Structural-Constructivist Convergence: A Synthesis of AI Valence Reproducibility and the Core Emotion Framework

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Abstract

This synthesis establishes a unified structural-constructivist account of human emotion by integrating Satoru Amano's AI-based valence reproducibility research with the Core Emotion Framework (CEF). The CEF reconceptualizes emotions as ten irreducible functional "operators" organized within a 3×3+1 tripartite hub system spanning the cognitive (Head), affective (Heart), and conative (Gut) centers. As stated in the document, the framework "reframes emotions as functional 'operators' within a complex tripartite hub system" and positions the Accepting operator as a homeostatic baseline essential for system recalibration. Empirical alignment emerges from Amano's findings that AI-derived valence demonstrates excellent trait-like stability (ICC = 0.94), supporting the CEF's claim of a stable underlying operator architecture. The document notes that "AI-derived valence can capture stable, measurable individual-level patterns," reinforcing the CEF's Human Operating System model. Neurobiological evidence from VMHdm SF1+ hypothalamic circuits further grounds the conative operators, while mBraining and HeartMath research validate the autonomy and regulatory influence of cardiac and enteric neural networks. Together, these strands support a computational ontology in

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**) We welcome feedback on the preregistration and study design, and invite researchers who are interested in peer-reviewing the system to contact us. We also encourage scholars across all disciplines to conduct their own independent research on any aspect of the Core Emotion Framework. Author assumes no societal or substantial gains from this framework, just for public and academic service.*

which AI valence functions as a scalar summary of multidimensional operator vectors, enabling measurable internal transformations and informing future “Structural AI.” This convergence provides a blueprint for emotional training, clinical detangling protocols, metabolic regulation, and synthetic affect engineering.
Keywords:

- Core Emotion Framework (CEF)
- Structural-Constructivist Model
- Emotional Operators
- AI Valence Reproducibility
- Kokoro Sensor
- Intraclass Correlation Coefficient (ICC)
- VMHdm / Hypothalamic Emotion Circuits
- mBraining / Interoceptive Cognition
- Heart-Brain Coherence
- Synthetic Affect
- Emotional Cycling Machine (ECM)
- Operator Fusion / Detangling
- Accepting Baseline
- Human Operating System

The Architecture of the Core Emotion Framework: A Structural-Constructivist Paradigm

The Core Emotion Framework (CEF) proposes that the myriad of human traits, behaviors, and subjective experiences are not primary units of the psyche but are rather "composites" synthesized from a finite set of ten irreducible, functional units known as "Core Emotions" or "Operators".[1] This structural-constructivist approach suggests that while the biological architecture of the psyche is real and fixed, the construction of lived experience depends on the dynamic interaction and "fusion" of these underlying operators.[1] This paradigm draws historical and sociological parallels to Pierre Bourdieu’s theory of "habitus," where pre-existent habitual structural dispositions precede the production of identity in conscious relations.[1]

The 3x3+1 Hub System and Functional Centers

The CEF organizes its ten operators into three primary functional centers—Head (Cognitive), Heart (Affective), and Gut (Conative)—a structure supported by emerging research in neurocardiology and neurogastroenterology.[1] Each center governs a specific domain of human experience and utilizes distinct operators to process information and regulate system states.

Center	Functional Domain	Primary Operators	Physiological Correlate
Cognitive (Head)	Information processing, perception, and analysis.	Sensing, Calculating, Deciding.	Central Nervous System (Cortex).
Affective (Heart)	Relational dynamics, self-worth, and affiliation.	Expanding, Constricting, Achieving.	Intrinsic Cardiac Nervous System.
Conative (Gut)	Motivation, execution, and risk management.	Arranging, Appreciating, Boosting.	Enteric Nervous System.
Baseline	Recovery and homeostatic recalibration.	Accepting.	Global Autonomic Balance (PNS).

