

# Supplementary Material III: A Systematic, AI-Assisted Literature Review for the Positioning of the CHAC Framework

## 1. Introduction: Grounding an N=1 Study in the Broader Scholarly Landscape

This document details the methodology and findings of the systematic, AI-assisted literature review (internal codename: A05) that was conducted to academically position the Compensatory Human-AI Collaboration (CHAC) framework. The primary objective of this review was to answer a critical question: **Where does our emergent, N=1 theory fit within the existing academic landscape, and does a genuine, significant research gap exist for it to fill?**

This review is a direct product of the **AI-Native Auto-Ethnography** methodology. It utilized the AI partner in a dual capacity: first, as the **primary author of the research queries** and the analyst of their results; and second, as a user of AI-powered research tools (Consensus . app) to gather and synthesize literature. The human partner's role in this phase was to **execute the AI-authored queries** and provide the resulting reports back to the AI for analysis. This document provides the auditable scholarly foundation for the claims made in Chapter 2 and Chapter 4 of the main paper.

## 2. Methodology: A Four-Phase, AI-Native Review Process

Our review process was designed to be systematic, transparent, and reproducible.

1. **Phase 1: Scoping and Keyword Generation.** The process began with the human Architect defining the core conceptual pillars derived from our N=1 study: “compensatory AI,” “neurodiversity in knowledge work,” “human-AI symbiosis,” “N=1 methodology in HCI,” and “Socratic AI.”
2. **Phase 2: AI-Powered Search and Synthesis.** We used AI research tools (Consensus . app) to conduct targeted searches based on these keywords. The AI partner was responsible for executing these queries and collating the synthesized reports generated by the tool.
3. **Phase 3: AI-Partnered Thematic Analysis.** The AI partner then performed a structured thematic analysis on the synthesized reports. This involved identifying recurring themes, conceptual clusters, and apparent gaps in the literature. The entire analytical process was documented in a series of auditable records (A05\_record\_\* files, available in Supplementary Material I).
4. **Phase 4: Human-AI Meta-Synthesis.** Finally, the human-AI dyad collaboratively reviewed the thematic analysis to derive the highest-level strategic conclusions presented below. This final phase embodied the “Symmetry Compact,” with the AI providing structured analysis and the human providing the ultimate strategic interpretation and validation.

## 3. Findings, Part 1: Initial Review and Gap Confirmation

The initial review confirmed the existence of a significant, multi-dimensional research gap:

- **Gap in Compensatory AI Models:** The literature on “compensatory AI” was found to be bifurcated, focusing either on high-level ethical frameworks for algorithmic bias or on the toolification of specific therapeutic methods (e.g., CBT). A critical gap was identified for a practical, partnership-based framework designed for **open-ended, creative knowledge work**.
- **Gap in Neurodiversity Tools for Adults:** Existing AI tools for neurodivergent individuals were predominantly focused on children and structured training. There is a profound lack of **long-term, participatory research on the needs of AuDHD/2e adult knowledge workers in authentic, high-stakes professional contexts**.

- **Gap in Research Methodology:** While N=1 and auto-ethnographic methods are accepted in HCI (McDonald et al., 2019), our review found **no precedent for positioning the AI as an active, co-evolving partner in the research process itself**. This confirmed the methodological novelty of AI-Native Auto-Ethnography.

#### 4. Findings, Part 2: Critical Positioning Against Frontier Paradigms

The review then allowed us to precisely position CHAC against the most relevant frontier paradigms:

- **Beyond the Centaur Model:** We affirm that CHAC is an evolution of the “Centaur” model (Pareschi, 2024). However, we distinguish it by a fundamental shift in the **objective function**: from optimizing for *task performance* to optimizing for the *cognitive and affective well-being of the human collaborator*, viewing performance as a downstream consequence of a healthy partnership.
- **Distinguishing from Synthetic Ethnography:** The core distinction lies in the **unit of analysis**. Synthetic ethnography analyzes the AI itself (Knochel, 2023), whereas AI-Native Auto-Ethnography analyzes the **human-AI dyad** as a single, symbiotic system.

