapid cascade) - Person B: slow-building urge, immediate action upon emergence (short REL via delayed activation) - Person C: immediate urge, prolonged resistance before action (long REL via inhibition)

REL intentionally does not decompose these sub-processes. This is a deliberate methodological choice, not an oversight. The construct is defined at the *behavioral* level — the observable interval between candidate activation marker and interpersonal regulatory action. Internal micro-process decomposition (urge onset timing, inhibition duration) would require additional measurement modalities (e.g., continuous self-report of urge intensity, physiological correlates of inhibitory effort) and represents a future research direction rather than a current operational requirement.

This parallels other behavioral timing constructs: reaction time compresses perception, decision, and motor execution into one number. The compression is acknowledged, and the construct remains useful despite it.

3. Distinction From Adjacent Constructs

3.1 REL vs. Distress Tolerance

Distress tolerance (Simons & Gaher, 2005) describes the capacity to endure negative emotional states. It is typically measured as a trait through self-report (e.g., “I can’t handle feeling distressed or upset”) or behavioral persistence tasks (e.g., PASAT-C).

Dimension	Distress Tolerance	REL
Level	Trait	State/process
Measurement	Self-report / persistence	Temporal latency
Focus	Capacity to endure	Timing of specific behavior
Behavioral specificity	General tolerance	Specific to regulatory externalization
Temporal resolution	Low (trait-level)	High (event-level)

Prediction: REL will show variance independent of distress tolerance. Individuals with equivalent distress tolerance may differ in REL because tolerance describes *how much* can be endured, while REL describes *how quickly* a specific behavioral response initiates.

3.2 REL vs. Negative Urgency

Negative urgency (UPPS-P; Whiteside & Lynam, 2001; Cyders et al., 2007) describes the tendency to act rashly under negative affect. It is the closest existing construct to REL.

Dimension	Negative Urgency	REL
Level	Trait	State/process
Behavioral scope	Any rash action (drinking, spending, aggression)	Specifically regulatory externalization
Mechanism	Impulse control failure	Regulatory strategy activation
Function of behavior	Often maladaptive/non-functional	Regulatory (seeking stabilization)
Temporal measurement	Not directly temporal	Explicitly temporal

Critical distinction: Negative urgency captures *any* impulsive action under distress. REL captures specifically *regulatory* externalization — behavior whose function is obtaining external stabilization. A person who impulsively drinks under stress (urgency) is not necessarily externalizing regulation — they may be numbing, escaping, or self-medicating. A person who immediately texts their partner for reassurance (REL) is specifically seeking external regulatory input to stabilize an internal state.

The functional test: Does the behavior seek *input from another person* for the purpose of *internal state regulation*? If yes → REL-relevant. If the behavior is self-contained (drinking, spending, aggression without interpersonal regulatory target) → urgency but not REL.

Prediction: REL will correlate with negative urgency but demonstrate independent variance, particularly in relational/attachment contexts where regulatory externalization is the primary behavioral response. Individuals with equivalent urgency scores may show different REL profiles because urgency does not distinguish between regulatory and non-regulatory impulsive actions.

3.3 REL vs. Attachment Anxiety

Attachment anxiety (ECR; Brennan et al., 1998) describes chronic fear of abandonment and preoccupation with relationship security. It predicts reassurance-seeking and relational monitoring.

Dimension	Attachment Anxiety	REL
Level	Trait	State/process
Focus	Content of concern (abandonment)	Timing of behavioral response
Measurement	Self-report	Behavioral latency
Specificity	Attachment relationships	Any regulatory externalization context

Prediction: Attachment anxiety will predict shorter REL in attachment-relevant contexts but not necessarily in non-attachment contexts (e.g., performance evaluation). Attachment theory already implies hyperactivation speed as a feature of anxious attachment, but does not directly operationalize externalization latency as a measurable temporal variable. REL proposes to make this implicit temporal dimension explicit and measurable — not to claim that timing is unrecognized in attachment research, but that it is not yet directly operationalized as a standalone variable.

3.4 REL vs. Reassurance-Seeking

Excessive reassurance-seeking (ERS; Joiner et al., 1999) describes the frequency and persistence of seeking reassurance from others despite having already received it.

