The Structural-Constructivist Architecture of the Core Emotion Framework: A Comprehensive Technical and Empirical Analysis of Affective Mechanics

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- https://huggingface.co/datasets/CoreEmotionFramework/CEF_Main_Archive/tree/main
- https://www.optimizeyourcapabilities.com/Publications/
- https://scholar.google.com/citations?user=ORdecUoAAAAJ
- https://philpeople.org/profiles/jamel-bulgaria
- https://zenodo.org/communities/030303/
- https://osf.io/hz53j/

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- https://osf.io/ac4x2/overview
- **Pilot study:**
- https://osf.io/fydsq/wiki?wiki=j7q8g

Abstract

The evolution of affective science has been marked by a persistent tension between discrete models of universal biological categories and constructivist theories emphasizing the emergent nature of psychological states. The Core Emotion Framework (CEF), primarily developed by Jamel Bulgaria, represents a structural-constructivist resolution to this historical crisis by defining emotional life as a set of ten functional operators organized within a tripartite hub system.[1] This framework moves beyond descriptive taxonomies to offer a mechanistic "Human Operating System" (Human OS) capable of processing information, regulating relational aperture, and structuring

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*) *We welcome feedback on the preregistration and study design, and invite researchers who are interested in pre-reviewing the system to contact us.*

action.[1] By treating emotions as internal transformations rather than mere narratives or fixed biological programs, the CEF provides a computationally tractable model that bridges the gap between human experience and synthetic emotion architecture.[1]

The foundational architecture of the CEF is organized as a 3×3+1 system, consisting of three primary functional centers: the Head (Cognitive-Representational), the Heart (Affective-Regulatory), and the Gut (Somatic-Inferential), with the tenth operator, Accepting, serving as the essential system baseline.[1] This structure is supported by an extensive archive of technical specifications, practitioner manuals, and empirical datasets hosted across platforms such as Zenodo, OSF, and Hugging Face.[3] Central to the framework's validity is its commitment to open science, utilizing preliminary empirical constraints—such as the short-term test-retest reproducibility patterns identified by Amano et al. (2026)—as boundary conditions for future measurement and validation.[1]

The Theoretical Foundation of Structural Constructivism

The Core Emotion Framework posits that the historical divide in affective science—between the discrete models of scholars like Paul Ekman and the constructivist perspectives of researchers like Lisa Feldman Barrett—can be resolved through a functional ontology.[1] Basic Emotions Theory has long argued for a set of universal, biologically hard-wired categories such as fear, anger, and joy, characterized by distinct facial expressions and physiological markers.[5] Conversely, Constructed Emotion Theory suggests that these categories are cultural and linguistic labels applied to fluid states of core affect and sensory input.[1]

The CEF resolves this dichotomy by reframing emotions as "operators"—functional units that perform specific psychological work.[1] These operators act as the "CPU instructions" of the psyche, determining how information enters the system, how it is processed against internal goals, and how the individual commits to action.[1] This approach acknowledges the biological underpinnings of affective states while providing the modular flexibility required for cultural and individual variation. The framework is not presented as an established taxonomy but as a falsifiable working hypothesis intended to guide systematic research into the mechanics of the human experience.[1]

The importance of a multi-dimensional representation of emotion is underscored by external scholarly research. Fontaine et al. (2007) demonstrated that the traditional two-dimensional models focusing exclusively on valence and arousal are insufficient to capture the full complexity of emotional meaning across different languages and cultures.[6] Their analysis identified four essential dimensions—evaluation-pleasantness, potency-control, activation-arousal, and unpredictability—which accounted for over 75% of the variance in the meaning of emotion words.[6] The CEF maps these empirical findings onto its tripartite architecture, suggesting that these dimensions emerge from the underlying functional roles of its ten operators.[6]

The Decalogue of Operators: Functional Definitions and Mechanistic Roles

The CEF identifies exactly ten core emotional operators, each performing a unique role within the internal architecture. No other operators exist within this system, providing a closed-loop model of emotional dynamics.[2]

The Head Center: The Representational Processor

The Head center is the domain of navigation and logic. It does not "feel" the world in a somatic sense but maps it, processing raw data into actionable clarity.[1]

Operator	Functional Role	Strategic Objective	Canonical Position
Sensing	Raw intake of environmental and internal data.	Attunement and detection of change.	Head Right (CW Cycle)
Calculating	Rational integration and pattern	Objective analysis and predictive	Upper Right (CW

	recognition.	clarity.	Cycle)
Deciding	Transition from internal data to commitment.	Aligned action and self-trust.	Head Center

