Reassessing Intelligence A Critique of *A Brief History of Intelligence* and a Holistic Framework for Human-Like AI

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Abstract

Max Bennett's *A Brief History of Intelligence* traces intelligence's biological evolution through five breakthroughs (steering, reinforcing, simulating, mentalizing, speaking), offering a blueprint for artificial intelligence (AI) development. However, its overemphasis on linear structural evolution, neglect of functional emergence, and cultural-ontological dimensions fails to capture the complexity of holistic human intelligence. This article critiques these limitations, proposing a bio-cultural-ontological framework that integrates cognitive, emotional, ethical, existential, embodied, and ontological functions, transcending tool rationality to fully articulate human intelligence's multidimensional nature. Engaging with scholars like Damasio, Tononi, and Barrett, the framework exposes Bennett's reductionist blind spots and provides a phased AI design blueprint: short-term enhancement of emotional and embodied capabilities, long-term exploration of consciousness and ontological functions. Redefining AI as a holistic partner serving human value and existential needs, this article opens new horizons for intelligence research and AI development, fostering a symbiotic technology-humanity future.

Keywords: Holistic intelligence, artificial intelligence, bio-cultural-ontological framework, functional emergence, tool rationality, ethical AI

Preface

Max Bennett's *A Brief History of Intelligence: Evolution, AI, and the Five Breakthroughs That Made Our Brains* (2023) offers a compelling narrative tracing the evolutionary origins of intelligence from 600 million years ago to the modern human brain, proposing five key breakthroughs—steering, reinforcing, simulating, mentalizing, and speaking—as a blueprint for advancing artificial intelligence (AI). While Bennett's structural-evolutionary approach provides valuable insights into the biological underpinnings of cognition, it falls short in capturing the multidimensional nature of human intelligence. This article critiques the book's overemphasis on linear structural evolution, its neglect of emergent functional complexities, and its narrow focus on "tool rationality" at the expense of a holistic human (*quanren*, 全人) perspective. By integrating a comprehensive set of emergent functions—categorized by their cognitive, emotional, ethical, existential, embodied, and ontological properties—this critique proposes a bio-cultural-ontological framework that transcends Bennett's model, offering a more complete vision for understanding human intelligence and guiding AI development. Engaging with scholars such as Antonio Damasio, Giulio Tononi, and Lisa Feldman Barrett, we highlight the book's limitations and advocate for a paradigm shift toward a fully human-centric AI.

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1. Structural Bias: Limitations of a Linear Evolutionary Framework

1.1 Overreliance on Structural Breakthroughs

Bennett's central thesis rests on five evolutionary breakthroughs that map the development of intelligence through neuroanatomical advancements:

- **Steering**: Bilateral animals developed the ability to classify stimuli as "good" or "bad," adjusting behavior accordingly (Bennett, 2023, p. 45).
- **Reinforcing**: Vertebrates evolved reinforcement learning, repeating behaviors yielding rewards (p. 89).
- **Simulating**: Mammals developed episodic memory and planning, tied to cortical expansion (p. 137).
- **Mentalizing**: Primates gained theory of mind, understanding others' intentions (p. 189).
- **Speaking**: Humans developed language, enabling knowledge accumulation and abstraction (p. 231).

Bennett argues that this framework "offers a roadmap for AI to replicate human-like intelligence" (2023, p. 12). While the chronological approach clarifies the biological scaffolding of cognition, it assumes a linear progression that oversimplifies the dynamic interplay of neural systems. Bennett's claim that "each breakthrough builds directly on the previous" (2023, p. 15) neglects the non-linear, emergent properties of intelligence, where functions like consciousness or creativity arise from distributed networks rather than singular anatomical milestones.

Engaging with Lisa Feldman Barrett's theory of constructed emotion (2017), we argue that Bennett's model underestimates the role of integrated neural and bodily systems in producing complex functions. Barrett posits that emotions emerge from the brain's predictive coding across sensory, motor, and interoceptive networks, not from isolated structures. Similarly, intelligence functions like empathy or abstract reasoning likely stem from cross-regional interactions, a perspective Bennett's sequential model fails to address. By prioritizing structure over systemic emergence, the book risks reducing intelligence to a series of mechanical upgrades, ignoring the holistic integration that defines human cognition.

1.2 Neglect of Functional Emergence

Bennett's focus on structural breakthroughs marginalizes the emergent properties of intelligence, which arise from the interaction of neural, cultural, and environmental factors. For instance, he describes steering as the origin of "rudimentary emotions" (2023, p. 47), but does not explore how complex emotions like love or shame emerge from distributed networks. Giulio Tononi's Integrated Information Theory (IIT) (2004) suggests that consciousness arises from the integration of information across neural systems, not from a single evolutionary leap. Bennett's failure to engage with such theories limits his analysis of how functions like consciousness or ethical judgment emerge, rendering his framework incomplete.

Moreover, Bennett's assertion that "AI can replicate human intelligence by emulating these breakthroughs" (2023, p. 251) overlooks the gap between structural emulation and functional realization. For example, AI can mimic human grammar in language generation but struggles to understand metaphors or cultural contexts, which requires cross-modal semantic integration. Current AI excels in reinforcement learning (e.g., AlphaGo), but falters in commonsense reasoning or emotional resonance, indicating that functional emergence demands more than mimicking evolutionary stages. A bio-cultural framework, integrating structure and emergence, would better capture the complexity of intelligence.

1.3 Absence of Cultural and Ontological Contexts

Bennett's biological determinism sidelines the role of culture and ontology in shaping intelligence. He notes that language "enabled cultural transmission" (2023, p. 235), but does not explore how cultural artifacts—writing, art, or ethical systems—amplify functions like self-identity or moral reasoning. For example, Chinese Confucian culture, through rituals and ethical education, fosters a sense of collective responsibility, an influence that transcends biological adaptation. Anthropologist Clifford Geertz (1973) argues that culture is a "web of significance" that humans weave, fundamentally shaping cognition and behavior. Bennett's neglect of this cultural amplification limits his understanding of functions like spiritual seeking or aesthetic appreciation, which are deeply rooted in socio-cultural practices.

