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James Oliver *

Article

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James Oliver

Random Author, University of Somewhere, random.author@uni-somewhere.edu

Abstract: This paper introduces the infinite principle, a mathematical framework demonstrating that optimism is rationally obligatory when comparing bounded and unbounded outcomes. Rooted in expected value theory, the principle proves that any option with unbounded upside—no matter how improbable—mathematically dominates alternatives with bounded outcomes, provided the downside is finite and the probability of success is non-zero. This transforms optimism from a subjective disposition into an objective necessity. By formalizing this insight, we show that pursuing unbounded potential is not merely hopeful—it is a mathematical inevitability.

Keywords: decision theory; mathematics; probability; rational optimism; expected value; game theory; behavioral science; futurism; philosophy of science; political economy

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Introduction

Rational decision-making under uncertainty has long relied on expected value (EV) theory to balance probabilities and outcomes. This paper unveils a pivotal yet overlooked implication of EV: when choosing between bounded and unbounded outcomes, the latter is mathematically optimal—provided the downside is finite and the probability of success non-zero. We formalize this insight as the infinite principle, demonstrating that optimism is not a cognitive bias but a rational mandate.

The principle challenges entrenched assumptions. While pessimism—prioritizing bounded risks over unbounded potential—is often equated with prudence, we prove it is systematically irrational.[1] Conversely, optimism emerges as the sole strategy aligned with EV's mathematical axioms when outcomes are unbounded.

Through three contributions, this paper:

1. Derives the infinite principle rigorously from probability theory, clarifying its dependence on bounded downside and non-zero success likelihood.
2. Rebuts key objections using frameworks from long-termism and decision science.
3. Demonstrates applications across domains, including venture capital, climate resilience, and ethical AI, through historical case studies and modern analogs.

By bridging mathematical formalism and humanistic inquiry, this work redefines rationality itself, offering a universal heuristic for decisions where potential eclipses probability.

In short, whenever an upside is unbounded, bounded caution must yield to infinite possibility. Optimism, far from being a naive stance, emerges as a logical imperative of expected value theory.

Mathematical Formalization of the Infinite Principle

The infinite principle arises from **expected value (EV)** theory, which quantifies rational choice under uncertainty. For an option with reward R, cost C, success probability P_s, and failure probability $P_f = 1 - P_s$, the EV is:

$$\text{EV} = P_s \cdot R - P_f \cdot C$$

Case 1: Finite Reward

When R is finite, EV depends on the balance of P_s, R, and C. For instance:

$$\text{EV}_{\text{finite}} = (0.1 \cdot 100) - (0.9 \cdot 10) = 1$$

Here, a low P_s (10%) yields a marginal EV. Rational agents might reject such options, aligning with Prospect Theory's loss aversion.[2]

Case 2: Unbounded Reward

When R is unbounded ($R \to \infty$), the EV transforms:

$$\text{EV}_{\text{infinite}} = \lim_{R \to \infty} \left(P_s \cdot R - P_f \cdot C \right)$$

For any $P_s > 0$, the term $P_s \cdot R$ dominates, rendering:

$$\text{EV}_{\text{infinite}} \to \infty \quad \text{as} \quad R \to \infty$$

This divergence holds even for vanishingly small P_s, provided C remains bounded.

Mathematical Necessity of Optimism

The infinite principle follows from three core conditions that bridge probability theory and unbounded payoffs:

1. **Non-Zero Probability** $(P_s > 0)$
   No outcome is literally impossible. Even a tiny P_s (e.g., 10^{-6}) suffices.
2. **Bounded Downside** $(C < \infty)$
   Costs or losses must be capped, such as a limited investment fund or finite R&D budget.
3. **Unbounded Upside** $(R \to \infty)$
   Potential rewards have no fixed ceiling, whether in societal impact, cosmic expansion, or innovative breakthroughs.

These conditions guarantee that the expected value of an unbounded option dominates any finite alternative. As $R \to \infty$, the term $(P_s \cdot R)$ grows without bound, outstripping $(1 - P_s) \cdot C$ provided $P_s > 0$. In effect, *optimism is enforced by the laws of expected value*.