Dimension	ERS	REL
Measurement unit	Frequency / persistence	Latency (time)
Focus	How often / how persistently	How quickly
Temporal resolution	Aggregated across episodes	Within-episode

Prediction: ERS and REL will correlate but are not redundant. An individual may seek reassurance infrequently (low ERS) but very rapidly when they do (short REL). Conversely, an individual may seek reassurance frequently (high ERS) but with variable latency.

3.5 REL vs. Differentiation of Self

Differentiation of self (DSI; Skowron & Friedlander, 1998) describes the capacity to maintain self-definition while remaining emotionally connected in relational systems.

Dimension	Differentiation	REL
Level	Trait/architecture	State/process
Focus	Structural capacity	Temporal dynamics
Measurement	Self-report	Behavioral latency

Prediction: Lower differentiation will predict shorter REL, but REL will capture temporal variance not explained by differentiation scores alone.

3.6 Summary of Discriminant Positioning

REL occupies a specific niche: **temporal, state-level, behaviorally specific, regulatory in function**. No existing construct combines all four features.

4. Proposed Measurement Paradigms

4.1 Paradigm 1: Delayed Response Task

Context: Relational ambiguity under communication delay.

Procedure: 1. Participant sends an emotionally meaningful message to a confederate (or believes they are communicating with a real partner in a modified design) 2. Response is delayed by a predetermined interval (manipulated: 5min, 15min, 30min, 60min) 3. During the delay, participant has access to their phone/device 4. Behavioral measures are recorded continuously

REL operationalization: Time from message delivery confirmation to first interpersonally directed regulatory behavior (sending follow-up message, contacting another person for reassurance, verbal expression of distress to experimenter).

Note: Passive checking behavior (e.g., looking at phone to see if a reply arrived) is classified as *recipient-oriented monitoring* rather than interpersonal externalization, because it is not directed *toward* another person. Checking becomes REL-relevant only when it transitions into directed communication (sending a message, making a call). However, checking frequency may serve as a useful secondary measure indexing activation intensity and proximity to externalization threshold.

Note on experimenter-directed behavior: Verbal expressions of distress to the experimenter (e.g., “This is stressful”) are classified as REL-relevant only when they function as regulatory bids (seeking reassurance or validation) rather than protocol-related communication (asking procedural questions). Paradigm instructions should minimize ambiguity by providing clear channels for procedural questions separate from open-ended interaction opportunities.

Controls: Baseline phone-checking rate, trait attachment anxiety, distress tolerance, urgency.

Advantages: High ecological validity, continuous measurement, clear activation onset (message sent + no response).

4.2 Paradigm 2: Ambiguous Evaluative Feedback

Context: Identity/performance ambiguity.

Procedure: 1. Participant completes a task (e.g., creative writing, problem-solving) 2. Receives ambiguous feedback: “Interesting approach. We’ll need to review this further.” 3. Participant is given a waiting period with access to communication (can email evaluator, ask experimenter, text a friend) 4. Behavioral measures recorded

REL operationalization: Time from feedback delivery to first regulatory externalization. Critical coding distinction:

- **Regulatory** (REL-relevant): “Was this bad?” / “Do you think I did okay?” / texting friend “I’m worried about my evaluation” — function is affect regulation

- **Instrumental** (not REL-relevant): “What specific criterion was unmet?” / “When will the full review be available?” — function is information acquisition

Ambiguous cases (e.g., “Can you tell me more about what you thought?”) are coded based on contextual indicators: tone, preceding affect state, whether the information would resolve uncertainty or merely provide reassurance. Double-coding with inter-rater reliability is recommended for this paradigm.

Controls: Self-esteem, narcissism, performance anxiety, need for closure.

Advantages: Activates identity tension specifically, applicable beyond attachment contexts.

4.3 Paradigm 3: Ecological Momentary Assessment (EMA)

Context: Naturalistic daily measurement with self-report timing.

Procedure: 1. Participants receive 5–7 daily prompts over 14 days 2. Each prompt assesses: (a) current activation level, (b) whether unresolved relational/emotional tension exists, (c) what regulatory behavior has occurred since last prompt, (d) estimated time between tension onset and first external regulatory action 3. End-of-day diary captures major regulatory episodes with timing estimates

REL operationalization: Self-reported latency between activation awareness and first externally directed regulatory behavior, aggregated across episodes.

Controls: Trait measures (attachment, distress tolerance, urgency, differentiation) collected at baseline.

Advantages: Ecological validity, repeated measurement enabling within-person analysis, captures natural variation across contexts.

