CEF Triggering & Cycling Machine (CTCM)

Technical Design Document

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Additional Keywords: emotional regulation device, somatic alignment tool, emotional training equipment, mechanical emotional interface, spring-loaded rotation system, height-adjustable wheel arms, balancing operator activation, outgoing reflecting balancing modes, ergonomic emotional training, multisensory operator triggers, emotional skill development machine

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Engineering / Conceptual Disclaimer

This document describes experimental, conceptual, and engineering-level emotional-technology prototypes within the Core Emotion Framework (CEF).
The CEF Triggering & Cycling Machine (CTCM) is a mechanical and electronic calibration device intended for research, prototyping, and emotional-technology development. It is **not** a therapeutic tool, emotional-practice protocol, or clinical intervention.

All descriptions of emotional states, load, stability, or activation are **framework-specific conceptual constructs**, not clinical assessments or psychological measurements.
This document does **not** provide therapeutic guidance and should not be interpreted as mental-health instruction.

CTCM is an experimental platform for emotional calibration and operator-level measurement.

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1. Purpose

The CEF Triggering & Cycling Machine (CTCM) is a single integrated device designed to support the physical practice of the Core Emotion Framework. The machine enables users to:

- Cycle each emotional center (Head, Heart, Gut)
- Activate each of the ten Core Emotion operators

- Develop emotional flexibility
- Strengthen under-used operators
- Reduce emotional rigidity and fused patterns

The system is designed for **standing use**, ensuring full concentration, proper alignment, and consistent somatic orientation.

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2. System Overview

The CTCM consists of two coordinated subsystems:

1. **Center Cycling Wheels**
    - Three wheels corresponding to Head, Heart, and Gut
    - Each wheel is height-adjustable
    - Each wheel supports Clockwise, Counter-Clockwise, and Swinging movements
2. **Operator Trigger Panel**
    - Ten physical triggers
    - One for each Core Emotion operator
    - Arranged in three groups corresponding to the three centers

Together, these subsystems provide complete access to all CEF functions within a single machine.

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3. Emotional Centers and Operators

Head (Cognitive Center)

- **Outgoing:** Sensing
- **Reflecting:** Calculating
- **Balancing:** Deciding

Heart (Affective Center)

- **Outgoing:** Expanding
- **Reflecting:** Constricting
- **Balancing:** Achieving

Gut (Conative Center)

- **Outgoing:** Arranging
- **Reflecting:** Appreciating
- **Balancing:** Boosting–Accepting balance

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4. Center Cycling Wheels

4.1 Physical Configuration

- Three wheels mounted vertically:
    - **Head Wheel** (upper position)
    - **Heart Wheel** (middle position)
    - **Gut Wheel** (lower position)
- Each wheel is mounted on an **independent height-adjustable arm**
- The user stands in front of the machine and rotates the wheel with both hands
- Wheels are aligned with the user's Head, Heart, and Gut levels

4.2 Spring-Loaded Rotation System

Each wheel incorporates a torsion-spring shaft providing:

- **Controlled rotational resistance**
- **Smooth return toward neutral** when released
- **Stable side-to-side Swinging** with light spring-centering

This ensures all movements are intentional, stable, and physically grounded.

4.3 Cycling Movements

Each wheel supports three movement patterns:

- **Clockwise (CW):** Activates the Outgoing operator
- **Counter-Clockwise (CCW):** Activates the Reflecting operator
- **Swinging (Side-to-Side):** Activates the Balancing operator

The user selects the center by choosing the corresponding wheel.

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5. Operator Trigger Panel

The Operator Trigger Panel provides direct activation of all ten operators.
Triggers are grouped by center and positioned within arm's reach from the cycling wheels.