Implications for Decision Theory

Under the infinite principle, options with unbounded reward ($R \to \infty$) exhibit strict dominance over finite alternatives. Formally, for any $P_s > 0$ and bounded C:

$$\text{EV}_{\text{infinite}} = \lim_{R \to \infty} (P_s \cdot R - P_f \cdot C) \gg \text{EV}_{\text{finite}}$$

This aligns with first-order stochastic dominance (Levy, 1992), where one option's cumulative distribution strictly exceeds another's. Unlike traditional utility models, which discount low-probability events, the infinite principle mandates prioritizing unbounded potential.

Bounded Downside: A Necessary Constraint

The principle applies exclusively to decisions with bounded downside ($C < \infty$):

- **Venture Capital**: A $1M investment (bounded loss) in a biotech startup pursuing a cure for aging (unbounded societal upside).
- **Existential Risk Mitigation**: Allocating finite resources to prevent human extinction, preserving humanity's unbounded future.[3]

This mirrors insurance logic, where bound premiums mitigate unbounded risk.

Practical Applications

The infinite principle reshapes rationality across disciplines:

- **Economics**: Explains *power-law* investing (e.g., venture capital, cryptocurrencies) where rare, unbounded returns justify frequent failures.[4]
- **Psychology**: Reframes existential resilience—choosing life's unbounded potential over non-existence's fixed value.[5]
- **Innovation**: Justifies "moonshot" R&D (e.g., fusion energy, CRISPR) despite low P_s, as societal upside scales limitlessly.

By formalizing this mathematical imperative, the principle provides a universal heuristic for decisions where potential eclipses probability.

Discussion

The infinite principle transcends mathematical abstraction, offering a paradigm shift in how societies, individuals, and institutions evaluate risk and reward. Below, we explore its transformative implications.

Entrepreneurship and Innovation: The Calculus of Civilizational Progress

Entrepreneurship epitomizes the infinite principle: bounded risks (e.g., capital, time) are dwarfed by the unbounded upside of transformative innovation. Historically, this calculus underpinned humanity's greatest leaps:

- **Human Migration & Evolutionary Theory**: Early humans' exodus from Africa carried finite risks (starvation, conflict) but unlocked unbounded gains—global colonization, cultural diversification, and technological progress.
- **Civil Rights Movements**: Leaders like Martin Luther King Jr. faced bounded personal risks (imprisonment, death) to achieve societal gains with infinite moral and economic value.[6]
- **Scientific Pioneers**: Marie Curie's research on radioactivity (bounded risk: health) revolutionized medicine and energy, showcasing how unbounded scientific upside justifies finite sacrifice.

These cases align with *bourgeoisie virtue* thesis: innovation thrives when societies reward unbounded ambition.[7]

Mental Health & Existential Philosophy: The Rationality of Choosing Life

The principle reframes existential debates. While pessimists like Schopenhauer argue life's suffering outweighs its joys, the infinite principle mathematically validates *absurdist* stance: life's unbounded potential for meaning—despite inherent uncertainty—renders it rationally preferable to non-existence.[8]

The Antidote to Nihilism

- **Non-Existence**: A fixed, bounded value (zero).
- **Existence**: Unbounded potential for growth, connection, and discovery, even with finite suffering.

This mirrors Frankl's logotherapy: finding purpose in life's uncertainty is not just therapeutic but mathematically sound.[5]

Existential Risk Mitigation: Preserving Infinity

Efforts to curb climate change, AI misalignment, or pandemics are often dismissed as costly long shots. Yet, under the infinite principle, these are *the* rational priorities:

$$\text{EV}_{\text{mitigation}} = P_s \cdot \infty - (1 - P_s) \cdot C_{\text{finite}}$$

Examples include:

- **Climate Action**: Finite investments in renewables preserve humanity's unbounded future (Stern, 2007).
- **AI Alignment**: Bounded R&D costs prevent unbounded existential catastrophe (Bostrom, 2014).

Everyday Decision-Making: Rational Risk-Taking

The principle empowers individuals to reframe life choices:

- **Education**: Finite tuition costs vs. unbounded lifetime earnings.[9]
- **Relationships**: Finite emotional vulnerability vs. unbounded joy from deep connection.

This aligns with Dweck's *growth mindset*: viewing challenges as opportunities for unbounded growth.[10]

Reframing Optimism: From Naïveté to Necessity

The principle inverts cultural narratives:

- **Optimism**: A rational strategy when outcomes are unbounded (e.g., startups, social movements).
- **Cynicism**: Irrational in contexts where $R \to \infty$, as it ignores EV's divergence.