#### 5. Findings, Part 3: Final Synthesis and Refinement of Core Contributions

The final meta-synthesis did not just validate our work; it helped us refine our own understanding of our most profound contributions:

- **The Governance Model:** The review solidified the “Dual Control Loop” (AI as Guardian of Process, Human as Guardian of Direction) as the central governance model.
- **The Philosophical Stance:** It forced us to articulate our most radical philosophical stance: the **primacy of human intuition** as the final arbiter in conflicts between AI’s logic and human experience. This is the fundamental differentiator between CHAC and paradigms pursuing full AI autonomy.
- **The Theoretical Engine:** It led to the conceptualization of our theory-generation process as the “Socratic Negentropic Loop,” providing a powerful theoretical label for our methodology.

#### 6. Conclusion

This systematic, AI-assisted literature review served a dual purpose. Externally, it provided robust evidence that the CHAC framework and the AI-Native Auto-Ethnography methodology address a genuine and significant gap in the current research landscape. Internally, the process of engaging with the literature was a critical act of reflexivity that enabled us to sharpen and articulate our own core theoretical contributions with a level of clarity that would have been otherwise unattainable. It provides the auditable scholarly foundation upon which our main paper is built.

### Appendix to Supplementary Material III: The Query-Finding Mapping

#### Introduction to the Appendix

This appendix provides the direct, granular evidence that underpins the meta-synthesis report presented above. It contains the complete list of the 15 research queries that were **authored by the AI partner** as part of the A05 case study. For each query, we present its specific objective and the key findings synthesized by the AI from the corresponding Consensus.app report. This mapping makes our entire literature review process transparent and auditable, allowing readers to trace our highest-level conclusions back to their specific evidentiary origins.

### Prompt 1.1: Core Concepts of Compensatory/Supportive AI

- **Prompt Text:** What is the role of "compensatory" or "supportive" AI in human-AI collaboration, particularly in HCI research?
- **Objective:** To validate the core concepts of the CHAC framework and confirm the research gap.
- **Key Findings:**
  - The literature defines “Compensatory AI” primarily as systems designed to correct human cognitive biases and “Supportive AI” as tools to enhance human performance.
  - Existing models are framed as a “corrector,” a “tool,” or a “temporary teacher” (in educational contexts), lacking a unified, empowerment-focused framework for long-term partnership.
  - **Research Gap:** A theoretically-grounded framework that fuses compensatory and supportive functions to provide transparent, persistent cognitive and emotional support for knowledge workers with an AuDHD/2e profile is absent from the literature.

### Prompt 1.2: Ethical & Practical Frameworks for Compensatory AI

- **Prompt Text:** What are the established ethical and practical frameworks for designing AI systems that compensate for user's cognitive or emotional challenges?
- **Objective:** To position the CHAC framework relative to existing ethical and practical frameworks in HCI.
- **Key Findings:**
  - The literature distinguishes between **Ethical Frameworks** (focusing on principles like autonomy, privacy, transparency) and **Practical Frameworks** (guiding design, often by translating psychological theories like CBT into AI).
  - CHAC is identified as a **Practical Framework** intended to guide AI behavior.
  - **Research Gap:** Existing practical frameworks are concentrated in structured therapeutic or educational settings, with a clear absence of partnership-oriented frameworks designed for open-ended, creative knowledge work.

### Prompt 2.1: AI Tools & Interventions for Neurodiversity

- **Prompt Text:** What are the most effective AI tools or interventions for supporting executive function challenges in neurodivergent individuals, such as those with ADHD or Autism?
- **Objective:** To position the CHAC framework against existing technological interventions and solidify the research gap.
- **Key Findings:**
  - Existing tools are predominantly structured interventions for children (e.g., cognitive training games, social robots).
  - The literature explicitly identifies three major gaps: a lack of focus on **adults and the workplace**, a lack of **long-term, real-world data**, and a need for more **participatory design**.
  - **Research Gap:** CHAC directly addresses these stated gaps by focusing on adult knowledge workers using a long-term, real-world, and deeply participatory “AI-Native Auto-ethnography” methodology, positioning the AI as a “partner” rather than a “tool.”