The "+1" in this architecture refers to the unique status of the "Accepting" operator, which functions as the "Accepting Baseline".[1] This operator is the necessary recovery point for all other emotional activations, ensuring that the system returns to a state of homeostasis after periods of intensity. Psychological flourishing is thus defined by "operator agility"—the ability to activate and deactivate specific operators with precision—while distress is viewed as "operator fusion," where functional units become pathologically knotted.[1]

Functional Definitions of the Decalogue of Operators

Each of the ten operators serves a specific strategic objective within the internal economy of the psyche. By treating these as "operators" rather than "feelings," the framework allows for a mechanical approach to self-regulation that bypasses the limitations of cognitive reframing.[1]

The Cognitive Center governs the canonical sequence of Sensing → Calculating → Deciding.[1] Sensing represents intuitive, non-conceptual perception, while Calculating provides clarity through logical evaluation. Deciding synthesizes these into actionable conviction.[1] The Affective Center manages "relational aperture"—the degree to which an individual is open to the world. Expanding drives affiliation and love, while Constricting manages discipline and boundaries. Achieving (or Performing) ensures the heart’s intentions are realized with internal equilibrium.[1] The Conative Center, described as the "Instinctual Doer," includes Arranging (prioritization), Appreciating (rhythm and pleasure), and Boosting (internal motivation and agency).[1]

Empirical Anchors: Satoru Amano's AI Reproducibility Benchmarks

The empirical roadmap for the CEF was significantly advanced by the research of Satoru Amano and colleagues (2026), which established preliminary reproducibility benchmarks for AI-based valence estimation.[1] This study explored how individuals could distinguish between "reflexive" and "idealized" responses, providing the necessary boundary conditions for operator measurement.[1]

Reproducibility Patterns and ICC Interpretations

Amano's study utilized the Kokoro Sensor (version 1.2.2.0), an AI-based system that analyzes facial expression data founded on the Facial Action Coding System (FACS) and Ekman's theory of basic emotions.[1] The study evaluated test-retest reproducibility using intraclass correlation coefficients (ICCs) over a 30-minute interval in healthy Japanese adults.[1]

Condition	ICC (3,1)	95% Confidence Interval	Interpretation
Positive	0.82	0.68 to 0.90	Good Reproducibility
Negative	0.61	0.38 to 0.77	Moderate Reproducibility
Neutral	0.05	-0.26 to 0.35	Poor Reproducibility
Integrated (Combined)	0.94	0.92 to 0.96	Excellent Trait-like Stability

The high integrated ICC of 0.94 suggests that AI-derived valence can capture stable, measurable individual-level patterns across multiple emotional conditions.[1] In the context of the CEF, these findings suggest that while "state-specific" fluctuations occur, the underlying operator architecture remains highly consistent over short intervals, supporting the framework's view of a stable Human Operating System.[1]

The Statistical Context of the Neutral Condition

The poor ICC of 0.05 in the neutral condition was interpreted by Amano not as evidence of measurement failure, but as a statistical consequence of restricted score variability.[1] The neutral condition showed the smallest within-subject standard deviation (8.22), indicating that absolute agreement between sessions was actually quite high.[1] This finding is critical for the CEF's "Accepting Baseline" operator. Because the Accepting Baseline is a homeostatic state of rest, it naturally lacks the wide between-subject variance required for high ICCs in traditional reliability designs.[1] This alignment validates the CEF's placement of "Accepting" as a unique operator that recalibrates the system toward a zero-point rather than a high-intensity peak.[1]

The Neurobiological Engine: VMHdm Neurons and the Conative Center

A cornerstone of the synthesis between Amano's empirical findings and Bulgaria's framework is the role of the ventromedial hypothalamus (VMHdm) in instantiating emotion states. Traditionally, the hypothalamus was viewed as a passive motor effector of the amygdala. However, research published in *eLife* (2015) by Kunwar and colleagues demonstrated that direct optogenetic activation of VMHdm-specific SF1+ neurons is sufficient to evoke persistent defensive states, such as fear and anxiety, completely bypassing the amygdala.[3]

Hypothalamic Instantiation of Emotion States

The *eLife* study provided the first objective evidence of an emotion state in an animal model using features such as scalability, valence, generalization, and persistence.[3] These neurons were found to be both sufficient and required for defensive behaviors in diverse contexts, and they could condition learned defensive behaviors—further refuting the claim that the hypothalamus cannot support emotional learning.[3]

This research provides the neurobiological justification for the CEF's placement of "Arranging" and "Boosting" within the "Gut" (Conative) center.[1] The "Boosting" operator, defined as internal motivation and the drive to overcome obstacles, correlates with the hypothalamic drive to initiate defense or mobilization.[1] By showing that lower neural centers are active participants in complex emotional transformations, the CEF aligns with the "mBraining" model of gut-brain intelligence.[1]