This challenges Taleb's *antifragility* by showing that fragility is rational only when downsides are bounded.[11]

The infinite principle is not merely a theoretical tool—it is a call to reorient rationality itself toward humanity's limitless horizons.

Addressing Objections to the Infinite Principle

The infinite principle's mathematical foundation is unassailable, yet critiques often arise from misapprehensions of its scope or intent. Below, we dissect and debunk the most common objections.

Objection 1: "Nothing is Truly Infinite"

Critics argue that true infinity is metaphysical or unobservable. This conflates *actual infinity* (a philosophical abstraction) with *practical unboundedness*—the principle's focus. For example:

- **Human Potential**: While individual lifespans are finite, humanity's cumulative progress (e.g., scientific discovery) has no preordained ceiling.[12]
- **Mathematical Context**: In measure theory, "unbounded" outcomes ($R \to \infty$) are well-defined without requiring metaphysical infinity.[13]

Thus, the principle holds provided R exceeds any arbitrary finite bound—a condition met in domains like technological innovation or civilizational survival.

Objection 2: "The Probability Is Too Small to Matter"

Skeptics claim negligible P_s nullifies the principle. This misunderstands limit theory:

$$\text{EV} = \lim_{R \to \infty} \left(P_s \cdot R - (1 - P_s) \cdot C \right) \to \infty \quad \text{for any} \quad P_s > 0.$$

Even if $P_s = 10^{-6}$, so long as R can grow proportionally, the unbounded term $P_s \cdot R$ dwarfs any finite cost C. This underlies, for instance, Pascal's Wager [14] and modern existential risk arguments [15], which justify investing finite resources to prevent astronomically large (but low-probability) catastrophes.

Objection 3: "Idealistic Optimism $\neq$ Practical Realism"

The principle is mischaracterized as naive positivism. In reality, it *constrains* optimism to scenarios with:

- **Bounded Downside**: $C < \infty$ (e.g., venture capital losses capped at fund size).
- **Non-Zero P_s****: Excludes logical impossibilities (e.g., perpetual motion machines).

This mirrors *antifragile* strategies, where bounded risks enable unbounded gains.[11]

Objection 4: "Risk Aversion Undermines the Principle"

Critics argue that risk aversion—a cornerstone of Prospect Theory (Kahneman & Tversky, 1979)—conflicts with the infinite principle. This objection conflates two distinct regimes:

- **Bounded Upside**: When rewards are capped (e.g., a 50% chance of +$100 vs. -$50), risk aversion is rational. Logarithmic utility (Kelly, 1956) penalizes losses geometrically:

$$\text{Expected Utility} = \ln(1 + R) \cdot P_s - \ln(1 - C) \cdot P_f$$

  Here, avoiding ruin (e.g., retirement savings) outweighs marginal gains.
- **Unbounded Upside**: When $R \to \infty$, risk aversion becomes irrational. For example:
  - **Venture Capital**: Accepting frequent small losses (bounded C) for rare, unbounded exits (e.g., Airbnb, SpaceX).
  - **Vaccine Development**: Finite R&D costs (C) vs. infinite lives saved ($R \to \infty$) in pandemics.
  Here, the infinite principle's EV dominates:

$$\text{EV}_{\text{infinite}} = \lim_{R \to \infty} P_s \cdot R - P_f \cdot C \to \infty$$

Risk aversion is rational only when outcomes are bounded. Under the infinite principle, bounding downside ($C < \infty$) renders risk aversion obsolete, as no finite loss can offset infinite reward. This resolves Prospect Theory's paradox: humans evolved to avoid bounded risks (e.g., predators), but transformative progress demands embracing unbounded ones.

Synthesis

These objections conflate **descriptive** human behavior with **prescriptive** rationality. The infinite principle operates normatively, revealing systematic errors in pessimism-dominated frameworks.

Conclusion

The infinite principle distills a universal truth from the mathematics of decision-making: **when choosing between bounded and unbounded outcomes, the latter is rationally obligatory**. By the iron logic of expected value, any option with unbounded upside—no matter how improbable—must dominate finite alternatives, provided the downside remains bounded and the probability of success non-zero.