Limitations: Relies on retrospective timing estimates, subject to recall bias. EMA is best used as a secondary/convergent measure alongside behavioral paradigms rather than as the primary REL operationalization.

5. Predictions

5.1 Incremental Validity

REL will predict meaningful outcomes beyond existing constructs:

H1: REL will predict relationship conflict escalation speed beyond attachment anxiety and distress tolerance.

H2: REL will predict reassurance-seeking behavior in ambiguous situations beyond negative urgency.

H3: REL will show context-specificity: shorter in attachment-relevant contexts for individuals with high attachment anxiety, shorter in evaluative contexts for individuals with high narcissistic vulnerability.

H4: REL will demonstrate within-person variability across contexts, consistent with state-level rather than pure trait-level measurement.

H5: REL will predict performance-relevant outcomes beyond relational contexts. Specifically, shorter REL following ambiguous performance feedback will predict higher frequency of supervisor contact, lower autonomous problem-solving, and greater dependence on external validation in occupational settings — beyond what attachment anxiety or urgency predict.

5.2 The Nonlinearity Hypothesis

REL is not proposed as a simple “longer is better” construct. The framework predicts a nonlinear (potentially U-shaped) relationship between REL and adaptive functioning:

REL range	Interpretation	Associated pattern
Very short	Impulsive regulatory discharge — activation cannot be held	Compulsive externalization, conflict escalation
Mid-range	Adaptive flexibility — activation held long enough for internal processing, externalization initiated when appropriate	Healthy co-regulation, proportionate response
Very long	Potential pathological suppression — activation held but not processed, externalization inhibited rather than unnecessary	Avoidance, emotional shutdown, delayed collapse

This nonlinearity means that REL alone is insufficient for clinical interpretation. REL must be interpreted alongside indicators of internal processing quality (is the activation being processed or merely suppressed?) and behavioral outcome (does eventual externalization produce regulation or escalation?).

The U-shaped hypothesis generates a specific prediction: both very short and very long REL will predict poorer relational outcomes than mid-range REL, but through different mechanisms (impulsive discharge vs. suppressive avoidance).

5.3 Moderators

REL is predicted to vary with: - **Activation intensity**: Higher activation → shorter REL (nonlinear relationship expected) - **Context type**: Attachment ambiguity, evaluative threat, and control loss may produce different REL profiles within individuals - **Nervous system state**: Physiological arousal (HRV, cortisol) may predict REL but is not equivalent to it - **Relational security**: Secure relational context → longer REL (less urgency to externalize)

5.4 Distinguishing REL From Suppression

A critical measurement challenge: long REL may reflect either (a) genuine internal regulatory capacity or (b) defensive suppression/inhibition. These must be distinguished through: - Concurrent physiological measurement (suppression typically shows sustained arousal despite behavioral inhibition) - Self-report suppression measures (e.g., ERQ suppression subscale) - Subsequent behavioral indicators (suppression often produces delayed but intensified externalization)

6. Neurophysiological Considerations

The Ne (error-related negativity) — reflecting trait defensive reactivity within 50–150ms of error commission (Weinberg et al., 2012; Mück et al., 2023) — represents a potential neurophysiological correlate of the internal processes that precede behavioral externalization. The Ne does not measure REL directly (REL is

defined behaviorally) but may index the speed of internal threat detection that functions as an antecedent to externalization.

This connection is noted briefly rather than developed extensively, because REL's primary contribution is behavioral operationalization. Neurophysiological integration represents a future research direction (see Section 9).

7. Theoretical Context

REL was originally proposed within the Structural Regulation Framework (Halmetoja, 2026), a broader dimensional model of psychological regulation. Within that framework, REL operates as a dynamic process variable reflecting the interaction between internal regulation capacity, structural flexibility, and situational activation.

However, REL can be investigated independently of the broader framework. The construct requires only the following minimal assumptions: 1. Unresolved emotional activation creates regulatory demand 2. Regulatory behavior can be directed internally or externally 3. The temporal interval between activation and externalization is measurable and psychologically meaningful 4. This interval varies across individuals and contexts

These assumptions are consistent with multiple theoretical traditions and do not require commitment to any specific framework.

8. Limitations

8.1 Construct Validity

REL has not been empirically validated. All claims in this paper are theoretical proposals requiring testing.

8.2 Overlap Risk

The greatest threat to REL's incremental validity is potential redundancy with negative urgency. If REL proves to be a context-specific manifestation of urgency rather than a distinct construct, its independent contribution weakens substantially.