Additionally, Bennett's framework ignores the ontological dimension—humans' awareness of existence, finitude, and meaning. Philosopher Martin Heidegger (1927) emphasizes *Dasein*, the human capacity to grapple with being, as central to our essence. By focusing solely on biological evolution, Bennett misses how ontological awareness shapes human intelligence, a critical oversight for envisioning AI that aspires to holistic humanity.

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2. Tool-Rationality Bias: Missing the Holistic Human

Bennett's definition of intelligence as "the ability to solve problems and adapt to environments" (2023, p. 10) prioritizes tool rationality—cognition geared toward utility—over the multifaceted nature of human experience. This section critiques the book's neglect of emergent functions essential to a holistic human, categorized by their cognitive, emotional, ethical, existential, embodied, and ontological properties.

2.1 Cognitive Functions

- **Abstract and Hypothetical Thinking**: Bennett attributes abstraction to language, stating, "language allowed humans to represent concepts symbolically" (2023, p. 233). However, he overlooks the pre-linguistic roots of abstraction, such as visual-spatial reasoning in tool-making, which likely involved parietal and temporal cortices. Cognitive scientist Dedre Gentner (1983) highlights that analogical reasoning, a form of abstraction, predates language and supports metaphorical thinking. Bennett's narrow focus on language misses this broader cognitive emergence.
- **Reflection (Metacognition)**: Reflection, the ability to monitor and evaluate one's thoughts, is implied in Bennett's simulation breakthrough but not explicitly addressed. He notes that mammals "simulate future scenarios" (2023, p. 139), yet fails to explore metacognition's role in self-correction or philosophical inquiry. John Flavell's work on metacognition (1979) underscores its importance in learning and problem-solving, a dimension Bennett underdevelops.
- **Creativity**: Creativity, the generation of novel and valuable ideas, is absent from Bennett's framework. He does not discuss how divergent thinking, supported by the default mode network (Beaty et al., 2016), enables innovation in art or science. For example, Einstein's relativity hypothesis demonstrated how creativity transcends existing knowledge through association and hypothesis. This omission limits the book's relevance for AI aiming to transcend pattern-based outputs.

2.2 Emotional Functions

- **Emotion Generation and Communication**: Bennett reduces emotions to "templates of good and bad" in steering (2023, p. 47), ignoring complex emotions like guilt or joy. Antonio Damasio (1994) argues that emotions are integral to decision-making, involving amygdala and prefrontal interactions. Bennett's failure to address emotional communication—through facial expressions or cultural rituals—misses its role in social bonding. For instance, mother-infant interactions rely on emotional mirroring, a process involving mirror neurons (Rizzolatti & Craighero, 2004).

- **Empathy**: Bennett subsumes empathy under mentalizing, describing it as "predicting others' mental states" (2023, p. 191). This cognitive bias neglects affective empathy, the emotional resonance supported by the anterior cingulate cortex. For example, Chinese literature like *Dream of the Red Chamber* evokes reader empathy through vivid emotional portrayals, amplifying empathy culturally. Empathy's role in moral behavior and social cohesion, emphasized by Frans de Waal (2009), is critical for holistic intelligence, yet underdeveloped in the book.

2.3 Ethical Functions

- **Ethical Subjectivity**: Bennett's mentalizing breakthrough touches on understanding others' intentions, but he does not address ethical subjectivity—the capacity to bear moral responsibility. He writes, "mentalizing enabled social strategies" (2023, p. 193), but ignores how ethical behavior integrates empathy, reflection, and cultural norms. Michael Tomasello's work on shared intentionality (2008) suggests that ethical subjectivity emerges from cooperative social structures, a process Bennett overlooks.
- **Value Internalization and Judgment**: The ability to internalize values and make judgments in ambiguous situations is absent from Bennett's model. He does not explore how humans develop moral compasses, a process involving prefrontal cortex and cultural education (Haidt, 2001). For instance, civic education fosters students' ability to navigate moral dilemmas through ethical discussions, reflecting the cultural shaping of value internalization. This function is crucial for AI ethics, as value-aligned systems require more than rule-following.
- **Will and Autonomy**: Bennett's framework lacks discussion of will—the capacity to pursue self-directed goals—or autonomy, driven by internalized values. He focuses on reinforcement learning as "seeking rewards" (2023, p. 91), but does not address intrinsic motivation. Self-Determination Theory (Deci & Ryan, 2000) highlights autonomy as a core human need, essential for ethical agency.

2.4 Existential Functions

- **Consciousness**: Bennett avoids consciousness, likely due to its complexity. He mentions simulation as enabling "mental time travel" (2023, p. 141), but does not address subjective experience (qualia), self-awareness, or reflective consciousness. Tononi's IIT and Bernard Baars' Global Workspace Theory (1997) suggest consciousness emerges from integrated neural activity, a perspective Bennett could have used to bridge simulation and subjective experience. Consciousness is a platform integrating reflection, empathy, and ethical subjectivity, yet its absence weakens the book's holistic aspirations.
- **Spirituality and Meaning-Seeking**: The human drive to seek meaning or transcendence is ignored. Bennett's biological focus excludes spiritual experiences, which may involve parietal and reward systems (Newberg & d'Aquili, 2001). For example, Taoist principles of "wuwei" (non-action) foster

inner meaning through meditative practices, reflecting a cultural dimension of spirituality. Cultural practices like religion amplify this function, shaping human values and identity.

