

Generalized Theory of Cognitive Relativity: Bridging Philosophical Tradition, Cognitive Science, and Artificial Intelligence through Pure Reason

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Abstract

This research proposes Cognitive Relativity as an innovative epistemological framework, metaphorically extending Einstein's theories of relativity to human cognition. It asserts that cognition is inherently frame-dependent, shaped by cognitive biases and contextual influences. The study reinterprets Kant's Pure Reason, integrating insights from cognitive psychology, neuroscience, and artificial intelligence, proposing a practical metacognitive methodology to systematically mitigate cognitive distortions. Emphasizing frame-shifting and metacognitive reflection, this model aims at progressively approximating objectivity by integrating multiple cognitive frames.

1 Introduction

The search for objective truth has persistently challenged philosophy and science alike. Immanuel Kant's *Critique of Pure Reason* established a foundation by proposing that human cognition structures reality through innate categories independent of experience. Yet, modern advances in cognitive science and artificial intelligence (AI) necessitate reevaluation and expansion of Kantian epistemology to accommodate emerging understandings of cognition.

Einstein's groundbreaking work in Special and General Relativity, illustrating that physical observations vary depending on the observer's frame of reference, revolutionized physics and our understanding of objective reality. Analogously, human cognition is subject to biases and perspectives that profoundly shape our interpretations. These biases have been extensively documented, yet practical strategies for systematically overcoming cognitive distortions remain elusive.

To bridge this gap, this research introduces *Cognitive Relativity*, an epistemological model that analogizes Einstein's relativity with human cognitive processes. We propose concepts such as *cognitive frame*, *cognitive gravity*, and *cognitive curvature* to describe the contextual and biased nature of cognition. Cru-

cially, this work explicitly avoids endorsing absolute relativism, advocating instead for *Pure Reason*, a dynamic, reflective methodology that integrates philosophical rigor, cognitive psychology, and AI technologies. Pure Reason serves as a metacognitive toolset that enables critical self-reflection, facilitates frame-shifting, and systematically enhances epistemic clarity.

The subsequent sections detail historical philosophical foundations, cognitive scientific insights, and implications for AI development, establishing a comprehensive interdisciplinary approach.

2 Research Objectives

The study’s primary objective is the formulation of Cognitive Relativity as a coherent epistemological model unifying classical philosophy, cognitive sciences, and artificial intelligence. To achieve this, the research outlines the following goals:

- Analyze the historical evolution of pure reason, particularly in Kantian epistemology, and reinterpret it through the lens of cognitive relativity.
- Investigate cognitive scientific theories, notably dual-process theory, schema theory, and cognitive biases, establishing the empirical foundations of cognitive relativity.
- Assess how cognitive relativity can inform and enhance artificial intelligence, particularly in creating reflective, adaptive AI capable of self-aware reasoning.
- Develop a practical methodology—Pure Reason—to mitigate cognitive biases and foster meta-cognitive reflection.

The significance of this study lies in providing both theoretical clarity and practical guidance in epistemology, cognitive psychology, and AI, contributing a valuable interdisciplinary framework to contemporary scholarship.

3 Philosophical Approaches to Pure Reason

3.1 Pure Reason in the Philosophy of Immanuel Kant

Immanuel Kant (1724–1804) fundamentally reshaped the philosophical landscape regarding the capabilities and limits of human cognition with his seminal work, the *Critique of Pure Reason*. Kant argues that cognition arises not passively through mere sensory experience, but actively through innate cognitive structures—*a priori* forms and categories of understanding—such as causality, quantity, and spatial-temporal intuition. These categories allow reason to structure the chaos of sensory input into coherent perception, yet simultaneously restrict cognition to phenomena, the realm of appearances, precluding direct knowledge of noumena, or things-in-themselves, that exist independently of perception [13].

3.2 Phenomena and Noumena: Boundaries of Knowledge

Kant's critical distinction between phenomena (objects as structured by human cognition) and noumena (objects as they are independently of human perception) introduces a fundamental epistemological limitation. Pure Reason, according to Kant, is capable of knowledge only within the realm of phenomena, and any attempt to extend beyond to grasp noumena leads inevitably to metaphysical illusion. This delineation marks not merely a philosophical insight but establishes a rigorous boundary for epistemic humility and self-critique within rational inquiry [13].