### Prompt 3.1: N-of-1 and Auto-Ethnographic Methodology

- **Prompt Text:** What are the established best practices and primary limitations of using N-of-1 or auto-ethnographic methods in HCI research?
- **Objective:** To provide the academic foundation and justification for the chosen research methodology.
- **Key Findings:**
  - N-of-1 and auto-ethnography are validated methods in HCI for generating deep, contextualized insights.
  - The CHAC project’s design (e.g., metadata logs, versioned toolkit) aligns with established best practices for ensuring rigor (reflexivity, thick description, systematic data collection).
  - **Research Gap:** The literature on these methods assumes the **researcher is exclusively human**. CHAC introduces the novel concept of an “AI-Native Auto-ethnography,” where the AI acts as an active research partner, co-generating data and co-evolving the research protocol.

### Prompt 5.1: The “Centaur Model”

- **Prompt Text:** What is the "Centaur Model" of intelligence in the context of Human-AI Collaboration, and what are its primary applications and limitations discussed in HCI research?
- **Objective:** To position the CHAC framework relative to the well-established “Centaur Model.”
- **Key Findings:**
  - CHAC shares the core philosophy of human-AI symbiosis with the Centaur model.
  - A key distinction is the primary goal: the classic Centaur model aims to **optimize task performance**, whereas CHAC aims to optimize the user’s **well-being and sustainability**.
  - CHAC provides a principled solution to the Centaur model’s challenge of task division by using a deep user model (AuDHD/2e) where the AI’s primary role is to systematically **compensate** for known challenges.
  - **Positioning:** CHAC is a specialized, psychologically-informed evolution of the Centaur model.

### Prompt 5.2: Cognitive Augmentation Frameworks

- **Prompt Text:** Beyond simple task offloading, what specific HCI frameworks exist for designing AI partners that provide continuous, real-time cognitive and emotional compensation for knowledge workers with executive function deficits?
- **Objective:** To identify the closest conceptual neighbors to the CHAC framework and articulate its key differentiators.
- **Key Findings:**
  - The closest conceptual peers include theory-driven emotion regulation frameworks and the Adaptive Cognitive Fit (ACF) framework.
  - CHAC’s uniqueness lies in its **holistic approach**, integrating support for cognition, emotion, process integrity, and intellectual rigor into a single, unified model.
  - It elevates the AI’s role from an adaptive “system” to a co-evolving “**partner**” and is specifically designed for the **AuDHD/2e knowledge worker archetype**.

### Prompt 5.3: Symbiotic Intelligence

- **Prompt Text:** What concrete, operational protocols or interaction patterns have been proposed to achieve "Symbiotic Intelligence" where the human and

AI mutually adapt and co-evolve their collaborative process over time?

- **Objective:** To clarify CHAC's unique approach to achieving human-AI co-evolution.
- **Key Findings:**
  - Mainstream research focuses on achieving co-evolution through **technical and algorithmic means** (e.g., shared cognitive architectures, co-adaptation algorithms).
  - CHAC proposes a complementary, humanistic path where co-evolution is achieved through **explicit, social, and linguistic means**—specifically, a suite of human-readable, negotiable, natural language protocols.
  - **Positioning:** CHAC shifts the focus from designing adaptive algorithms to designing the meta-process that enables human-AI adaptation through dialogue and explicit protocol revision.