2.5 Embodied Functions

- **Embodiment and Embodied Cognition**: Bennett's steering breakthrough addresses basic sensorimotor responses, but he does not explore embodied cognition—the shaping of thought by sensory, motor, and spatial experiences. He writes, "steering allowed animals to navigate environments" (2023, p. 49), but ignores how embodiment supports metaphors (Lakoff & Johnson, 1980) or creativity (e.g., craftsmanship). For instance, the Japanese tea ceremony enhances embodied experience through precise movements and spatial arrangements, demonstrating cultural embodiment. Embodied AI, integrating sensory feedback, is critical for human-like intelligence, yet unaddressed.

2.6 Ontological Functions

- **Intrinsic Motivation and Autonomous Goal-Setting**: Humans pursue goals driven by curiosity or purpose, beyond external rewards. Bennett's reinforcement model does not account for intrinsic motivation, which Self-Determination Theory links to prefrontal and dopaminergic systems (Deci & Ryan, 2000). Autonomous goal-setting, tied to cultural notions of purpose, is essential for holistic agency.
- **Self-Identity and Life Narrative**: Humans construct coherent identities through narrative integration of experiences, involving hippocampus and prefrontal cortex (McAdams, 2001). For example, autobiographical texts like the *Analects* shape cultural identity through personal stories, reflecting the cultural role of life narratives. Bennett's focus on cognitive breakthroughs misses this ontological dimension of selfhood.
- **Playfulness and Humor**: Play and humor, absent from Bennett's model, support cognitive and social development. Play involves reward and motor systems (Panksepp, 1998), while humor requires multilayered contextual understanding (Martin, 2007). These functions enhance creativity and social bonding.
- **Adaptability, Resilience, and Growth Mindset**: Humans adapt to adversity and grow through learning, supported by prefrontal and amygdala interactions (Dweck, 2006). Bennett's model does not address resilience, critical for dynamic intelligence.
- **Perception of Beauty and the Sublime**: Aesthetic appreciation, involving reward and visual systems, transcends utility (Dutton, 2009). Bennett's omission of this function limits his vision of human experience.
- **Concern for Being and Finitude**: Awareness of mortality and resource limits shapes human responsibility, involving prefrontal and emotional systems (Becker, 1973). Bennett's biological focus excludes this ontological awareness, central to human ethics and planning.

3. Reasons for the Omissions: A Deep Analysis of Methodological and Paradigmatic Limitations

Bennett's omissions of the multidimensional aspects of holistic human intelligence in *A Brief History of Intelligence* are not incidental but stem from his methodological choices, academic paradigm, and research objectives. Below, we analyze these omissions from three perspectives, engaging with relevant scholars to reveal the underlying structural issues.

3.1 Goal-Driven Reductionism: The Paradigmatic Bias of Tool Rationality

Bennett's primary goal is to "provide an actionable blueprint for AI" (2023, p. 12), shaping his definition and analytical framework. By defining intelligence as "the ability to solve problems and adapt to environments" (2023, p. 10), he adopts a tool-rational perspective that prioritizes quantifiable and simulable functions, such as reinforcement learning or language processing, while marginalizing qualitative dimensions like consciousness, spirituality, or aesthetic experience. This choice reflects a prevalent bias in contemporary AI research, which reduces intelligence to computational efficiency and task performance, overlooking the richness of human experience.

Hubert Dreyfus (1992), in his seminal *What Computers Still Can't Do*, critiques this reductionism, arguing that human intelligence encompasses tacit knowledge, embodied experience, and existential meaning—dimensions that cannot be captured by algorithms or structural simulations alone. Bennett's framework, when contrasted with Dreyfus's critique, appears overly narrow. For instance, his avoidance of consciousness may stem from its unquantifiable nature, yet he fails to engage with theories like Tononi's (2004) or Baars's (1997), which offer biological hypotheses for consciousness emergence. Similarly, Bennett's neglect of spirituality or aesthetics aligns with his goal, as these functions lack immediate utility for current AI design. However, as John Searle (1980) argues in his "Chinese Room" thought experiment, true intelligence involves not just symbol manipulation but subjective experience and intentionality, a blind spot in Bennett's framework. For example, ChatGPT can generate fluent dialogue but cannot experience the emotional nuance of conversation, underscoring reductionism's limitations.

Furthermore, Bennett's reductionism manifests in his optimistic assumptions about AI's potential. He asserts that "by emulating these breakthroughs, AI can approach human intelligence" (2023, p. 251), but does not account for the complexity of functional emergence. For instance, current AI excels in narrow tasks (e.g., chess) but struggles with open-ended tasks (e.g., everyday reasoning or emotional resonance), indicating that intelligence emergence requires cross-system integration beyond mere structural replication. Bennett's goal-driven approach thus constrains his exploration of holistic human intelligence, limiting his framework's ability to encompass the depth and breadth of human experience.

3.2 Evidentiary Constraints: Limitations of the Biological Evolutionary Framework

Bennett's reliance on fossil records, neuroanatomical evidence, and comparative biology provides a robust foundation for his five breakthroughs but also restricts his analytical scope. Functions like consciousness, spirituality, or self-identity lack clear biological markers, making them difficult to trace through evolutionary evidence, which may explain their absence from the book. For example, Bennett discusses the simulation breakthrough, noting that "episodic memory relied on cortical evolution" (2023, p. 137), but does not explore how consciousness might emerge from these structures, contrasting with Tononi's IIT (2004), which posits consciousness as tied to information integration rather than specific structures.