3.3 Post-Kantian Developments: Idealism and Dialectics

Kant's demarcation between phenomenal and noumenal realms significantly influenced later philosophical traditions. German Idealists, such as Fichte, Schelling, and Hegel, endeavored to reconcile this divide, each proposing alternative frameworks wherein reason either constructs reality or progressively comprehends the absolute through dialectical processes. For instance, Hegel's dialectics posit that reason engages dynamically with contradictions, synthesizing them progressively towards comprehensive understanding, suggesting an evolving, historically situated rationality rather than a static, timeless one [7].

3.4 Existential and Phenomenological Perspectives

Later philosophical movements, notably Phenomenology and Existentialism, further critiqued and expanded Kant's original insights. Husserl's phenomenology proposed a rigorous methodological approach (*epoché*), suspending natural attitudes to investigate consciousness directly, thereby illuminating how reason structures lived experience [10]. Heidegger and existentialists, meanwhile, emphasized reason's grounding within human existence, highlighting its practical, embodied, and situational nature, rather than a detached logical abstraction. Such reinterpretations position Pure Reason as inherently contextual, dynamic, and intimately entwined with existential conditions [8].

3.5 Contemporary Philosophical Debates

Contemporary philosophical discourse continues grappling with critical questions emanating from Kant's legacy:

- **Accessibility of Noumena:** Is it theoretically possible for reason to transcend the phenomenal limitations outlined by Kant? Postmodern and analytic philosophers debate vigorously on this possibility, with views ranging from strict Kantian limitation to more permissive epistemologies that entertain partial or indirect access to noumenal reality [19].

- **Autonomy of Reason vs. Experience:** Philosophers such as Wittgenstein and Quine have argued persuasively against purely *a priori* cognition, suggesting reason’s dependence on linguistic and empirical contexts. The debate persists over the extent to which cognition can ever claim genuine autonomy from experiential conditioning [24].
- **Formalization of Rational Cognition:** Advances in cognitive science and artificial intelligence increasingly pose questions about the computational formalization of reasoning. Can Kant’s *a priori* structures of cognition find an empirical counterpart in neural or computational architectures, or is rationality inherently irreducible to algorithmic processes? [4]

3.6 Philosophical Positioning of Cognitive Relativity

The model of Cognitive Relativity positions itself within contemporary epistemological debates by advocating a middle ground between strict Kantian constraints (the inaccessible noumenal reality) and radical relativism (the equal validity of all perspectives). Rather than endorsing epistemological relativism, Cognitive Relativity explicitly promotes a progressive convergence of diverse cognitive perspectives toward increased epistemic objectivity. Thus, it aligns philosophically with contemporary perspectival realism [15] and pragmatic rationalism, acknowledging the inherent contextuality of knowledge yet simultaneously endorsing rational strategies for progressively transcending cognitive limitations.

4 Integrating Philosophy, Cognitive Science, and Artificial Intelligence

Recent interdisciplinary research in cognitive science and artificial intelligence provides compelling avenues to revisit Kant’s philosophical concept of Pure Reason. Notably:

- Cognitive schemas, echoing Kant’s *a priori* categories, have emerged in psychological theories explaining how perception is pre-structured through mental frameworks before conscious interpretation [18].
- Dual-process theories (such as Kahneman and Tversky’s System 1 and System 2) empirically ground Kant’s distinction between intuitive and deliberate cognitive processes. System 1, fast and heuristic-driven, contrasts with System 2’s slower, analytical reasoning, paralleling Kant’s reflective Pure Reason [11].
- Chomskian theories of innate universal grammar and Fodor’s modularity of mind hypothesis resonate with Kantian *a priori* structures, suggesting neural architectures might mirror philosophical constructs of cognition [1].

These intersections illustrate the potential for a robust synthesis: a redefined Pure Reason that incorporates philosophical rigor, empirical validity, and computational applicability. This integrative framework offers prospects for both a deeper philosophical understanding and practical cognitive enhancement through technology.

5 Theoretical Foundations: Cognitive Relativity

Inspired metaphorically by Einstein’s theories of Special and General Relativity, we propose *Cognitive Relativity*, an innovative epistemological model that systematically describes cognition as inherently relative to the observer’s cognitive framework. Central metaphors from physics provide a structured vocabulary for understanding cognition’s contextual dependencies and biases [2].

5.1 Cognitive Frame of Reference

A cognitive frame refers to the structured set of assumptions, beliefs, and prior knowledge that shape an individual’s perception, reasoning, and decision-making processes. Analogous to physical reference frames in relativity theory, cognitive frames determine how individuals interpret experiences, events, and data [5]. These frames vary widely across cultural, educational, and individual contexts, highlighting cognition’s inherently contextual nature [9].