The Sensing operator is defined as the first operator within the CEF architecture. It serves as a foundational motion that cultivates present-moment awareness, both internally and relationally.[2] This operator is crucial for survival, allowing for the detection of potential threats and the identification of resources.[2] Beyond simple perception, Sensing involves the process of detecting and responding to changes in the environment, which guides action and shapes experience. Challenges associated with Sensing include sensory overload, where excessive stimuli lead to stress and difficulty focusing, and sensory impairment or misinterpretation, such as optical illusions.[2]

Calculating is the second operator, positioned immediately after Sensing in the clockwise cycle of the Head center.[2] Its role is to support the rational integration of emotional information, serving as a bridge between raw sensory input and refined understanding.[2] Calculating enables cognitive empathy—understanding others' perspectives through rational analysis—and pattern recognition. It emphasizes "unemotional mathematical thinking" as a critical skill for making objective decisions in professional fields such as finance, engineering, and healthcare.[2] By detaching from subjective fears or biases, Calculating helps maintain a balanced perspective and reduces emotional strain in high-stakes environments.[2]

Deciding is the third operator and acts as the center "hinge" of the Head hub. It arises from the synthesis of Sensing and Calculating, converting internal clarity into purposeful motion.[2] In the CEF, Deciding represents emotional commitment and the "felt sense of readiness" that guides choice.[2] It serves as the transition point between "knowing" (analysis) and "doing" (action). Effective operation of Deciding fosters self-trust and agency. The framework outlines a structured approach to decision-making that merges intuition (Sensing) with data (Calculating) to ensure choices are aligned with core values

and minimize regret.[2]

The Heart Center: The Affective-Regulatory Engine

The Heart center provides the magnitude and direction of an individual's drive. It regulates the relational aperture—the degree to which one is open or closed to the external world.[1]

Operator	Functional Role	Strategic Objective	Canonical Position
Expanding	Openness, curiosity, and inclusivity.	Imaginative stretch and emotional range.	Heart Right (CW Cycle)
Constricting	Refinement and structured boundaries.	Clarity, precision, and skilled articulation.	Heart Left (CCW Cycle)
Achieving	Energy management and sustained engagement.	Adaptability and "performing-juggling."	Heart Center

Expanding is the fourth operator, promoting qualities of openness and receptivity to new ideas.[2] It supports emotional inclusivity, allowing individuals to hold multiple possibilities or truths simultaneously. Engaging with the Expanding operator fosters mental flexibility, creativity, and resilience. Relitionally, it is linked to the capacity for empathy, which is essential for building deep connections and mutual respect.[2] This

operator is vital for addressing complex global challenges, as it encourages collaboration and the leveraging of diverse perspectives.[2]

The fifth operator, Constricting (also referred to as "precising"), involves the refining of emotional expression through structured boundaries.[2] Unlike suppression, Constricting is viewed as skilled articulation—an emotional narrowing that creates clarity and precision. It plays a regulating role in communication and interpersonal coherence. The cornerstone of this operator is exactness, which is critical in fields like aerospace engineering, medicine, and academic writing.[2] Meticulous attention to detail through Constricting ensures safety, efficiency, and trust. Challenges include the discipline required to maintain rigorous standards, while the rewards include enhanced performance and higher satisfaction.[2]

Achieving is the sixth operator, situated in the heart center and characterized by a "swinging" motion.[2] It reflects the emotional agility and adaptability required to meet the layered roles and shifting demands of dynamic environments. The CEF explicitly links this operator to "performing-juggling," citing physical juggling as a manifestation of mastering multitasking and cognitive shifting. Research indicates that learning to juggle increases gray matter in brain areas responsible for coordination and motor skills, enhancing problem-solving and spatial awareness.[2] Achieving facilitates energy management and sustained engagement, helping individuals stay "emotionally upright" in complex situations.[2]

The Gut Center: The Somatic-Inferential Foundation

The Gut center acts as the visceral anchor. it handles the weight and order of existence, ensuring the system is grounded and energized.[1]

Operator	**Functional Role**	**Strategic Objective**	**Canonical Position**
Arranging	Systems-thinking and structural coherence.	Stability, foresight, and relational fluidity.	Gut Right (CW Cycle)

Appreciating	Recognition, celebration, and gratitude.	Reciprocity, connection, and joy.	Gut Left (CCW Cycle)
Boosting	Intentional energizing of the system.	Vitality, morale, and resilience.	Gut Center