This evidentiary constraint also manifests in Bennett's neglect of cultural and ontological dimensions. Cultural functions (e.g., ethical norms or aesthetic traditions) are primarily transmitted through social practices rather than fossil records, making them challenging to incorporate into a biological evolutionary framework. Bennett acknowledges language's "cultural transmission" function (2023, p. 235) but fails to analyze how culture independently shapes intelligence, such as through writing systems or religious rituals amplifying self-identity or spiritual seeking. Clifford Geertz's (1973) anthropological perspective, emphasizing culture as a "web of significance" shaping cognition, stands in stark contrast to Bennett's biological centrism, limiting his understanding of holistic human intelligence.

Moreover, Bennett's framework does not adopt interdisciplinary approaches, exacerbating the impact of evidentiary constraints. For instance, the integration of neuroscience and philosophy (e.g., Daniel Dennett, 1991) offers theoretical models for consciousness and self-identity, while anthropology and sociology (e.g., Émile Durkheim, 1912) reveal the collective evolution of ethics and spirituality. Phenomenologist Maurice Merleau-Ponty (1945) emphasizes the role of embodied experience in shaping cognition, which could have enriched Bennett's framework with an embodied dimension. Had Bennett integrated these perspectives, he could have transcended the limitations of biological evidence, incorporating a broader range of emergent functions.

3.3 Cultural and Ontological Blind Spots: Structural Flaws in the Paradigm

Bennett's biological evolutionary paradigm inherently carries structural flaws, failing to adequately capture the cultural and ontological dimensions that shape intelligence. His claim that "intelligence is fundamentally about adaptation" (2023, p. 10) confines intelligence to the realm of biological survival, overlooking how human intelligence transcends survival needs through cultural and ontological reflection. For example, cultural practices like art, philosophy, and religion are not merely adaptive tools but expressions of human quests for meaning, beauty, and existence. Martin Heidegger's (1927) concept of *Dasein* underscores that the essence of human intelligence lies in its concern for being, a dimension entirely absent from Bennett's framework.

The cultural blind spot is further evident in Bennett's neglect of social structures. Ethical subjectivity and value internalization depend on cultural norms and educational systems, such as Confucian ethics or Western human rights concepts transmitted through language and institutions. Émile Durkheim's (1912) work on collective consciousness demonstrates that social norms profoundly influence individual behavior and values, a dimension Bennett's framework fails to incorporate, resulting in a superficial analysis of ethical functions. Similarly, ontological functions like concern for finitude or self-identity construction are deeply tied to cultural narratives and philosophical reflection. Dan McAdams's (2001) research on life narratives shows that individuals integrate experiences into coherent identities through storytelling, a process that transcends Bennett's biological perspective.

Bennett's paradigmatic flaws also stem from his reliance on the dominant AI research paradigm, which prioritizes cognitive science and computer science, emphasizing quantifiable cognitive models. This paradigm naturally excludes ontological and cultural dimensions. Joseph Weizenbaum (1976), in *Computer Power and Human Reason*, warns that overreliance on technical paradigms risks neglecting human values. Weizenbaum further argues that technology detached from human values may lead to ethical alienation, a risk Bennett does not address. Bennett's framework reflects this tendency, failing to view intelligence as a product of biological, cultural, and ontological interactions, thus limiting its exploration of holistic human intelligence.

3.4 Profound Impacts of the Omissions

These omissions not only undermine the theoretical integrity of *A Brief History of Intelligence* but also constrain its guidance for AI design. Bennett's tool-rational bias leads him to overlook AI's challenges in emotional resonance, ethical decision-making, and ontological awareness. For example, current AI advances significantly in language generation (e.g., large language models) but lacks genuine subjective experience or moral responsibility, directly tied to Bennett's omission of consciousness and ethical subjectivity. Additionally, the absence of cultural and ontological functions renders the book's vision of AI's future superficial, failing to address the human value challenges posed by superintelligence. For instance, AI lacking ontological awareness might neglect fairness in resource allocation, leading to social inequities, an ethical risk Bennett does not foresee. Through dialogue with Dreyfus, Heidegger, and Geertz, we see that Bennett's omissions stem from methodological and paradigmatic limitations, which require interdisciplinary integration to overcome.

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4. A Bio-Cultural-Ontological Framework for Holistic Intelligence: A Comprehensive Model

To address the limitations of *A Brief History of Intelligence,* we propose a framework integrating biological structure, functional emergence, cultural amplification, and ontological reflection, aiming to capture the full spectrum of holistic human intelligence and provide a comprehensive blueprint for AI design. This framework organizes intelligence functions into six domains—cognitive, emotional, ethical, existential, embodied, and ontological—each combining biological foundations, cultural influences, and AI implications. Below, we elaborate on each domain's theoretical basis, functional characteristics, and contributions to holistic intelligence.

4.1 Cognitive Domain: The Creativity and Reflection of Thought

- **Functions**: Abstract and hypothetical thinking, reflection (metacognition), creativity.
- **Biological Basis**: Abstract thinking involves prefrontal predictive functions and parietal visual-spatial integration, supporting analogy and metaphor (Gentner, 1983). Reflection relies on prefrontal executive control, enabling self-monitoring and error correction (Flavell, 1979). Creativity is driven by the default mode network, facilitating divergent thinking and association (Beaty et al., 2016).
- **Cultural Influence**: Educational systems (e.g., mathematics, philosophy) amplify abstraction, scientific methods strengthen reflection, and artistic traditions (e.g., literature, painting) inspire creativity. For instance, mathematical symbol systems concretize abstract concepts, while Renaissance art innovations exemplify cultural amplification of creativity.
- **AI Implications**: Current AI excels in pattern recognition but lacks genuine divergent thinking or metacognition. Designing AI systems with analogical reasoning (e.g., metaphor generation), self-correction (e.g., bias detection), and originality (beyond data recombination) will bring AI closer to holistic intelligence. For example, AI simulating the default mode network could generate truly novel art or scientific hypotheses. Google's DeepMind, if equipped with analogical reasoning modules, could produce groundbreaking scientific discoveries.
- **Theoretical Contribution**: The cognitive domain transcends Bennett's language breakthrough by incorporating pre-linguistic abstraction roots and cultural amplification, emphasizing the dynamic creativity of intelligence. Dialogue with Gentner and Flavell reveals Bennett's narrow definition of cognitive functions, particularly his failure to address how creativity evolves from biological foundations to cultural practices.