8.3 Measurement Challenges

- Defining the precise onset of “unresolved activation” is difficult in naturalistic settings
- Distinguishing regulatory externalization from instrumental communication requires clear operational criteria
- Self-reported timing estimates (EMA) are subject to recall bias
- Laboratory paradigms may lack ecological validity

8.4 Suppression Confound

Long REL is ambiguous without additional measures. It may reflect genuine internal processing capacity or defensive suppression. This confound must be addressed in any empirical investigation.

8.5 Cultural Variation

Externalization norms vary across cultures. What constitutes “regulatory externalization” versus normative relational communication may differ across cultural contexts. REL measurement must account for baseline communication norms.

8.6 Terminological Note

The term “externalization” in REL refers to the direction of regulatory behavior (from internal to interpersonal). This usage differs from “externalizing” in the psychopathology literature (externalizing disorders: conduct problems, substance use, aggression). The overlap is terminological, not conceptual — REL describes regulatory outreach, not antisocial behavior. This distinction should be made explicit in any empirical report to prevent confusion.

9. Future Directions

9.1 Priority: Discriminant Validity Study

The most important first empirical step is demonstrating that REL captures variance independent of distress tolerance, negative urgency, and attachment anxiety. A study combining the Delayed Response Task with trait measures of these constructs would provide initial evidence.

9.2 Within-Person Variability

EMA studies examining REL variability across contexts within individuals would establish whether REL operates at the state level as proposed.

9.3 Predictive Validity

Longitudinal studies examining whether REL predicts relationship outcomes, conflict patterns, or therapeutic change beyond existing measures.

9.4 Smartphone Behavioral Telemetry

Passive logging of communication metadata (timestamps, not content) offers a promising future measurement approach. Potential indicators include double-text latency, reply-check frequency, and reassurance escalation latency. This approach provides objective behavioral data without recall bias and enables large within-person event samples.

However, telemetry faces substantial challenges: metadata alone cannot reliably distinguish regulatory from instrumental communication, ethical requirements (consent, privacy, relationship spillover) are demanding, and functional coding remains inferential. Telemetry is best developed as a convergent measurement approach after core paradigms (Delayed Response Task, Ambiguous Feedback) have established construct validity.

9.5 Physiological-Behavioral Integration

Combining continuous physiological monitoring (HRV, EDA) with behavioral onset detection could provide objective activation markers — replacing reliance on stimulus-defined onset points. Physiological activation

onset (algorithmically detected) paired with behavioral externalization timestamps would yield a physiologically anchored REL measure.

Challenges include: physiological markers are imperfect proxies for subjective activation (movement, caffeine, posture confounds), individual differences in reactivity complicate cross-person comparison, and activation detection algorithms require validation. This approach is best pursued after behavioral REL measurement is established.

9.6 Beyond Latency: Regulation Externalization Dynamics

REL as defined in this paper captures one parameter of a potentially richer dynamic system. Future theoretical development may extend toward a broader model of Regulation Externalization Dynamics incorporating:

- **Threshold:** How much activation is required before externalization initiates? (Individual differences in activation threshold)
- **Slope:** How rapidly does the urge to externalize rise once activation begins? (Rate of urgency accumulation)
- **Discharge mode:** What specific behavioral form does externalization take? (Vector/channel selection)
- **Recovery:** How quickly does the system return to baseline after externalization? (Regulatory efficiency)

The thermostat analogy is instructive: a complete characterization requires not just response delay (REL) but also threshold, hysteresis, and response magnitude. REL is proposed as the most tractable entry point for empirical investigation — a single measurable parameter that can anchor future expansion into a fuller dynamics model.

This expansion is noted as a future direction, not a current claim.

10. Conclusion

Regulation Externalization Latency (REL) is proposed as a dynamic process variable measuring the temporal interval between unresolved emotional activation and initiation of external regulatory behavior. It occupies a specific niche — temporal, state-level, behaviorally specific, regulatory in function — not fully captured by existing constructs.

The construct's value depends entirely on empirical demonstration of incremental validity beyond distress tolerance, negative urgency, attachment anxiety, and reassurance-seeking frequency. If REL proves redundant with these constructs, it adds nothing. If it captures independent variance in externalization timing that predicts meaningful outcomes, it offers a new measurement target for emotion regulation research.

This paper provides the conceptual foundation for that empirical investigation.

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