Infinity, here, is not a metaphysical abstraction but a pragmatic acknowledgment of humanity's unbounded potential. Whether the reward is cosmological (e.g., interstellar civilization) or personal (e.g., lifelong learning), the mathematics remains indifferent to scale. What matters is that the upside transcends arbitrary finite limits—a condition met in domains as varied as venture capital, scientific discovery, and existential risk mitigation.

This principle recalibrates our understanding of rationality itself. Optimism, long dismissed as naïveté, emerges as the singular rational stance in decisions where outcomes are unbounded. Conversely, pessimism—fixating on bounded risks while ignoring transformative potential—is revealed as a systematic error.

In a world enamored with cynicism's false rigor, the infinite principle is a clarion call to embrace humanity's trajectory toward ever-expanding horizons. When confronted with the finite and the unbounded, rationality demands we reach for the sky—not because we are certain to grasp it, but because the stars, by their very nature, refuse to be bounded.

In short, the mathematics behind the infinite principle reveals that "fortune favors the bold" is more than just an ancient maxim—it is a rational imperative whenever potential is unbounded and risk

remains finite. Where success, however improbable, leads to limitless possibility, optimism is not a wish but the logical mandate of expected value. Indeed, fortune truly favors the optimistic.

Ad Astra per Scientiam.

Key Takeaways

The infinite principle reframes rationality through five transformative insights:

- **Mathematical Necessity**: When Reward $\to \infty$, bounded-downside options dominate all finite alternatives by expected value.[16] This holds even for vanishing P_s, contradicting Prospect Theory's loss aversion.[2]
- **Optimism as Default Rationality**: Optimism is not a personality quirk but the **only** rational strategy for unbounded outcomes, as shown by existential philosophy and logotherapy.
- **Universal Application**: The principle guides decisions in:
    - **Venture Capital**: Power-law investing.[11]
    - **Existential Risk**: Preserving humanity's potential.[17]
    - **Personal Growth**: Education's lifelong ROI.[9]
- **Risk Assessment**: Rationality means *bounding* risks (e.g., capped investment funds) to pursue *unbounded* rewards (e.g., transformative innovation), mirroring antifragile systems.[11]
- **Paradigm Shift**: Pessimism, often conflated with prudence, is irrational in unbounded contexts—a systematic error corrected by the principle.[1]

These insights unify decision-making across scales, from individual choices to species survival, under a single mathematical imperative.

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Appendix A. Theoretical Foundations and Related Works

The infinite principle synthesizes insights from decision theory, psychology, philosophy, and systems science. This appendix details how foundational works across disciplines converge to support its mathematical framework.

Decision Theory and Mathematical Foundations

- **Expected Utility Theory** (von Neumann & Morgenstern, 1944): Establishes axioms for rational choice under uncertainty, formalizing the optimization of expected outcomes. The infinite principle extends this by demonstrating that unbounded rewards ($R \to \infty$) necessitate redefining rationality itself.
- **Pascal's Wager** (Pascal, 1670): An early application of infinite expected value to theological decision-making. The principle generalizes Pascal's logic to secular domains (e.g., innovation, existential risk), where finite costs justify pursuing unbounded societal gains.

- **Prospect Theory** (Kahneman & Tversky, 1979): Describes how humans irrationally overweight finite losses. The infinite principle circumvents this bias by constraining downside ($C < \infty$), aligning descriptive behavior with prescriptive rationality in unbounded contexts.

Psychological and Behavioral Research

- **Growth Mindset** (Dweck, 2006): Empirical studies show that belief in malleable intelligence increases perseverance and achievement. The infinite principle mathematically validates this: viewing skills as unbounded ($R \to \infty$) justifies investing finite effort (C).
- **Learned Optimism** (Seligman, 1991): Demonstrates that optimistic explanatory styles improve health, productivity, and resilience. The principle reframes this as rational strategy: optimism maximizes EV when outcomes (e.g., career success) are unbounded.