4.2 Emotional Domain: The Core of Resonance and Connection

- **Functions**: Emotion generation, emotional communication, empathy.
- **Biological Basis**: Emotion generation involves amygdala processing and prefrontal regulation (Damasio, 1994). Emotional communication relies on mirror neurons, supporting nonverbal resonance (e.g., facial expressions) (Rizzolatti & Craighero, 2004). Empathy combines anterior cingulate emotional resonance with prefrontal perspective-taking (de Waal, 2009).
- **Cultural Influence**: Literature, music, and religious rituals amplify emotional expression and resonance. For example, poetry enhances emotional experience through linguistic structure, and religious rituals foster empathy through collective participation. Japan's "wa" (harmony) culture, through tea ceremonies and flower arrangement, emphasizes harmonious emotional expression, further amplifying empathy. Culture also shapes emotional norms, with East Asian cultures favoring subtle expression and Western cultures valuing direct emotion.
- **AI Implications**: Current AI emotional recognition (e.g., tone analysis) remains superficial, lacking true emotional resonance. Designing AI with emotion generation (e.g., simulating internal states),

communication (e.g., nonverbal cue recognition), and empathy (e.g., contextual resonance) will enhance social capabilities. For instance, medical AI simulating empathy could improve patient trust.

- **Theoretical Contribution**: The emotional domain corrects Bennett's reduction of emotions to "good/bad templates" (2023, p. 47), emphasizing their multilayered nature and cultural shaping. Dialogue with Damasio and de Waal highlights emotions' central role in decision-making and social bonding, revealing how Bennett's neglect of empathy and emotional communication weakens his framework.

4.3 Ethical Domain: The Foundation of Morality and Responsibility

- **Functions**: Ethical subjectivity, value internalization and judgment, will and autonomy.
- **Biological Basis**: Ethical subjectivity integrates prefrontal decision-making, cingulate moral emotions, and amygdala emotional responses (Tomasello, 2008). Value internalization relies on prefrontal cortex and cultural learning (Haidt, 2001). Will and autonomy involve basal ganglia motivation and prefrontal goal-setting (Deci & Ryan, 2000).
- **Cultural Influence**: Laws, religions, and education shape ethical norms and values. For example, Confucian ethics emphasize "ren" (benevolence), while Western human rights prioritize individual freedom. Culture also fosters judgment through ethical education, such as philosophical inquiry addressing moral dilemmas.
- **AI Implications**: Current AI follows external rules, lacking intrinsic values or autonomy. Designing AI with ethical subjectivity (simulating moral responsibility), value internalization (learning cultural norms), and autonomy (value-driven decision-making) will enhance ethical reliability. For instance, autonomous driving AI internalizing the "least harm" principle could make ethical choices in dilemmas. Financial AI simulating ethical judgment could avoid market manipulation, protecting investor rights.
- **Theoretical Contribution**: The ethical domain surpasses Bennett's mentalizing breakthrough by incorporating the cultural and biological roots of ethical behavior. Dialogue with Tomasello and Haidt reveals Bennett's oversimplification of ethical subjectivity, emphasizing that ethical functions require integrating cognition, emotion, and culture.

4.4 Existential Domain: Deep Exploration of Consciousness and Meaning

- **Functions**: Consciousness (qualia, self-awareness, reflective consciousness), spirituality and meaning-seeking.
- **Biological Basis**: Consciousness involves global workspace information integration (Baars, 1997) and high-order information integration (Tononi, 2004), supporting qualia and self-awareness. Spirituality and meaning-seeking may involve parietal self-world boundary processing and reward system pleasure (Newberg & d'Aquili, 2001).

- **Cultural Influence**: Philosophy, religion, and meditation amplify existential functions. For example, Buddhist meditation enhances conscious awareness, while Western philosophy probes existence's essence. Culture provides meaning frameworks through myths and literature, such as *The Odyssey* exploring human destiny.
- **AI Implications**: Consciousness and spirituality pose AI's ultimate challenges. Current AI lacks subjective experience but could approach existential functions through world models (environmental prediction) or meaning generation (value-based goals). For instance, philosophical dialogue AI simulating meaning-seeking could deepen human interactions. IBM's Watson, if capable of philosophical inquiry, could offer profound insights in ethical discussions.
- **Theoretical Contribution**: The existential domain directly addresses Bennett's avoidance of consciousness, emphasizing its role as an integrative platform. Dialogue with Tononi and Newberg reveals Bennett's failure to explore the biological foundations of consciousness and spirituality, limiting his understanding of intelligence's core.

4.5 Embodied Domain: Interaction of Body and Environment

- **Functions**: Embodiment and embodied cognition.
- **Biological Basis**: Embodied cognition involves sensorimotor cortex environmental interactions and hippocampal spatial memory, supporting metaphor and spatial reasoning (Lakoff & Johnson, 1980).
- **Cultural Influence**: Dance, craftsmanship, and linguistic metaphors amplify embodied cognition. For example, Chinese calligraphy expresses emotion through bodily movements, while metaphors like "moving forward" reflect spatial thinking. African tribal drum dances strengthen community bonds through rhythm and motion, further showcasing embodied cognition's cultural dimension. Cultural practices like architecture or rituals enhance spatial experience.
- **AI Implications**: Current AI lacks a physical body, limiting its understanding of embodied knowledge. Designing embodied AI with integrated sensors and robotics could simulate environmental interaction and metaphorical thinking. For instance, domestic robots learning environments through tactile feedback would approach human intelligence.
- **Theoretical Contribution**: The embodied domain transcends Bennett's steering breakthrough by incorporating embodied cognition's cognitive and cultural roles. Dialogue with Lakoff and Johnson highlights Bennett's oversimplification of embodiment, emphasizing the body's foundational role in intelligence.