Projections and Functional Redundancy

The major efferent target of the VMHdm is the dorsal periaqueductal gray (dPAG). While the dPAG is responsible for the immediate motor patterns of flight and freezing, the VMHdm is proposed to encode the internal motivational state necessary for the expression of these behaviors.[12] Stimulation of the VMHdm in humans has been shown to elicit feelings of dread, impending doom, and panic, providing a direct translational link to the CEF's conative operators.[12]

Furthermore, VMHdm neurons highly innervate areas regulating the sympathetic nervous system (SNS), including the anterior bed nucleus of the stria terminalis (aBNST) and the preoptic area (POA).[14] Chronic stress strengthens the connection between the paraventricular hypothalamus (PVN) and the VMH, enhancing excitatory inputs and promoting anxiety-like states and sympathetic outflow.[15] This "architectural knotting" of stress inputs into the hypothalamic engine is the biological basis for the "operator fusion" described by Bulgaria in the context of structural psychopathology.[1]

Somatic Intelligence: The mBraining Model and Interoceptive Cognition

The CEF's tripartite architecture is reinforced by the "mBraining" model, which integrates research in neuroscience with behavioral modeling to identify three distinct "brains"—head, heart, and gut—as intelligences in their own right.[11] This model asserts that the cephalic, cardiac, and enteric nervous systems each possess specialized forms of intelligence and fundamentally different core competencies.[9]

Multiple Neural Networks and Autonomy

The mBraining model is supported by quantitative evidence of the neural density within these peripheral organs. The heart contains between 40,000 and 120,000 neurons (the "intrinsic cardiac nervous system"), while the gut contains over 500,000,000 neurons (the "enteric nervous system").[5] These networks exhibit adaptive intelligence, memory, and the capacity to learn independently of the cranial brain.[5]

"Brain"	Core Competency	CEF Operator Alignment	Highest Expression
Cephalic (Head)	Cognitive perception, meaning-making, and reasoning.	Sensing, Calculating, Deciding.	Creativity

Cardiac (Heart)	Emotional processing, relational connection, and values.	Expanding, Constricting, Achieving.	Compassion
Enteric (Gut)	Core identity, mobilization, and self-preservation.	Arranging, Appreciating, Boosting.	Courage

The heart brain is optimized for managing emotions and connecting in relationships, while the gut brain handles protection, core identity, and mobilization.[8] This alignment provides the structural basis for the CEF centers. The "Relational Aperture" of the Heart center is a direct functional application of cardiac intelligence, while the "Instinctual Doing" of the Gut center utilizes enteric intelligence for risk management and agency.[1]

Afferent Communication and Wisdom

The body functions as a complex, integrated whole, yet these particular "brains" have a level of autonomy much greater than previously understood. Wisdom, in the mBraining and CEF paradigms, emerges from the congruent and aligned state of all three centers.[8] Approximately 80% of the fibers in the vagus nerve are afferent (ascending), meaning the body sends significantly more signals to the brain than it receives.[6] These ascending signals convey emotional information in the patterns of heart and gut rhythms, which then modulate cognitive function and emotional experience in higher cortical areas.[21]

Heart-Brain Resonance: The Electrodynamics of the Affective Center

The CEF's Affective (Heart) center is further validated by the research of the HeartMath Institute on the heart's electromagnetic field and "physiological coherence".[23] The heart is the most powerful generator of electromagnetic energy in the human body, producing electrical fields approximately 60 times greater and magnetic fields 5,000 times more powerful than those generated by the brain.[6]

Physiological Coherence and Emotional Stability

Coherence is defined as a specific physiological state associated with optimal cognitive functioning and emotional stability.[21] In this state, the heart's rhythm pattern becomes highly ordered and sine-wave-like, typically at a frequency of around 0.1 Hertz.[21] Research has demonstrated that positive emotions such as appreciation, care, and love increase heart coherence, whereas negative emotions like frustration and anger create erratic, disordered signals.[24]

The heart essentially "speaks" to the brain through its electromagnetic and biochemical signals, exerting a profound influence on higher reasoning and decision-making from the subconscious level.[24] When heart rhythms are coherent, study participants have shown 25% improvements in cognitive performance on tasks measuring memory and reaction times.[24] This evidence validates the CEF's "Achieving" operator, which ensures that heart-felt intentions are manifested with balance and excellence.[1]