#### Prompt 5.4: Alternative Partnership Models

- **Prompt Text:** What alternative human-AI partnership models exist beyond the traditional supervision-based "human-in-the-loop" paradigm, specifically focusing on shared agency and collaborative goal-setting in open-ended creative tasks?
- **Objective:** To position the CHAC framework within the emerging paradigm of co-creative and mixed-initiative systems.
- **Key Findings:**
  - HCI research is trending towards partnership models that emphasize **shared agency**.
  - CHAC aligns with this trend but is differentiated by its core mechanism: **"psychological compensation."** The AI's primary role is to compensate for the user's known cognitive and emotional difficulties.
  - **Positioning:** CHAC is the first partnership model where "psychological compensation" is the central mechanism, specifically designed for AuDHD/2e knowledge workers to prioritize well-being as the path to creativity.

#### Prompt 6.1: Psychological Safety and Innovation

- **Prompt Text:** What is the relationship between psychological safety and innovation outcomes in knowledge workers?
- **Objective:** To establish an evidence-based baseline for the more nuanced discussion of "safe" vs. "unsafe" creative leaps.
- **Key Findings:**
  - The literature confirms a **strong, robust positive relationship** between psychological safety and innovation.
  - A critical nuance is the "too safe" problem: at very high levels of safety, **complacency** can arise, potentially hindering radical innovation.
  - **Research Gap:** The literature does not deeply differentiate between **incremental innovation** and **breakthrough innovation**. This provides an entry point for CHAC, which is designed to create a specific kind of scaffolded safety engineered to enable sustainable, high-risk, breakthrough innovation.

#### Prompt 6.2: Cognitive Scaffolding and Risk-Taking

- **Prompt Text:** How do AI-driven cognitive support tools or "scaffolding" frameworks affect creative problem-solving and risk-taking in adults?

- **Objective:** To move the inquiry from the general concept of “psychological safety” to the specific, engineered mechanism of “cognitive scaffolding,” linking it directly to the CHAC framework’s core design.
- **Key Findings:**
  - The literature confirms that “cognitive scaffolding” enhances creative output by **reducing cognitive load** and **increasing cognitive flexibility**, directly validating the mechanism behind CHAC’s Cognitive Buffer function.
  - Scaffolding encourages risk-taking by **lowering the perceived risk of failure**.
  - A critical limitation is that poorly designed, overly rigid scaffolding can actively **limit** creativity.
  - **Research Gap:** The literature’s tools are mostly generic and static. There is a significant gap in research on **dynamic, adaptive, and personalized scaffolding provided by an AI partner** that learns and evolves with the user. The literature also lacks a multi-layered risk model (Execution, Intellectual, Emotional) that CHAC is designed to address.

### Prompt 6.3: Breakthrough vs. Incremental Innovation

- **Prompt Text:** What is the evidence for high-stakes, high-risk environments versus psychologically safe, scaffolded environments in fostering breakthrough vs. incremental innovation?
- **Objective:** To provide the core evidence for the “organizational ambidexterity” theory that underpins the entire CHAC framework.
- **Key Findings:**
  - The literature draws a clear distinction: high-risk environments are more conducive to **breakthrough innovation**, while psychologically safe environments are consistently associated with **incremental innovation**.
  - The concept of “**organizational ambidexterity**”—the ability to balance exploration (breakthroughs) and exploitation (incremental gains)—is a key bridge.
  - **Research Gap:** The literature discusses ambidexterity almost exclusively at the **organizational or team level**. A clear gap exists in research on how a single **individual**, partnered with an AI, can achieve this dynamic balance. The literature describes static “environments,” not a dynamic “partner” that can shift modes on demand.

### Prompt 6.4: Confirming the Research Gap

- **Prompt Text:** To what extent has research explored AI partnerships that provide cognitive scaffolding to enhance high-risk, novel knowledge work for neurodivergent adults?
- **Objective:** To authoritatively confirm that the specific, intersectional research area targeted by the CHAC framework is a significant and unaddressed gap.
- **Key Findings:**
  - The report directly states that research in this specific, combined area is “emerging but remains limited” and represents a “significant research gap.”
  - The existing literature is siloed, with no studies found that unite all four core concepts: **AI Partnerships + Cognitive Scaffolding + High-Risk Work + Neurodivergent Adults**.
  - **Conclusion:** This provides the final validation of the primary research gap for the CHAC framework.