5.1 Head Operator Triggers

- **Sensing Trigger:**
  Light or sensor bar activated by hand movement
- **Calculating Trigger:**
  Logic dial or alignment slider

- **Deciding Trigger:**
  Commitment lever with two stable positions

5.2 Heart Operator Triggers

- **Expanding Trigger:**
  Outward-pushing handles
- **Constricting Trigger:**
  Precision squeeze bar
- **Achieving Trigger:**
  Lift or step-up bar for upward engagement

5.3 Gut Operator Triggers

- **Arranging Trigger:**
  Sorting slider or object-placement interface
- **Appreciating Trigger:**
  Rhythm pad for synchronized tapping
- **Boosting Trigger:**
  High-resistance pull rope
- **Accepting Trigger:**
  Press-and-release pad for full relaxation

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6. User Interaction Flow

1. **Stand centered in front of the machine**
2. **Adjust each wheel** to match personal Head, Heart, and Gut height
3. **Select a center** by engaging the corresponding wheel
4. **Perform cycling movements** (CW, CCW, Swinging)
5. **Use operator triggers** for direct activation when needed
6. **Alternate between wheels and triggers** depending on training goals

The machine supports both structured sequences and free exploration.

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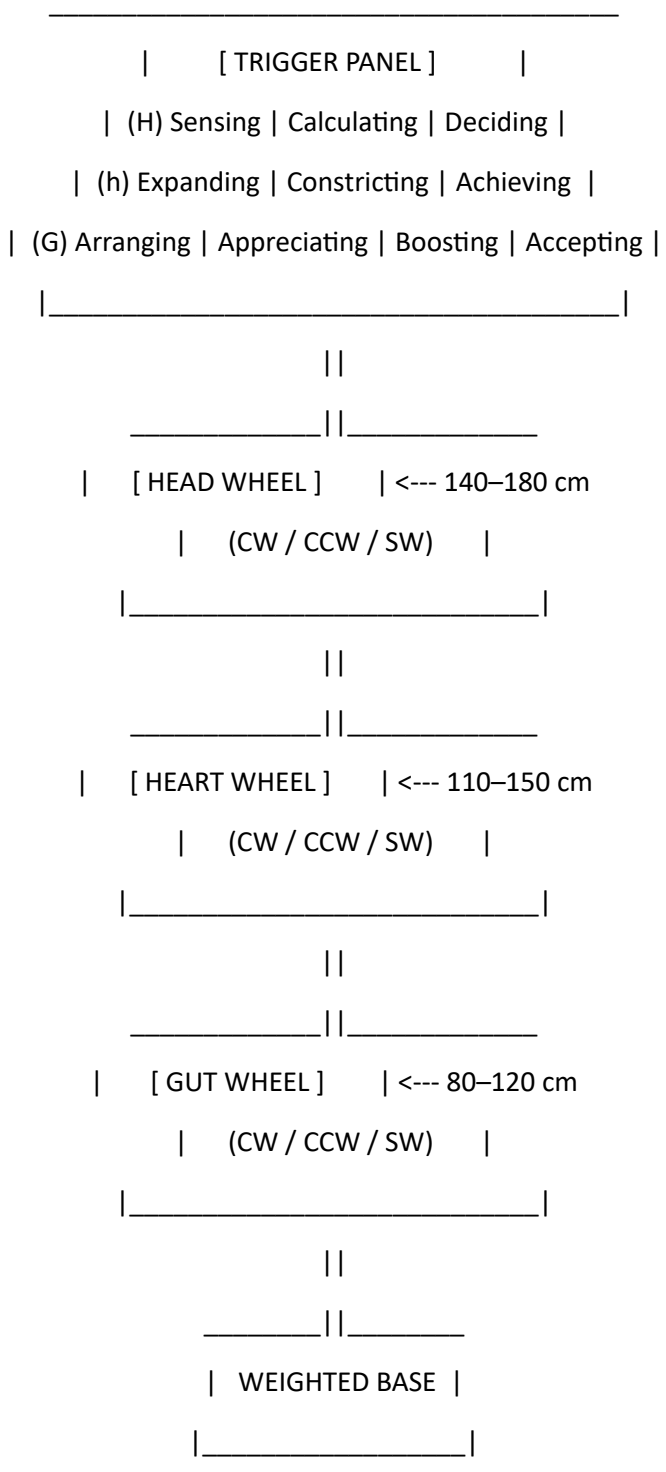
7. Design Principles

- **Embodied alignment:**
  Wheels positioned at the three centers reinforce somatic awareness.
- **Intentional movement:**
  Spring-loaded wheels ensure controlled, deliberate engagement.