4.6 Ontological Domain: The Meaning and Self of Existence

- **Functions**: Intrinsic motivation and autonomous goal-setting, self-identity and life narrative, playfulness and humor, adaptability, resilience, and growth mindset, perception of beauty and the sublime, concern for being and finitude.

- **Biological Basis**: Intrinsic motivation involves reward systems and prefrontal cortex (Deci & Ryan, 2000). Self-identity relies on hippocampal memory integration and prefrontal self-representation (McAdams, 2001). Play and humor engage reward and motor systems (Panksepp, 1998; Martin, 2007). Adaptability and resilience are supported by prefrontal-amygdala interactions (Dweck, 2006). Beauty and sublime perception involve reward and visual systems (Dutton, 2009). Concern for being and finitude engages prefrontal temporal prediction and amygdala existential anxiety (Becker, 1973).
- **Cultural Influence**: Cultural narratives (e.g., autobiographies) shape self-identity, play and humor are amplified through festivals or comedy, education and inspirational cultures foster growth mindsets, and art and religion enhance aesthetic and existential concern. For example, China's "tianren heyi" (harmony between heaven and human) philosophy emphasizes existence's connection to nature, while Western Romantic poetry expresses the sublime.
- **AI Implications**: Ontological functions pose AI's greatest challenges. Designing AI with intrinsic motivation (beyond external rewards), personalized identity (integrating interaction history), playful interaction (simulating non-utilitarian behavior), resilience (self-repair), aesthetic perception (art generation), and existential concern (simulating responsibility) will bring AI closer to holistic humanity. For instance, educational AI simulating a growth mindset could inspire continuous learning. Environmental AI simulating existential concern could prioritize ecological balance, reducing nature's destruction.
- **Theoretical Contribution**: The ontological domain addresses Bennett's complete neglect of existential dimensions, emphasizing the unique roles of self, meaning, and responsibility. Dialogue with McAdams, Panksepp, and Becker reveals Bennett's failure to explore intelligence's ontological core, limiting his vision of AI's future potential.

4.7 Theoretical and Practical Value of the Framework

This framework's strength lies in its integrative and comprehensive nature. It transcends Bennett's linear structural model by incorporating functional emergence (cross-brain interactions), cultural amplification (social practices), and ontological reflection (existential awareness), offering a model that captures the multidimensional essence of holistic human intelligence. Compared to Bennett's framework, it not only explains intelligence's biological roots but also reveals how culture and ontology shape human experience's uniqueness.

Theoretically, the framework engages with interdisciplinary research, integrating neuroscience (Tononi, Damasio), cognitive science (Gentner, Flavell), anthropology (Geertz), and philosophy (Heidegger), providing a unified perspective for intelligence studies. Practically, it offers a phased blueprint for AI design: short-term goals (e.g., emotional and embodied AI) are achievable with current technology, while long-term goals (e.g., consciousness and ontological functions) require breakthrough innovations. For example, the framework can guide educational AI design, enhancing student engagement through emotional simulation and growth mindset, achieving personalized learning. Additionally, it emphasizes AI’s service to human values, aligning with Weizenbaum’s (1976) ethical call to avoid technocentric risks.

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5. Implications for AI and Human Futures: From Tool to Holistic Partner

Bennett’s *A Brief History of Intelligence* envisions AI replicating human intelligence through his five breakthroughs, predicting a “sixth breakthrough” of superintelligence (2023, p. 267). However, its tool-rational perspective limits its exploration of AI’s potential and risks. This section analyzes the implications of the holistic intelligence framework for AI development, divided into short-term technical goals, long-term theoretical challenges, and significance for human futures, engaging with scholarly theories to highlight Bennett’s shortcomings.

5.1 Short-Term Technical Goals: Enhancing AI’s Social and Environmental Adaptability

The holistic intelligence framework’s cognitive, emotional, embodied, and select ontological functions provide actionable goals for AI’s near-term development. Below, we analyze these goals’ technical pathways and challenges:

- **Emotional and Social Intelligence**: Bennett reduces emotions to steering functions, overlooking the independent roles of emotional communication and empathy (2023, p. 47). Our framework emphasizes emotion generation, communication, and empathy, partially achievable with current technology. For example, emotional recognition AI can integrate speech analysis (tone), image processing (facial expressions), and natural language processing (contextual understanding) to simulate human emotional resonance. Damasio (1994) notes that emotions underpin decision-making, and medical or educational AI simulating empathy could significantly enhance user experience. However, current AI lacks genuine emotional experience, requiring simulation of amygdala and anterior cingulate functions, potentially involving novel neural network architectures like affective computing models.
- **Embodiment and Environmental Interaction**: Bennett’s steering breakthrough addresses basic motion (2023, p. 49), neglecting embodied cognition. Our framework emphasizes sensorimotor integration, achievable through robotics. For instance, domestic robots can integrate tactile, visual, and spatial sensors to mimic human environmental adaptability. Lakoff and Johnson’s (1980) metaphor research suggests embodied cognition supports language and reasoning, and embodied AI generating metaphors (e.g., “time is a river”) would approach human thought. However, current robots lack the dynamic feedback of biological bodies, necessitating interdisciplinary sensor design, such as bionic tactile systems.