5.2 Cognitive Gravity

Cognitive gravity represents the internal psychological forces—particularly cognitive biases—that systematically “pull” human judgments toward familiar interpretations and conclusions, thus limiting cognitive flexibility. Similar to gravitational attraction in physics, cognitive gravity manifests as resistance to changing beliefs, confirmation bias, anchoring, and availability heuristics, significantly constraining objective reasoning [11, 22].

5.3 Cognitive Curvature

Extending the gravitational metaphor, cognitive curvature describes the degree to which cognitive biases distort an individual’s reasoning process away from a logically straight path. Strong cognitive curvature indicates high susceptibility to biases, rigid thought patterns, and low cognitive flexibility. Conversely, reducing cognitive curvature enhances openness, adaptability, and the ability to integrate alternative perspectives [17].

5.4 Dynamics of Cognitive Frame-Shifting

Essential to Cognitive Relativity is the practice of cognitive frame-shifting—the intentional, metacognitive process of moving between different cognitive frames to mitigate biases. Effective frame-shifting involves recognizing one’s existing cognitive gravity and actively employing strategies to reduce cognitive curvature, such as reflective reasoning, perspective-taking, philosophical inquiry, and structured dialogical interactions [15].

6 Measuring Cognitive Curvature and Gravity: Empirical Challenges and Methodological Possibilities

The concepts of cognitive curvature and cognitive gravity, while initially metaphorical, hold significant potential for empirical exploration. Cognitive curvature represents the degree to which thought deviates from rationality under the influence of cognitive biases and emotional reactions, whereas cognitive gravity indicates the strength and persistence of such biases pulling cognition away from objective analysis.

Currently, the measurement of these concepts remains more metaphorical than precise, primarily due to technological and methodological limitations in cognitive science and neuroscience. Nevertheless, this does not preclude the possibility of developing more rigorous approaches in the future. Presently, empirical analogs include methods such as Jungian associative tests and neurophysiological tools like electroencephalography (EEG). For example, by employing EEG or oscillographic monitoring during discussions or reflections on emotionally charged topics, one could quantify neural activation patterns correlating with cognitive biases.

A practical empirical framework could involve repeated testing of emotional responses to specific cognitive stimuli throughout cognitive therapy or training sessions based on the Pure Reason methodology. Observing systematic changes in brain activation patterns in response to previously bias-inducing stimuli would provide a valuable empirical indicator of decreasing cognitive curvature. Such a methodological approach would help bridge the gap between the current theoretical-metaphorical model and rigorous empirical testing, progressively grounding cognitive relativity in measurable psychological and neurophysiological phenomena.

It is important to acknowledge explicitly that, at this stage, these proposed measures remain illustrative rather than definitive. However, continuous advancement in neuroimaging and computational neuroscience techniques may soon permit more accurate and reliable quantifications, validating cognitive relativity’s empirical credibility.

In summary, while acknowledging current empirical limitations, this section illustrates potential methodological pathways through which cognitive curvature and cognitive gravity could become opera-

tionalizable constructs, enhancing the practical applicability and scientific rigor of the cognitive relativity framework.

6.1 Ethical Considerations and Psychological Autonomy

An essential consideration in applying Cognitive Relativity and Pure Reason methodologies lies in respecting the psychological autonomy of individuals. Exploration and intervention into one’s cognitive and psychological processes are only meaningful and ethically acceptable when voluntarily undertaken. Cognitive self-awareness and deliberate metacognitive reflection, which form the core of Pure Reason, inherently require developed critical thinking, profound self-honesty, and recognition of one’s own biological and evolutionary nature.

It must be explicitly recognized that the metaphorical concept of cognitive exploration has no legitimate intruders—no external entity can ethically or effectively impose cognitive recalibration or metacognitive reflection against one’s will. Effective cognitive intervention presupposes an individual’s genuine interest in understanding and improving their cognitive landscape. Without a sincere desire to introspect and critically engage with one’s own cognitive biases and evolutionary constraints, attempts at cognitive restructuring or bias mitigation will remain superficial and ineffective.

Therefore, fostering cognitive relativity through Pure Reason relies fundamentally upon personal readiness, openness, and informed consent. This aligns with ethical standards that emphasize respect for individual autonomy and the principle of self-directed psychological exploration.