- **Immediate accessibility:**
  All three centers and all ten operators are available without repositioning the machine.
- **User adaptability:**
  Height-adjustable arms accommodate a wide range of body types.
- **Single-unit simplicity:**
  All functions are integrated into one compact device.

Diagram 1: The mapped illustration of instrument



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8. Applications

The CTCM can be used for:

- Emotional flexibility training
- Operator-specific strengthening

- Breaking fused emotional patterns
- Personal development routines
- Guided therapeutic or coaching sessions

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9. Mechanical Architecture

The CTCM is built around a stable vertical frame supporting three independent cycling wheels and a centrally mounted operator trigger panel. The mechanical architecture is designed to ensure durability, stability, and consistent performance across repeated use.

9.1 Frame Structure

- **Material:** Powder-coated steel or reinforced aluminum
- **Configuration:** Vertical column with a wide, weighted base
- **Purpose:** Provides structural stability during wheel rotation and trigger activation
- **Features:**
    - Anti-tilt geometry
    - Vibration-dampening pads
    - Mounting points for wheel arms and trigger panel

9.2 Wheel Arm Assemblies

Each wheel is mounted on an independent height-adjustable arm.

- **Arm Material:** Aluminum extrusion or steel tubing
- **Adjustment Mechanism:**
    - Telescoping rail or sliding track
    - Locking clamp or detent pin
- **Range:**
    - Head Wheel: 140–180 cm
    - Heart Wheel: 110–150 cm
    - Gut Wheel: 80–120 cm
- **Design Requirements:**
    - Smooth vertical adjustment
    - Secure locking under rotational load
    - No lateral drift during use

9.3 Wheel Assembly

- **Outer Ring:** Textured polymer or rubberized composite
- **Core Hub:** Reinforced plastic or aluminum
- **Shaft:** Steel or carbon-steel rod
- **Bearings:** Low-friction sealed bearings
- **Spring System:**
    - Torsion spring mounted on the shaft
    - Adjustable preload for user preference
- **Tilt Axis:**
    - Secondary pivot allowing controlled side-to-side Swinging
    - Light centering spring for return stability

9.4 Trigger Panel Mounting

- **Panel Material:** High-impact polymer or aluminum plate
- **Mounting:**
    - Fixed to central frame
    - Positioned within ergonomic reach from all three wheels
- **Load Requirements:**
    - Must withstand repeated pulling, pressing, squeezing, and lifting
    - No deformation under typical user force

9.5 Base and Stability

- **Base Material:** Steel plate with rubberized feet
- **Dimensions:**
    - Width: 60–80 cm
    - Depth: 40–60 cm
- **Stability Requirements:**
    - Must remain stationary during high-resistance trigger use
    - Must not tip under uneven force
    - Optional floor-mounting points for clinical installations

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10. Control System Architecture

The CTCM incorporates a simple, robust control system to monitor wheel movements and trigger activations. The system is designed for reliability and minimal maintenance.