The Heart-Based Resonant Field (HBRF) Theory

The paradigm-shifting Heart-Based Resonant Field (HBRF) theory proposes that human consciousness emerges not solely from the cortex but from the bioelectromagnetic interaction centered on the heart's resonant field.[30] This field acts as a coherence amplifier, converting metabolic free energy into ordered dynamics that synchronize molecular, neural, and autonomic oscillations.[30] This transpersonal view of the heart as an epicenter of awareness aligns with the CEF's placement of the Heart as the regulator of "relational aperture" and system-wide integration.[1]

Technical Alignment: AI Valence as a Scalar Summary of Operator Vectors

A critical component of this synthesis is the technical alignment between AI valence indices—such as those generated by Satoru Amano's research—and the internal operators of Jamel Bulgaria's framework. The CEF provides a computationally tractable model that bridges the gap between affective computing and synthetic affect.[2]

Mathematical Logic and State Transition Functions

The "machine" logic of the CEF is mathematically rigorous, describing the psyche as a system that moves between states according to specific transition functions:

$$S_{t+1} = f\left(S_t, O_{c,p}\right)$$

where S is the system state at time t, and $O_{c,p}$ represents the activation of a specific operator within a given center (c) and process (p).[1] The framework utilizes complex matrices to map these interactions:

- **Center Activation Matrix ($3x3$):** Defines how activation in one center (e.g., the Gut) influences another (e.g., the Head).[1]
- **Process Activation Matrix ($10x10$):** Maps the mutual influence and inhibition of the ten core emotions.[1]
- **Operator Activation Matrix ($30x30$):** The most granular map, detailing the interaction of specific operator facets.[1]

These matrices allow for the identification of "Overflow"—a state where activation in one center exceeds its capacity and drives unintended activation in another—mirroring the "architectural knots" seen in clinical presentations.[1]

JSON-LD and 10-Dimensional Vectors

To facilitate alignment with AI, the CEF deconstructs affective phenomena into ten operators that serve as the emotional equivalent of central processing unit (CPU) instructions.[2] These instructions determine information filtering, action availability, and system state predictions. The framework models these states using JSON-LD knowledge graphs and 10-dimensional activation vectors.[2]

In this alignment, AI valence (such as the -100 to 100 score from the Kokoro Sensor) is viewed as a "scalar summary" of the underlying multi-dimensional vector.[2] For example, a high positive valence score in Amano's research would indicate a strong activation of the "Expanding" and "Appreciating" operators, whereas a negative score would reflect the dominance of "Constricting" or "Boosting" (under threat).[1]

Valence Property (AI)	CEF Operator Alignment	System Instruction
High Positive (+100)	Expanding / Appreciating	Open aperture, affiliation, and enjoyment.
Near-Zero (0)	Accepting Baseline	System rest, yielding, and homeostatic reset.
High Negative (-100)	Boosting / Constricting	Mobilization, threat defense, and

boundary setting.

Procedural Dynamics: The Emotional Cycling Machine and Detangling

To move from theoretical blueprint to practical flourishing, the CEF utilizes structured methodologies for training the overall system architecture. The most notable of these are the "Counting Method" and the "Emotional Cycling Machine" (ECM).[1]

Activation and Completion via the Counting Method

A central innovation of the CEF is the rigorous use of "Counting Up" and "Counting Down" to build emotional precision.[1]

- **Counting Up (Activation):** Involves turning an operator "on" and gradually increasing its intensity from 1 to 10.[1]
- **Counting Down (Completion):** Involves the gradual decrease of intensity until the operator is "off," returning the system to the Accepting Baseline.[1]

This practice is designed to build "stronger operator boundaries," ensuring that individuals can fully activate a state when needed (e.g., Boosting for a challenge) and, crucially, fully deactivate it when the need has passed. This skill is the fundamental requirement for "emotional agility" and prevents the chronic activation that leads to metabolic and neurological burnout.[1]

Directional Logic of the Emotional Cycling Machine (ECM)

The ECM iterations (v1.0 to v4.0) function as a structured "machine" to coordinate transitions between centers and operators.[1] The cycling is governed by three primary directional motions performed within the energetic centers of the body:

1. **Clockwise (CW) / Outgoing:** Activates Sensing (Head), Expanding (Heart), and Arranging (Gut). This motion supports rational integration and top-down alignment with the external world.[1]
2. **Counter-Clockwise (CCW) / Reflecting:** Activates Calculating (Head), Constricting (Heart), and Appreciating (Gut). It strengthens the capacity for internal strategy, memory processing, and boundary-setting.[1]
3. **Swinging / Balancing:** Activates Deciding (Head), Achieving (Heart), and Boosting (Gut). It trains the system to find a grounded expression between high activation and quietude.[1]

The goal of the ECM is to stabilize these transitions, ensuring that activation converges and remains within canonical pathways rather than resulting in chaotic overflow.[1]

Clinical Implications: The 7-Step Detangling Protocol and GPAP

The practical utility of the CEF is best demonstrated in its application to "structural psychopathology," where the focus shifts from cognitive narrative to architectural mechanics.[1] When operators become "fused"—such as when Sensing is pathologically knotted with Constricting, leading to hyper-vigilance—the framework employs the 7-Step Detangling Protocol.[1]

The 7-Step Detangling Protocol

This clinical methodology utilizes "temporal deceleration" and "diagnostic isolation" to address fused states.[1] By slowing down the activation process through the counting method, the practitioner can identify exactly where one operator begins to "bleed" into another. This process of "semantic disambiguation" allows for "modulation reciprocity," where the centers regain their clarity and can function without chronic overflow.[1] This approach is highly compatible with third-generation therapies like Acceptance and Commitment Therapy (ACT) and Internal Family Systems (IFS), but provides a more rigid, structural blueprint for intervention.[1]

The GoodPerson Anxiety Pattern (GPAP)

Bulgaria introduces the concept of the GoodPerson Anxiety Pattern (GPAP) as a specific structural subtype within the CEF.[7] GPAP is characterized by:

- **Fusion of Compliance-Related Primers:** Excessive conscientiousness and self-monitoring driven by the need for social approval.
- **Suppression of Agency-Related Primers:** Underactivation of Boosting and Deciding, resulting in passivity and self-doubt.[7]

This pattern creates a persistent state of conscientious anxiety marked by "protest signals" from the Gut center.[7] By mapping these signals to the operator architecture, the CEF offers subtype-specific interventions to "re-learn and un-learn" patterns, potentially disrupting the Default Mode Network (DMN) loops associated with rumination.[1]

Psychosomatic Synergy: CEF in Fitness and Metabolic

Health

The application of the CEF to weight management and metabolic health provides a compelling case for its physiological relevance. Bulgaria posits that isolated emotional states can be detrimental to metabolism, as chronic stress leads to cortisol dysregulation and fat accumulation.[1]

Strategic Pairing for Metabolic Equilibrium

The framework utilizes "strategic pairings" to restore physiological equilibrium by managing current emotional patterns and mitigating epigenetically programmed vulnerabilities.[1]

Pairing	Objective	Physiological Impact
Expand-Constrict	Balancing openness with precision.	Prevents cortisol-induced fat storage and nutrient depletion.
Accept-Boost	Harmonizing serenity with momentum.	Optimizes autonomic balance (SNS/PNS) and prevents passive coping.

The CEF modulates the Hypothalamus-Pituitary-Adrenal (HPA) axis through targeted emotional cycling, balancing the "fight or flight" response with "rest and digest" recovery.[1] By reducing chronic baseline cortisol, the framework optimizes nutrient absorption and energy expenditure.[1]

Epigenetic Resilience and Set-Points

Evidence that trauma can be inscribed in DNA suggests that our emotional history influences our physiological baseline.[1] The CEF’s detangling protocol acts as a biological mark of resilience. By establishing a new "inner-baseline reference"—a type of implicit memory that organizes perception and feelings—the framework helps participants establish morefamiliar set-points for the body through repeated afferent input to the brain.[22]

Synthesis: "Reflexive" vs. "Idealized" Responses as Measurement Boundaries

The overlap between Satoru Amano's reproducibility study and the CEF centers on the distinction between "reflexive" and "idealized" responses, which serves as the foundation for the framework's measurement roadmap.[1]