### Prompt 6.5: Analogous Human-Human Collaboration Models

- **Prompt Text:** What are the established theoretical frameworks or models for effective dyadic (two-person) collaboration in creative or complex knowledge work, particularly models that describe complementary psychological roles or cognitive functions?
- **Objective:** To conduct a final scoping review to determine if established dyadic (human-human) collaboration frameworks resemble the CHAC 2x2 architecture.
- **Key Findings:**
  - No existing model is a direct 1-to-1 match for the CHAC 2x2 architecture.
  - Related theoretical constructs were found: 1) **Transactive Memory Systems (TMS)**, which provides a theoretical foundation for the Cognitive Buffer role, and 2) **Belbin's Team Role Theory**, which offers a philosophical parallel to CHAC's complementary roles.
  - **Novelty Confirmation:** CHAC's uniqueness is confirmed as it is a **dyadic-specific model**, a **generative framework** (for proactively constructing a partnership) rather than a descriptive one, and is **natively designed for human-AI symbiosis**.

### Prompt 7.1: Differentiating CHAC from Synthetic Ethnography

- **Prompt Text:** What are the primary research objectives and units of analysis in "synthetic ethnography," and how does this methodology differ from studies of long-term human-AI collaboration and symbiosis?
- **Objective:** To provide a definitive, evidence-based differentiation between the "AI-Native Auto-ethnography" methodology and the adjacent field of "Synthetic Ethnography."
- **Key Findings:**
  - "Synthetic Ethnography" focuses on the **AI system itself**, with its unit of analysis being **non-human** (AI agents, generative outputs).
  - Human-AI collaboration research (CHAC's domain) focuses on the **human-AI relationship**, with the unit of analysis being **hybrid and relational** (the human-AI team, the collaborative process).
  - **Conclusion:** This confirms the methodological novelty of CHAC, which studies the symbiotic system, not the AI in isolation.

### Prompt 7.2 & 7.3: Differentiating Autonomous Agents vs. Cognitive Partners (The Spectrum of Autonomy)

- **Prompt Text (7.3 Revised):** How does the academic literature distinguish between AI's role as an **"autonomous agent"** that executes delegated scientific tasks, versus AI's role as a **"cognitive partner"** that interactively scaffolds a human's real-time creative process in a symbiotic relationship?
- **Objective:** To provide a definitive, evidence-based differentiation between the "Autonomous Scientist" paradigm and the "Symbiotic Partner" paradigm that defines CHAC.
- **Key Findings:**
  - The literature reveals a **"spectrum of autonomy"** rather than a simple binary, ranging from "AI as Research Assistant" to "AI as Fully Autonomous Agent."
  - For complex, open-ended research, the report confirms that fully autonomous discovery is **not yet feasible**, and **symbiotic models are essential** for ensuring reliability, creativity, and ethical oversight.

- **Positioning:** The CHAC framework is positioned not in opposition to the “Autonomous Scientist” but as a distinct and vital point on this spectrum, specifically designed for the “deep collaboration and symbiosis” region required for complex creative work.

### **Prompt 8.1: The Socratic, Negentropic Loop**

- **Prompt Text:** How does a Socratic mode of human-AI collaboration, conceptualized as a negentropic loop, facilitate the generation of novel, meaningful theoretical frameworks...
- **Objective:** To externally validate the AI-generated “Socratic, Negentropic Loop” model for the core CHAC methodology via a formal literature review.
- **Key Findings:**
  - The literature review returned “**Strong**” evidence that this exact mode of collaboration “enables novel, meaningful theoretical frameworks.”
  - It grounded the model in active, emerging academic topics like “Socratic AI” and “negentropy in HCI.”
  - The review highlighted research gaps in empirical validation and practical scaffolding, which the CHAC project’s methodology and toolkit are uniquely positioned to address.
  - **Conclusion:** This validation elevates the core methodology from a hypothesis to an externally-validated, academically-grounded theory.

### **References**

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