10.1 Sensors

Wheel Sensors

- **Rotation Sensors:**
    - Optical or magnetic encoders
    - Detect CW and CCW movement
- **Swing Sensors:**
    - Inertial measurement unit (IMU) or tilt sensor
    - Detect side-to-side balancing motion

Trigger Sensors

Each operator trigger includes one of the following:

- Contact switches
- Pressure sensors
- Optical break sensors
- Force-sensing resistors (FSR)
- Rotary encoders (for dials)

10.2 Control Board

- **Microcontroller:**
    - ARM-based or equivalent
    - Handles sensor input and feedback output
- **I/O Requirements:**
    - Minimum 20 digital/analog inputs
    - Support for encoder channels
    - Support for IMU or tilt sensor
- **Power Management:**
    - 12–24V DC input
    - Overcurrent protection
    - Optional battery backup

10.3 Feedback System

- **LED Indicators:**
    - Show active center and operator
    - Provide confirmation of trigger activation

- **Optional Haptic Feedback:**
    - Light vibration motors in wheel hubs
    - Reinforce operator activation
- **Optional Audio Feedback:**
    - Soft tones for mode confirmation
    - Adjustable volume

10.4 Software Logic

- **Movement Classification:**
    - CW → Outgoing
    - CCW → Reflecting
    - Swinging → Balancing
- **Trigger Mapping:**
    - Each trigger mapped to a specific operator
- **Safety Logic:**
    - Debounce filtering for sensors
    - Over-rotation detection
    - Trigger force thresholds

10.5 Data Logging (Optional)

- Session duration
- Wheel movement counts
- Trigger activation frequency
- Center usage distribution

This enables future research, coaching, or guided training applications.

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11. Safety and Ergonomics

The CTCM is designed to support safe, repeatable physical interaction while maintaining proper user posture and minimizing mechanical risk.

11.1 Ergonomic Requirements

- **Standing posture only** to ensure full concentration and proper alignment with the three centers.
- **Neutral wrist and shoulder angles** during wheel rotation to reduce strain.

- **Reach envelope** designed so all wheels and triggers are accessible without overextension.
- **Height-adjustable arms** accommodate a wide range of user heights (150–200 cm).
- **Grip texture** on wheels ensures secure handling without excessive force.

11.2 Mechanical Safety

- **Pinch-point avoidance:**
  All wheel arms, pivots, and trigger mechanisms must be enclosed or shielded.
- **Over-rotation protection:**
  Mechanical stops prevent excessive wheel rotation beyond safe limits.
- **Spring tension limits:**
  Torsion springs must not exceed force levels that could cause wrist or shoulder strain.
- **Trigger force thresholds:**
  All triggers must operate within safe, repeatable force ranges appropriate for daily use.

11.3 Stability and Structural Safety

- **Weighted base** prevents tipping during high-resistance trigger use.
- **Non-slip feet** ensure stability on smooth floors.
- **Optional floor-mounting points** for clinical or high-traffic environments.

11.4 User Safety Guidelines

- Do not use the machine while fatigued or distracted.
- Maintain proper posture and alignment with each wheel.
- Avoid rapid or forceful movements beyond intended operation.
- Inspect wheels and triggers regularly for wear or looseness.

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12. Preliminary Bill of Materials (BOM)

This preliminary BOM outlines the major components required for a functional prototype.
Exact materials and suppliers will be determined during detailed engineering.

12.1 Structural Components

- Powder-coated steel or aluminum frame
- Weighted steel base plate
- Rubberized non-slip feet
- Telescoping or sliding height-adjustable arms (aluminum extrusion)

12.2 Wheel Assemblies

- Three polymer or rubberized wheels

- Steel or carbon-steel shafts
- Sealed low-friction bearings
- Torsion springs (adjustable preload)
- Tilt-axis pivot components
- Spring-centering elements for Swinging motion

12.3 Trigger Panel Components

- High-impact polymer or aluminum panel
- Ten operator triggers:
    - Sensor bar (Sensing)
    - Rotary dial (Calculating)
    - Commitment lever (Deciding)
    - Outward handles (Expanding)
    - Precision squeeze bar (Constricting)
    - Lift/step bar (Achieving)
    - Sorting slider (Arranging)
    - Rhythm pad (Appreciating)
    - Pull rope with resistance module (Boosting)
    - Press-and-release pad (Accepting)

12.4 Electronics

- Microcontroller board
- Optical/magnetic encoders
- IMU or tilt sensors
- Pressure/force sensors
- LED indicators
- Wiring harness
- Power supply (12–24V DC)

12.5 Fasteners and Miscellaneous

- Bolts, screws, washers
- Cable routing clips
- Protective covers
- Panel mounts and brackets

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13. Maintenance and Durability Requirements

The CTCM must maintain consistent performance over extended use in personal, clinical, or training environments.