7 Pure Reason as a Metacognitive Methodology

To operationalize Cognitive Relativity, we introduce *Pure Reason* as a structured metacognitive methodology. Unlike Kant’s original conception—where Pure Reason denotes innate, *a priori* cognitive faculties—our model redefines it as an active cognitive strategy explicitly aimed at self-reflection, critical examination of biases, and systematic cognitive restructuring [13, 11].

7.1 Mechanisms of Pure Reason

Pure Reason employs several mechanisms designed to identify and overcome cognitive distortions:

- **Reflective Self-Awareness:** Continuous monitoring and questioning of one’s cognitive processes to recognize underlying biases and assumptions.
- **Hypothetico-Deductive Reasoning:** Systematic generation and testing of hypotheses to challenge existing cognitive schemas and biases.

- **Perspective-Taking and Frame Integration:** Intentional practice of adopting alternative cognitive frames to integrate multiple viewpoints into a more comprehensive understanding.
- **Cognitive Calibration:** Adjusting cognitive frames to reduce distortion, enhance accuracy, and approximate objective understanding more closely.

7.2 Application in Artificial Intelligence

Integrating Pure Reason into artificial intelligence offers potential enhancements in cognitive flexibility and adaptive reasoning. AI systems employing Pure Reason methodologies could autonomously detect internal inconsistencies, correct biases within their models, and dynamically adapt their cognitive frameworks based on reflective evaluation. This capability represents a significant advancement toward genuinely reflective and context-aware AI systems, capable of engaging in metacognitive self-correction [21, 14].

8 Empirical Foundations: Cognitive Psychology and Neuroscience

The theoretical propositions of Cognitive Relativity and Pure Reason are strongly supported by empirical research in cognitive psychology and neuroscience, especially through studies on cognitive biases, dual-process theories, and neural correlates of metacognition.

8.1 Dual-Process Theory

Dual-process theories, notably Kahneman and Tversky’s Systems 1 and 2, provide an empirical basis for understanding the cognitive relativity model. System 1 operates quickly, intuitively, and automatically, relying heavily on heuristics. In contrast, System 2 is deliberate, slow, analytical, and capable of logical reflection [11]. Pure Reason explicitly leverages System 2 to counteract the automatic biases of System 1, reinforcing the metacognitive capacity for self-reflection and bias correction.

8.2 Cognitive Biases and Empirical Evidence

Numerous empirical studies document the pervasive influence of cognitive biases—systematic deviations from rational judgment that arise from heuristic processing. For instance, the anchoring effect demonstrates how arbitrary initial information significantly influences subsequent judgments [23]. Similarly, framing effects show that individuals’ decisions differ dramatically based on contextually varying presentations of equivalent choices [12]. These biases empirically validate the concept of cognitive gravity, illustrating how cognitive frames systematically distort judgment.

8.3 Neuroscientific Insights into Metacognition

Recent advances in neuroscience provide further empirical validation for the model. Neuroimaging studies demonstrate that regions such as the anterior cingulate cortex (ACC) and the prefrontal cortex (PFC) are centrally involved in metacognitive processes like error detection, cognitive control, and reflection on one’s own cognitive states [3]. These findings support the feasibility of metacognitive training (Pure Reason), which enhances cognitive flexibility by strengthening neural pathways associated with reflective and corrective cognition.

8.4 Limitations of Empirical Evidence

While empirical foundations presented rely on established cognitive science and neuroscientific literature, practical validation of Cognitive Relativity and Pure Reason methodologies remains limited. Given the exploratory and interdisciplinary nature of this work—conducted independently and without extensive experimental resources—the initial validation primarily arises from theoretical coherence and conceptual synthesis. Future studies, ideally conducted in collaboration with specialized research institutions, should incorporate rigorous experimental validation to further substantiate these concepts empirically.

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The detailed technical considerations and practical implementation strategies for integrating Cognitive Relativity and Pure Reason into AI architectures will be comprehensively explored in subsequent dedicated research.

9 Potential Limitations and Risks

Despite the proposed model’s comprehensive theoretical structure and potential practical benefits, several limitations and risks must be addressed:

- **Resistance to Cognitive Change:** Individuals often exhibit significant resistance to metacognitive interventions, particularly when deeply ingrained cognitive biases or core identity beliefs

are challenged. Implementing Pure Reason methodologies may face practical difficulties related to motivational and psychological resistance.

- **Complexity of Metacognitive Training:** Effective metacognitive training requires significant intellectual investment, structured educational interventions, and sustained practice, posing challenges for widespread adoption without dedicated resources or expertise.
- **Misinterpretation and Misapplication:** Metaphorical concepts from relativity, if misunderstood or misapplied, could inadvertently lead to confusion or reinforcement of relativistic skepticism rather than the intended enhancement of epistemic clarity.