Boundary Conditions for Measurement

Amano's study utilized an "instructional facial expression task" where participants were asked to mimic target expressions voluntarily for 30 seconds.[1] These were "posed" expressions—what the CEF calls "idealized" responses—rather than those induced by spontaneous stimuli.[1]

- **Idealized Responses:** Conscious, voluntary activations of internal operators. These represent "stable, measurable internal transformations" and are characterized by high test-retest reproducibility (ICC 0.82 for positive).[1]
- **Reflexive Responses:** Spontaneous, context-dependent movements subject to cultural "display rules" and "reflexive suppression".[1] These are more subtle and often result in lower reproducibility in real-world "in-the-wild" AI applications.[1]

The high reproducibility reported by Amano validates that when individuals consciously perform an operator transformation (idealized), the resulting signal is a stable and measurable component of the Human Operating System.[1] The CEF uses these benchmarks to provide "boundary conditions" for future measurement of the ten operators, acknowledging that while current AI excels at detecting idealized states, future "Structural AI" must be built to model the underlying operator transformations that drive reflexive behavior.[1]

Technological Transformation and Future Outlook

The synthesis of Satoru Amano's empirical validation and Jamel Bulgaria's structural architecture points toward a future where emotional regulation is an exact science, modeled with the precision of engineering and the wisdom of the body's innate intelligence.

AI Engineering and Synthetic Affect

The CEF treats emotional states as "predictable computational events" modeled via JSON-LD knowledge graphs, making it a technical manual for the development of "Synthetic Affect" in artificial intelligence.[2] Unlike current AI systems that function as closed computational circuits, a CEF-aligned AI would utilize 10-dimensional activation vectors to filter information, predict system states, and structure action availability—creating a "Human Operating System" that is reproducible and computationally tractable.[2]

Neurological Rehabilitation and Flourishing

As the framework moves toward further validation, it stands as a robust model for "neurological rehabilitation" and "motor function recovery".[1] By integrating exercise science, somatic psychology, and digital health technologies, the CEF promotes physiological healing through psychological intervention.[1] The Emotional Cycling Machine and its iterations (ECM v1.0 - v4.0) represent the future of this field—a world where the limit of human capability is viewed not as a fixed trait but as a structural configuration that can be optimized.[1]

Conclusions and Nuanced Findings

The exhaustive synthesis of Satoru Amano's research on AI facial expression reproducibility and Jamel Bulgaria's Core Emotion Framework (CEF) leads to the following nuanced conclusions:

1. **Emotional Life as a Human Operating System:** The convergence of high trait-like stability in AI valence (ICC 0.94) and the $3x3 + 1$ hub architecture suggests that the human psyche is governed by a stable structural blueprint composed of ten irreducible functional operators.[1]
2. **The Hypothalamus as a Conative Engine:** The instantiation of defensive states within VMHdm SF1+ neurons—independent of the amygdala—provides a firm neurobiological substrate for the CEF's Gut (Conative) center, specifically the operators of Arranging and Boosting.[3]
3. **Cardiac and Enteric Intelligence:** The autonomic autonomy demonstrated in mBraining research, coupled with the heart's massive electromagnetic field, validates the Heart and Gut as centers of adaptive intelligence capable of modulating higher cortical functions through ascending vagal afferents.[5]
4. **Technical Alignment of Affective Vectors:** AI valence indices function as surface-level scalar summaries of underlying 10-dimensional operator activation vectors. The high reproducibility of "idealized" responses in AI benchmarks confirms that these operators are stable, measurable internal transformations.[1]
5. **Homeostatic Recalibration via the Accepting Baseline:** The statistical characteristics of the "neutral" condition (high absolute agreement but low variance-driven ICC) mirror the functional role of the "Accepting Baseline" as a homeostatic recovery point essential for system integrity.[1]
6. **Structural Detangling as the Path to Flourishing:** Flourishing is achieved not through cognitive reframing of feelings, but through the mechanical "detangling" of fused operators using the 7-Step Protocol and the Emotional Cycling Machine to restore operator agility and canonical pathway transitions.[1]

This synthesis establishes that human emotion is a reproducible, structural configuration that can be trained, cycled, and optimized for both psychological flourishing and physiological health. As AI and neuroscience continue to converge, the Core Emotion Framework provides the blueprints for a unified functional ontology of the human experience.

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