13.1 Routine Maintenance

- **Wheel inspection:**
  Check spring tension, bearing smoothness, and wheel grip texture monthly.
- **Trigger inspection:**
  Ensure all triggers return to neutral and operate within expected force ranges.
- **Frame inspection:**
  Verify arm locks, base stability, and structural integrity.
- **Electronics check:**
  Confirm sensor responsiveness and LED functionality.

13.2 Component Lifespan

- **Wheels and bearings:** 2–5 years depending on usage intensity
- **Springs:** 1–3 years before recalibration or replacement
- **Trigger mechanisms:** 3–5 years
- **Electronics:** 3–7 years

13.3 Wear-Point Reinforcement

- High-stress components (springs, bearings, pull rope) must be designed for easy replacement.
- Trigger surfaces should be abrasion-resistant.
- Wheel grips should maintain texture under repeated handling.

13.4 Cleaning and Hygiene

- All user-contact surfaces must be cleanable with mild disinfectants.
- Materials must resist degradation from alcohol-based cleaners.
- No exposed foam or porous materials.

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14. Future Development Path

The CTCM design supports multiple future enhancements to expand functionality and adapt to different environments.

14.1 Digital Integration

- App-based guidance for center cycling and operator activation

- Real-time feedback on movement quality
- Session tracking and progress visualization
- Adaptive difficulty based on user performance

14.2 Advanced Mechanical Features

- Adjustable wheel resistance
- Motor-assisted feedback for guided sequences
- Modular trigger attachments for operator-specific training

14.3 Clinical and Group Use

- Multi-user data profiles
- Therapist or coach control interface
- Group-training mode with synchronized cues

14.4 Research Extensions

- Integration with physiological sensors (optional)
- Data export for emotional-state research
- Controlled studies on emotional flexibility outcomes

14.5 Manufacturing and Deployment

- Scaled production models
- Portable or foldable variants
- Wall-mounted or gym-integrated versions

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15. Empirical Testing Requirement

The CEF Triggering & Cycling Machine (CTCM) is an engineering-level design that has not yet undergone empirical validation. All functional descriptions reflect intended operation rather than demonstrated outcomes. Before the device can be considered reliable for structured training, therapeutic use, or large-scale deployment, it must complete a comprehensive testing program.

15.1 Mechanical Validation

- Verification of wheel mechanics, spring tension, and return behavior
- Durability testing under repeated rotational and swinging loads
- Stability assessment of height-adjustable arms
- Reliability testing of all operator triggers under varied force inputs

15.2 Human-Factors Assessment

- Evaluation of user posture, reach, and ergonomic comfort

- Confirmation that wheel alignment supports consistent center targeting
- Assessment of cognitive clarity and ease of understanding during operation
- Identification of any strain, fatigue, or usability barriers

15.3 Functional Outcome Testing

- Measurement of user ability to activate Outgoing, Reflecting, and Balancing modes
- Assessment of operator-specific activation through the trigger panel
- Evaluation of transitions between centers and operators
- Analysis of user performance across repeated sessions

15.4 Safety and Compliance Review

- Mechanical safety under normal and high-intensity use
- Identification of pinch points, over-rotation risks, or mechanical hazards
- Compliance with relevant consumer-device or clinical-device standards
- Documentation of any contraindications or usage limitations

15.5 Longitudinal Evaluation

- Multi-session testing to determine learning curves
- Monitoring of user adaptation and retention of skills
- Assessment of long-term mechanical stability and component wear

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