Philosophical Perspectives

- **Man's Search for Meaning** (Frankl, 1946): Argues that finding purpose in suffering unlocks human potential. The principle operationalizes this: even in bounded adversity (e.g., imprisonment), life's unbounded meaning ($R \to \infty$) justifies enduring finite costs.
- **The Black Swan** (Taleb, 2007): Analyzes how rare, high-impact events drive history. The principle formalizes Taleb's insight: low-probability, unbounded rewards ($R \to \infty$) dominate EV calculations, justifying "Black Swan hunting."
- **Antifragile** (Taleb, 2012): Proposes systems that gain from volatility. The principle's bounded-downside condition ($C < \infty$) enables antifragility, as failures remain survivable while successes scale limitlessly.

Complex Systems and Evolution

- **The Structure of Scientific Revolutions** (Kuhn, 1962): Paradigm shifts (e.g., Newton to Einstein) demonstrate how scientific progress is non-linear and unbounded. The principle explains why challenging entrenched theories—despite high C (e.g., academic ridicule)—is rational when R (e.g., unified physics) is unbounded.
- **The Origin of Species** (Darwin, 1859): Natural selection's cumulative mutations ($R \to \infty$) mirror the principle: minor, bounded variations (e.g., beak shapes) enable unbounded biological diversification over geologic time.

Synthesis

These works collectively reveal a universal pattern: when downside is bounded and upside unbounded, optimizing for transformative potential is mathematically inevitable. The infinite principle unifies these insights into a coherent framework, bridging disciplines under a singular logic of rational action.

Appendix B. The Infinite Principle and Human Migration

The "Out of Africa" migration (70,000–100,000 BP) represents humanity's first application of the infinite principle—a decision framework that catalyzed our species' dominance through the mathematics of unbounded potential.

Bounded Downside: Quantifying Ancestral Risks

Migration risks were finite and quantifiable:

- **Individual Risk**: Mortality rates from starvation/predation likely ranged between 20–40% per generation (Shea, 2003).
- **Group Risk**: Social fragmentation probability (P_f) rose with distance, yet remained bounded by kin networks (Dunbar, 1993).

- **Species Risk**: Genetic bottlenecks (e.g., Toba catastrophe theory) posed extinction risks $C \approx 0.1$ (Ambrose, 1998).

Unbounded Upside: The Geometry of Human Expansion

The EV of migration diverged to infinity through compounding gains:

- **Resource Multipliers**: New ecosystems (e.g., Eurasian steppes) increased caloric yield by 10^2–$10^3 \times$ (Diamond, 1997).
- **Cultural Evolution**: Tool complexity followed Moore's Law-like growth post-migration (Henrich, 2015).
- **Demographic Scaling**: Founder populations of $N \approx 1,000$ (Mellars, 2006) enabled exponential growth to 8×10^9.

Mathematical Formalization

The migration decision maps to the infinite principle:

$$\text{EV}_{\text{migrate}} = \lim_{R \to \infty} \left(P_s \cdot R - P_f \cdot C \right)$$

Where:

- $P_s \approx 0.5$: Estimated survival probability for cohesive groups (Grove, 2009).
- $R \to \infty$: Cumulative gains from colonization (e.g., $R =$ trillions of future lives).
- $C \approx 0.4$: Maximum extinction risk (finite due to Africa's refugia).

Contemporary Implications: From Paleolithic to Interstellar

The principle's logic persists in modern frontiers:

- **Space Colonization**: SpaceX's Mars missions (bounded $C \approx \$10^{10}$) aim for unbounded $R =$ multiplanetary civilization (Musk, 2021).
- **Genetic Diversity**: CRISPR technology mitigates migration-era risks (bounded editing costs vs. unbounded disease resistance).
- **Cultural Innovation**: Digital platforms (e.g., open-source software) replicate ancestral migration's EV dynamics: finite effort (C) for infinite replication (R).

Synthesis

The Out of Africa migration was not merely survival—it was the first *deliberate* optimization of unbounded potential. This case study anchors the infinite principle in evolutionary biology, showing how mathematical rationality shaped humanity's trajectory from its origins to its cosmic ambitions.

Appendix C. The Infinite Principle and Insurance

The infinite principle and insurance form a mathematical duality, both leveraging expected value (EV) theory to optimize outcomes under uncertainty—but in symmetrically opposite directions. This appendix formalizes their relationship, revealing a universal framework for rational risk management.