Arranging is the seventh operator, bringing form and foresight to emotional dynamics as a continuation of Achieving.[2] It enables "emotional systems-thinking," supporting the mapping of roles and flows within a relationship or organization. Cultivating this motion stabilizes emotional environments and promotes relational fluidity. Arranging is vital for leadership and coordination, as it involves the strategic alignment of structure and goals, the efficient allocation of resources, and the guidance of organizational culture toward innovation.[2]

The eighth operator, Appreciating, represents celebration and recognition.[2] It is an emotional motion that nourishes reciprocity and elevates the relational field. The framework breaks this practice into three arts: Appreciating (recognizing quality), Thanking (expressing gratitude), and Enjoying (taking pleasure in the moment). Regularly engaging the Appreciating operator boosts mood, enhances overall life satisfaction, and strengthens social bonds.[2] Somatically, it is associated with the gut-left region of the architecture and is linked to reduced symptoms of depression and increased emotional resilience.[2]

Boosting is the ninth operator, involving the intentional energizing of the emotional system to amplify motivation and morale.[2] Within the CEF, Boosting supports emotional amplification without causing destabilization—a "non-destabilizing amplification." It serves as a renewable source of connective power and contributes to overall vitality. The framework links Boosting to physical practices such as grounding (earthing) and core strengthening, which provide the stability and performance base needed for

emotional elevation.[2]

The Accepting Baseline: The Prerequisites of Flow

Operator	Functional Role	Strategic Objective	Canonical Position
Accepting	Surrender, integration, and peace.	Receptive presence and restoration.	Gut Bottom (Baseline)

The tenth operator, Accepting, is the culmination of the emotional circuit and the prerequisite for all other operators.[2] It represents a state of surrender and integration, restoration of the human system to a state of receptive presence. Accepting is defined as the recognition and embracing of the present moment without judgment or resistance.[2] The CEF clarifies that Acceptance is neither resignation (it does not imply powerlessness) nor endorsement (it does not mean agreeing with a situation).[2] Integrating this operator reduces the mental strain of resisting reality, thereby lowering stress and anxiety while improving emotional intelligence and interpersonal compassion.[2]

The Tripartite Hub System and the Human Operating System

The Core Emotion Framework's 3×3+1 hub system organizes these ten operators into a modular "Operating System" for the psyche.[1] This architecture allows for a multi-level explanation of emotional life, bridging representational, affective-regulatory, and somatic-inferential processes.[1]

The "3x3" component of the system refers to the nine active operators distributed across the three primary centers, while the "+1" refers to the Accepting Baseline that

acts as the grounding element for the entire structure.[1] This organization is not merely a metaphor but is designed to be computationally tractable, utilizing JSON-LD knowledge graphs and 10-dimensional activation vectors to bridge affective computing with human psychology.[1]

The interaction between these hubs determines the system's "relational aperture" and "action-opinion divergence".[1] When the operators are functioning correctly, they act as CPU instructions that determine what information enters the system and how it predicts future states. However, failures in the transitions between these centers lead to the predictable computational events characterized as psychopathology.[1]

Technical Specifications and Formal Architecture

The CEF is formally defined through its Technical Specifications (TS-series), which outline the system's functional analysis and architectural rules.[3]

Functional Centers and Operator Space

The framework is structured around three functional centers (Head, Heart, Gut) and ten regulatory processes (operators) distributed among them.[2] An operator is defined by the mapping $O : C \times P \longrightarrow R$, where each operator maps a center-process pair to a scalar activation value. These values do not encode narrative meaning but generate state transitions by modulating the system's activation levels.[2]

Operator Algebra and Composition

Operators can be binary (active/inactive) or scalar (continuous levels). The Deciding operator is uniquely defined as a constant-activation operator; its engagement is binary and determines the level of ambiguity the system is willing to carry.[2] Operators can compose in three primary forms:

- **Sequential Composition:** $O_a \circ O_b$, where one operator follows another in a defined cycle.
- **Parallel Composition:** $O_a \parallel O_b$, where operators act simultaneously.
- **Conditional Composition:** $O_a \rightarrow O_b$, where the activation of one depends on the state of another.[2]

Activation Matrices and Directionality

The architecture utilizes specific matrices to define the influence within the system:

- **Center Activation Matrix (A_C):** A 3×3 matrix defining the mutual influence of the functional centers.
- **Process Activation Matrix (A_P):** A 10×10 matrix defining the influence among the ten processes.
- **Operator Activation Matrix (A_O):** A 30×30 matrix defining influence among the thirty possible operator combinations.[2]