Acknowledging these challenges is essential for responsible and realistic implementation and provides clear directions for subsequent empirical and practical research.

10 Practical Implications and Applications

The proposed Cognitive Relativity framework and Pure Reason methodology hold significant practical implications across multiple domains, including education, ethics, artificial intelligence, and public discourse.

10.1 Educational Implications

Educational curricula can integrate Cognitive Relativity by explicitly teaching students about cognitive biases and training them in Pure Reason practices. Such education fosters critical thinking, cognitive flexibility, and enhanced ability to engage with diverse perspectives, preparing students to navigate complex societal issues effectively [22].

10.2 Ethical and Social Discourse

Applying Pure Reason in ethics and social discourse promotes epistemic humility and openness to dialogue. Recognizing that moral judgments are context-dependent and subject to cognitive biases encourages greater tolerance and nuanced understanding in polarized discussions, potentially reducing social conflict and facilitating consensus [6].

10.3 Artificial Intelligence Development

Incorporating Cognitive Relativity principles into AI systems significantly enhances their adaptability and ethical alignment. AI designed with metacognitive capabilities (Pure Reason) can autonomously identify and mitigate biases in their decision-making processes, thus improving reliability, transparency,

and ethical acceptability in critical applications such as healthcare, governance, and social media moderation [20].

10.4 Decision-Making and Policy Formulation

In decision-making and public policy formulation, employing Pure Reason methodologies ensures comprehensive consideration of diverse cognitive frames and deliberate reflection on biases influencing policy choices. Such practices can lead to more robust, balanced, and broadly acceptable outcomes in governance and organizational contexts [16].

11 Conclusion and Future Directions

This paper has introduced Cognitive Relativity, an innovative epistemological framework metaphorically inspired by Einstein’s relativity theories. The model conceptualizes human cognition as inherently frame-dependent, shaped significantly by contextual influences and cognitive biases. By employing metaphors such as cognitive gravity, cognitive curvature, and cognitive frames, we have articulated a coherent theoretical structure to analyze and mitigate cognitive distortions systematically.

Central to this model is Pure Reason, redefined as an active metacognitive practice that enables deliberate frame-shifting, reflective self-awareness, and systematic bias reduction. This methodological approach integrates insights from philosophy, cognitive science, neuroscience, and artificial intelligence, promising significant advancements in understanding and improving human cognition and decision-making.

11.1 Summary of Contributions

The contributions of this research include:

- A robust theoretical synthesis integrating philosophical, cognitive-scientific, and artificial intelligence perspectives.
- The development of a systematic metaphorical vocabulary (cognitive frame, cognitive gravity, cognitive curvature) that clearly communicates complex cognitive phenomena.
- A practical metacognitive methodology—Pure Reason—for overcoming cognitive biases and enhancing cognitive flexibility and epistemic humility.
- Clear implications for practical applications across diverse fields such as education, ethics, policy formulation, and artificial intelligence design.

11.2 Future Research Directions

To further advance the Cognitive Relativity framework, future research should consider:

1. **Empirical Validation:** Designing experimental studies and longitudinal interventions to empirically test the efficacy of Pure Reason methodologies in reducing cognitive biases and enhancing decision-making.
2. **Neuroscientific Investigations:** Exploring neural correlates of cognitive frame-shifting and metacognitive practices through advanced neuroimaging techniques.
3. **AI Implementation and Testing:** Developing and testing reflective AI systems based on Cognitive Relativity principles, evaluating their effectiveness in dynamic, real-world environments.
4. **Interdisciplinary Integration:** Further interdisciplinary research to refine and expand the theoretical and practical aspects of Cognitive Relativity by incorporating insights from psychology, philosophy, neuroscience, and artificial intelligence.

In conclusion, Cognitive Relativity and Pure Reason offer a promising interdisciplinary framework for advancing our understanding of cognition, mitigating biases, and fostering a more reflective and adaptable intellectual culture.

Addressing Potential Critiques

Given the innovative nature of Cognitive Relativity, some readers might prematurely associate it with epistemological relativism or absolutism. To preemptively address these concerns, we clarify explicitly: Cognitive Relativity neither implies absolute truth claims nor endorses radical relativism. Instead, it posits truth as a dynamic, asymptotic process. A comprehensive philosophical and theoretical justification of this position, along with its clear distinctions from classical relativism and absolutism, will be provided in a forthcoming dedicated publication.

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