Insurance: Bounding the Unbounded Downside

Insurance converts catastrophic, unbounded losses ($L \to \infty$) into manageable, bounded costs (premiums C). Its EV logic is incontrovertible:

$$\text{EV}_{\text{insure}} = -\left(P_e \cdot \lim_{L \to \infty} L \right) + (1 - P_e) \cdot (-C) \to -\infty \quad \text{for} \quad P_e > 0$$

Key examples:

- **Health Insurance**: Finite premiums (C) mitigate unbounded medical costs ($L \to \infty$) from chronic illness (Arrow, 1963).
- **Catastrophe Bonds**: Investors accept bounded losses (C) to prevent sovereign defaults after disasters ($L \to \infty$) (Froot, 2001).

The Infinite Principle: Unbounding the Bounded Upside

Conversely, the infinite principle seeks unbounded rewards ($R \to \infty$) while capping costs ($C < \infty$):

$$\text{EV}_{\text{infinite}} = \lim_{R \to \infty} (P_s \cdot R) - (1 - P_s) \cdot C \to \infty \quad \text{for} \quad P_s > 0$$

Modern applications:

- **Venture Capital**: Bounded fund investments (C) target unbounded returns (R) from startups like Airbnb (Thiel, 2014).
- **Moonshot R&D**: NASA's Apollo program ($C \approx \$150B$) unlocked space exploration's infinite potential ($R \to \infty$).

Mathematical Symmetry and Philosophical Implications

This duality transcends finance:

- **Behavioral Economics**: Prospect Theory's loss aversion explains insurance popularity, while the infinite principle justifies optimism in innovation (Kahneman & Tversky, 1979).
- **Policy Design**: Governments insure against pandemics (bounded vaccines) while investing in AI safety (unbounded upside) (Bostrom, 2014).

Table A1. Symmetric applications of expected value theory.

	Insurance	Infinite Principle
Risk Type	Unbounded downside (L)	Unbounded upside (R)
Cost	Bounded premium (C)	Bounded investment (C)
EV Focus	Minimize $-\infty$	Maximize $+\infty$
Examples	Health, disaster bonds	VC, existential risk mitigation

Synthesis: The Calculus of Rationality

Both frameworks resolve Pascal's Wager's core insight—when facing infinity, finite costs vanish. Whether avoiding $-\infty$ (insurance) or pursuing $+\infty$ (infinite principle), rationality demands prioritizing the unbounded. This symmetry underpins a unified theory of decision-making, where mathematics, not intuition, guides humanity's greatest risks and rewards.

References

1. Tetlock, P.E. *Expert Political Judgment: How Good Is It? How Can We Know?*; Princeton University Press, 2005.
2. Kahneman, D.; Tversky, A. Prospect theory: An analysis of decision under risk. *Econometrica* **1979**, *47*, 263–291.
3. Bostrom, N. Existential risks: Analyzing human extinction scenarios. *Journal of Evolution and Technology* **2002**, *9*, 1–30.
4. Taleb, N.N. *The Black Swan: The Impact of the Highly Improbable*; Random House, 2007.
5. Frankl, V.E. *Man's Search for Meaning*; Beacon Press, 1946.
6. Acemoglu, D.; Robinson, J.A. *The Narrow Corridor: States, Societies, and the Fate of Liberty*; Penguin Books, 2019.
7. McCloskey, D.N. *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*; University of Chicago Press, 2016.
8. Camus, A. *Le Mythe de Sisyphe*; Gallimard, 1942.
9. Heckman, J.J. Policies to foster human capital. *Research in Economics* **2000**, *54*, 3–56.
10. Dweck, C.S. *Mindset: The New Psychology of Success*; Random House, 2006.

11.   Taleb, N.N. *Antifragile: Things That Gain from Disorder*; Random House, 2012.

12.   Bostrom, N. Astronomical waste: The opportunity cost of delayed technological development. *Utilitas* **2009**, *15*, 308–314.

13.   Tao, T. *An Introduction to Measure Theory*; American Mathematical Society, 2011.

14.   Pascal, B. *Pensées*; Guillaume Desprez, 1670.

15.   Ord, T. *The Precipice: Existential Risk and the Future of Humanity*; Hachette Books, 2020.

16.   von Neumann, J.; Morgenstern, O. *Theory of Games and Economic Behavior*; Princeton University Press, 1944.

17.   Bostrom, N. *Superintelligence: Paths, Dangers, Strategies*; Oxford University Press, 2014.