Inter-center flow is fully bidirectional, ensuring that no single center holds a privileged or hierarchical relationship over another. This bidirectionality is essential for maintaining emotional flexibility and preventing the rigid patterns that characterize mental illness.[2]

Structural Psychopathology and Dysregulation Mechanics

Within the CEF, psychopathology is understood as the failure of the operator system to maintain structural integrity and canonical flow. The framework identifies several specific mechanisms of dysregulation.[1]

Fusion and Chronic Fusion

Fusion is a temporary cross-center modulation where the activation of one process alters another without changing their home centers. While transient fusion can be a part of complex emotional experiences, chronic fusion—a persistent, involuntary co-activation—leads to rigid, maladaptive states.[2] For example, "compliance fusion" is a hallmark of the GoodPerson Anxiety Pattern (GPAP), where an individual's agency is suppressed in favor of maintaining social harmony.[1]

Overflow and Drift

Overflow occurs when process activation exceeds the capacity of its home center, driving unintended activation in another center.[2] This often manifests as emotional signals "bleeding" into cognitive processes, leading to distorted calculations. "Solipsistic

drift" is another condition explored within the INTIMA research program, describing a state where internal emotional signals become decoupled from external relational grounding, creating a self-referential emotional loop.[8]

Clinical Pattern Analysis

The CEF treats conditions like anxiety and OCD as "predictable computational events".[1] Cognitive looping in OCD is analyzed as an over-activation of the Calculating operator that fails to transition lawfully to the Deciding operator. The system remains stuck in a pattern of rational integration and variable checking, unable to reach the commitment point necessary for action.[1] Similarly, conditions like Borderline Personality Disorder (BPD) and Narcissistic Personality Disorder (NPD) are analyzed through the lens of specific operator distortions and center imbalances.[3]

Practitioner Protocols and Structural Disassembly

The CEF Practitioner Manuals (PM-series) provide procedural guidance for restoring structural integrity and emotional agility.[2]

The 7-Step Detangling Protocol

This protocol is a central tool for separating fused emotional states and restoring canonical structure.[1] It follows a disciplined sequence:

1. **Identification:** Detecting the specific operators and centers involved in the fusion.
2. **Isolation:** Separating the operators and evaluating their individual activation levels.
3. **Differentiation:** Using functional cues (such as "raw intake intensity" for Sensing) to clarify the boundaries between fused processes.[2]
4. **De-Fusion:** Actively breaking the co-activation link.
5. **Rebalancing:** Adjusting scalar activation values to restore canonical balance.
6. **Stabilization:** Reinforcing center boundaries to prevent immediate re-fusion.
7. **Reintegration:** Re-establishing the lawful pathways for emotional transition.[2]

Emotional Transition and Mobility (PM-6)

Practitioner Manual 6 focuses on restoring the agility of the system by teaching "lawful

emotional transitions".[2] This manual identifies common distortions such as "Skipped Transitions" (where a user moves from Sensing directly to Deciding without Calculating) and "Cross-Center Drift." The Transition Mastery Protocol involves a five-step sequence: stabilizing the current operator, identifying the successor, preparing the modulation pathway, activating the successor, and re-establishing modulation reciprocity.[2]

Empirical Intersection: Analyzing Fontaine et al. (2007)

The paper "The World of Emotions Is Not Two-Dimensional" by Fontaine et al. (2007) provides crucial data that supports the multi-operator architecture of the CEF, despite being an external study.[6] The study's use of 144 features across six components of emotion—appraisals, bodily changes, facial/vocal expressions, action tendencies, feelings, and regulation—aligns with the CEF's "Facet Architecture" (TS-11), which decomposes operators into irreducible subcomponents.[2]

Correlation of Dimensions and Operators

The four dimensions identified by Fontaine et al. map directly onto the functional centers and operator dynamics of the CEF.[6]

Fontaine Dimension	**Variance**	**CEF Hub Alignment**	**Key Supporting Features from Table 1**
Evaluation-Pleasantness	35.3%	Gut (Appreciating/Accepting)	Felt negative (.886), In itself unpleasant (.911), Smiled (-.916).
Potency-Control	22.8%	Head (Deciding) / Heart (Achieving)	Felt powerless (.619), Lacked motivation

			(.740), Felt dominant (-.822).
Activation-Arousal	11.4%	Heart (Expanding) / Gut (Boosting)	Heartbeat faster (.927), Breathing faster (.893), Felt calm (-.529).
Unpredictability	6.0%	Head (Sensing/Calculating)	Jaw drop (.798), Unpredictable event (.680), Eyebrows go up (.723).