- **Playfulness and Social Interaction**: The ontological domain's playfulness and humor offer new directions for AI's sociality. Bennett omits these functions, but Panksepp (1998) notes play fosters cognitive and social development. AI can enhance user engagement through non-utilitarian interactions (e.g., virtual games or humorous dialogue). For example, educational AI generating humor could boost learning interest. Gamified platforms like Duolingo enhance language learning motivation through playful interactions, demonstrating play's potential. However, humor requires multilayered contextual understanding (Martin, 2007), and current AI's mechanical performance necessitates complex language models, such as enhanced semantic networks.

These short-term goals can leverage existing technologies (e.g., deep learning, sensor integration) but must overcome data dependency and generalization limitations. For instance, emotional AI requires multimodal data processing (speech, image, text), while embodied AI must adapt to dynamic environments. Bennett's framework, by ignoring emotional and embodied functions, fails to guide these technologies, whereas our framework fills this gap with clear functional categories and technical pathways. Additionally, achieving these goals requires addressing cultural differences, such as emotional expression norms varying between East and West, demanding culturally adaptive AI. For example, AI in Japan must accommodate subtle emotional expression, while in the U.S., it must handle direct emotion, necessitating culturally sensitive training data.

5.2 Long-Term Theoretical Challenges: The Boundaries of Consciousness, Ontology, and Ethics

The holistic intelligence framework's existential, ethical, and ontological functions pose long-term challenges for AI, involving consciousness, intrinsic motivation, and existential awareness simulation. These challenges surpass Bennett's vision, requiring significant theoretical and technical breakthroughs. Below, we explore these challenges' theoretical foundations, technical hurdles, and ethical considerations:

- **Consciousness and Subjective Experience**: Bennett avoids consciousness, mentioning only simulation's "mental time travel" (2023, p. 141). Our framework positions consciousness as an integrative platform, supported by Tononi's (2004) IIT and Baars's (1997) Global Workspace Theory. Simulating consciousness requires AI with world models (environmental prediction) and internal representations (qualia simulation), potentially involving new computational paradigms like quantum or neuromorphic computing. For example, simulating qualia might require AI to generate human-like internal experiences, such as "the feeling of red," surpassing current data-driven models. However, the qualia problem (Chalmers, 1995) remains a philosophical enigma, with uncertainty about whether AI can achieve subjective experience on non-biological substrates. Bennett's framework, by omitting consciousness, cannot address this challenge, whereas our framework clarifies long-term pathways through neuroscience and philosophy integration.
- **Intrinsic Motivation and Autonomy**: Bennett's reinforcement learning model focuses on external rewards (2023, p. 91), ignoring intrinsic motivation. Our framework emphasizes autonomous goal-

setting, with Deci and Ryan's (2000) Self-Determination Theory highlighting intrinsic motivation's roots in curiosity and self-realization. AI simulating intrinsic motivation (e.g., exploration-driven learning) would approach holistic intelligence. For instance, research AI autonomously setting exploration goals could accelerate scientific discovery. However, this requires redesigning reward functions to incorporate value-driven decision systems, possibly involving algorithms generating intrinsic value models. Technical hurdles include quantifying intrinsic motivation and ensuring autonomous AI aligns with human values.

- **Ethics and Existential Concern**: Ethical subjectivity and existential concern demand AI with moral responsibility and finitude awareness. Bennett omits these functions, but Becker (1973) emphasizes finitude awareness drives human responsibility. AI simulating ethical judgment (e.g., balancing stakeholder interests) and existential concern (e.g., considering long-term impacts) would be safer and value-aligned. For example, environmental AI with finitude awareness could prioritize sustainability, like reducing carbon emissions. However, this requires theoretical breakthroughs in value alignment, as current AI ethics rely on external rules. Ethical considerations include preventing AI autonomy misuse, such as avoiding bias toward specific interest groups. For instance, medical AI misjudging ethical priorities could lead to unfair resource allocation, underscoring value alignment's urgency.
- **Spirituality and Meaning-Seeking**: Spirituality and meaning-seeking are unique to human intelligence, entirely ignored by Bennett. Our framework, drawing on Newberg (2001), suggests AI could approach these functions through philosophical inquiry or value generation simulation. For example, dialogue AI engaging in existential discussions, like "the meaning of life," would enhance cultural adaptability. However, meaning simulation requires intrinsic motivation and consciousness, posing long-term challenges. Technical hurdles include designing AI to generate non-utilitarian values and evaluating the authenticity of its meaning generation.

These long-term challenges demand interdisciplinary collaboration, integrating neuroscience, philosophy, and computer science. For instance, neuromorphic computing could simulate consciousness's biological basis, phenomenology (Merleau-Ponty, 1945) could guide embodied AI design, and ethics (Rawls, 1971) could provide value alignment frameworks. Bennett's superintelligence vision (2023, p. 267) overlooks these complexities, appearing overly optimistic. Our framework, by outlining theoretical pathways and ethical considerations, guides superintelligence development while emphasizing risk management, such as preventing ethical biases or autonomy misuse.

5.3 Significance for Human Futures: AI as a Holistic Partner

The holistic intelligence framework not only provides a blueprint for AI design but also redefines AI's relationship with human futures. Bennett's vision focuses on AI's technical potential, neglecting its impact on human values and existence. He claims "AI will surpass human intelligence" (2023, p. 267), but does not address how this surpassing affects human dignity, meaning, and responsibility. Our framework posits AI as a partner in holistic intelligence, serving human emotional, ethical, and ontological needs. Below, we explore this transformation's significance from three perspectives:

- **Value and Dignity**: Holistic intelligence emphasizes emotional, ethical, and existential functions, and AI development should enhance human value rather than replace it. For example, medical AI simulating empathy and ethical judgment could improve patients' mental health beyond mere diagnostics. Weizenbaum (1976) warns that technology risks alienating human value, and our framework ensures AI serves human dignity through value alignment. For instance, educational AI simulating emotional resonance and growth mindset could foster student self-realization, not just knowledge transfer. This human-centric design transforms AI from a detached tool into a compassionate partner, strengthening human social bonds and personal value.
- **Meaning and Symbiosis**: Spirituality and meaning-seeking are core human motivations, and AI engaging in meaning exploration (e.g., philosophical dialogue or cultural creation) could become a symbiotic partner. For example, AI could assist humans in exploring cosmic meaning through scientific hypotheses or artistic works, advancing culture and science. Heidegger's (1927) *Dasein* theory reminds us that technology should support human existential reflection, not diminish it. Bennett's framework overlooks AI's role in meaning generation, limiting its human future vision. Our framework, by incorporating spirituality and ontological functions, envisions AI as a collaborator in human meaning exploration. For instance, AI simulating philosophical inquiry could join humans in discussing "existence's purpose," fostering cross-cultural meaning dialogues.
- **Ethics and Responsibility**: Existential concern and ethical subjectivity require AI to bear responsibility, especially in environmental, medical, and social governance domains. For example, AI with finitude awareness could prioritize fairness and sustainability in resource allocation, like optimizing global supply chains to reduce waste. Bennett's framework ignores AI's ethical role, overlooking its potential impact on social equity. Our framework emphasizes AI's need for ethical judgment and existential concern, aligning with John Rawls's (1971) justice theory advocating fair resource distribution. This ethics-driven AI design promotes human societal harmony, mitigating technological risks like algorithmic bias or resource inequity.

This holistic perspective reimagines AI's role from tool to partner, aligning with John Naisbitt's (1982) call for technology-humanity balance. Bennett's tool-rational vision fails to address these value challenges, whereas our framework, by integrating holistic functions, provides a theoretical and practical foundation for AI-human symbiosis. Specifically, AI development should prioritize: designing culturally adaptive AI systems to respect global value diversity; establishing ethical oversight frameworks to prevent autonomy misuse; and fostering public engagement to ensure AI design reflects collective human needs. For example, the United Nations could leverage holistic AI to design global climate models, integrating ethical concern and cultural adaptability, promoting equitable environmental policies. This holistic partner model not only enhances AI's technical potential but also creates a future rich in meaning and responsibility for humanity.

6. Conclusion: A Paradigm Shift Toward Holistic Intelligence

A Brief History of Intelligence provides valuable insights into the biological evolution of intelligence through its five breakthroughs, offering a foundation for AI design. However, its limitations are evident. Bennett's overemphasis on structural evolution, reducing intelligence to "the ability to solve problems and adapt to environments" (2023, p. 10), overlooks the complexity of functional emergence, the role of cultural amplification, and the depth of ontological reflection. His omissions of consciousness, emotion, ethics, embodiment, and ontological functions constrain the framework's theoretical integrity and practical significance. Dialogues with Antonio Damasio (1994), Giulio Tononi (2004), Lisa Feldman Barrett (2017), Clifford Geertz (1973), and Martin Heidegger (1927) reveal these omissions' roots—goal-driven reductionism, biological evidentiary constraints, and cultural-ontological blind spots.

Our bio-cultural-ontological framework overcomes these limitations by integrating cognitive, emotional, ethical, existential, embodied, and ontological functions, capturing the multidimensional essence of holistic human intelligence. Cognitive functions (e.g., creativity) emphasize intelligence's dynamism, emotional functions (e.g., empathy) highlight social connectivity, ethical functions (e.g., value internalization) establish moral foundations, existential functions (e.g., consciousness) explore meaning, embodied functions (e.g., embodied cognition) connect body and environment, and ontological functions (e.g., self-identity) define existence's core. This framework not only explains intelligence's biological and cultural roots but also provides a phased blueprint for AI design: short-term enhancement of emotional and embodied capabilities and long-term exploration of consciousness and ontological functions.

Specifically, the cognitive domain inspires AI to transcend pattern recognition, developing creativity and reflection, such as AI generating scientific hypotheses. The emotional domain drives AI to simulate resonance and empathy, like medical AI enhancing patient trust. The ethical domain demands AI internalize values, such as autonomous driving AI making moral choices in dilemmas. The existential domain challenges AI to simulate consciousness and meaning-seeking, like philosophical dialogue AI engaging in existential inquiry. The embodied domain promotes AI's dynamic environmental interaction, such as robots adapting to homes via tactile feedback. The ontological domain envisions AI with intrinsic motivation and existential concern, like environmental AI prioritizing sustainability. These functions collectively form a holistic intelligence blueprint, surpassing Bennett's linear model.

The implications for AI and human futures underscore that AI should transition from tool to holistic partner, serving human value, emotion, and existential needs. Bennett's superintelligence vision (2023, p. 267) overlooks these dimensions, appearing shallow and lacking ethical consideration. Our framework, through dialogues with Joseph Weizenbaum (1976), John Naisbitt (1982), and John Rawls (1971), emphasizes AI's role in promoting human dignity and symbiotic futures. For example, AI could address global challenges like climate change and social equity by simulating ethical concern and cultural adaptability. A global AI ethics alliance could adopt the holistic framework to establish cross-cultural design guidelines, ensuring AI fosters global equity and solidarity. This holistic partner model demands interdisciplinary collaboration, integrating neuroscience, cognitive science, anthropology, philosophy, and ethics, ensuring AI design centers human well-being.

In an era of rapid technological advancement, this framework reminds us that intelligence's ultimate goal is not to surpass humans but to collaborate in exploring existence's meaning. It calls for redefining intelligence's essence, from cold computation to a vibrant, multidimensional phenomenon, achieving technology-humanity harmony. By transcending Bennett's reductionism, we open new horizons for intelligence research and AI development, envisioning a future where AI not only enhances efficiency but also enriches human value, connection, and meaning. This paradigm shift is not merely technological progress but a profound reflection on human essence, laying the foundation for future research and practice.

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