The Evaluation-Pleasantness dimension is primarily defined by internal operators relating to valence, aligning with the Gut's role in recognizing value (Appreciating) and grounding (Accepting).[6] Potency-Control is the primary dimension for agency and control, corresponding to the Head's Deciding hinge and the Heart's Achieving agility.[6] Activation-Arousal focuses on physiological readiness for agency, which the CEF categorizes under Expanding and Boosting.[2] Finally, Unpredictability relates to the processing of information and novelty, the direct domain of the Sensing and Calculating operators in the Head center.[2]

The Role of Facets and Components

Fontaine's study confirms that a two-dimensional model misses "major sources of variation," particularly the Potency-Control and Unpredictability dimensions.[6] The CEF's Facet Architecture (TS-11) defines facets as center-bound and identity-preserving subcomponents that form the foundation for clinical modeling.[2] Many of the 144 features in the Fontaine study act as these facets. For instance, the appraisal "Incongruent with own standards" (.926) functions as a specific facet of the internal

evaluation process, while "Jaw drop" (.798) is a motor expression facet associated with the Sensing operator's response to novelty.[6]

Empirical Validation and the Open Science Roadmap

The Core Emotion Framework is designed to be a "falsifiable working hypothesis," and its empirical status remains open for community-driven validation.[1]

Preliminary Constraints and Reproducibility

The framework uses the short-term test-retest reproducibility patterns reported by Amano et al. (2026) in healthy Japanese adults as boundary conditions for future measurement.[1] By mapping these state-specific and trait-like stability metrics onto the 3×3+1 hub architecture, the CEF establishes an empirical baseline for its Open Validation Program.[1] This integration is critical for ensuring that the framework moves beyond theoretical modeling toward reproducible scientific evidence.

Action-Opinion Divergence (N=39)

An exploratory pilot study (N = 39) provided behavioral data suggesting that individuals can distinguish between their "reflexive" responses (culturally or habit-driven opinions) and their "idealized" or actual functional outputs (actions).[1] This "Action-Opinion Divergence" is used as a tool for operator validation and practitioner calibration, ensuring the framework measures actual functional movements rather than just subjective narratives.[1]

The INTIMA Benchmark and EmotionSprout

The CEF archive includes specialized datasets such as EmotionSprout and the INTIMA benchmark, hosted on Hugging Face.[1] These datasets provide the resources needed for computational emotion modeling and AI system training. The INTIMA program focuses on the "INTIMA benchmark" for AI systems requiring structured emotional semantics, helping developers build introspective or emotionally-aware systems that follow the CEF's canonical definitions.[4]

Synthetic Affect and AI Engineering

One of the most innovative applications of the CEF is in the field of Artificial Intelligence. By defining emotions as modular CPU instructions, the framework provides a bridge between human affective science and machine-based synthetic emotion.[1]

EI for AI: Teaching Emotion to Machines

The CEF aims to provide a structured interpretation of emotional states for AI engineering, using JSON-LD knowledge graphs to make emotional processes machine-readable.[1] This allows AI to model emotional "meta-stability" and "modulation elasticity," ensuring that synthetic emotional systems maintain structural integrity over time.[2]

Emotional Cycling Machines (ECM)

The framework's archive contains blueprints for Emotional Cycling Machines (ECM versions 1.0 through 4.0), which are technical applications of the theory.[3] These machines simulate emotional states through 10-dimensional activation vectors, allowing for the simulation of psychological flourishing or the modeling of specific dysregulation patterns for research purposes.[1]

Conclusion: The Structural-Constructivist Future

The Core Emotion Framework offers a comprehensive, mechanistic account of the human affective system that addresses the limitations of previous low-dimensional models. By organizing emotional life into a 3×3+1 architecture of functional operators, the CEF provides a precise language for both basic science and clinical practice. The integration of external data from Fontaine et al. (2007) and the use of reproducibility benchmarks from Amano et al. (2026) demonstrate the framework's empirical grounding and its potential to resolve the ongoing crisis in affective science.

As an open-science project, the CEF continues to evolve through its modular datasets, practitioner manuals, and technical specifications. Whether used to detangle chronic psychological fusions in a clinical setting or to provide a structural foundation for the next generation of emotionally intelligent AI, the framework represents a significant advancement in our understanding of the human operating system. Its future success depends on the continued, community-driven effort to test its predictions, refine its operators, and validate its structural-constructivist architecture across diverse cultures

and applications.

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