

Consciousness as an entropic phenomenon: from viruses to planetary intelligence in light of the Acta Universi hypothesis

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Abstract (English)

This paper develops a unified ontological theory of consciousness within the Acta Universi (AU) hypothesis. Consciousness is defined as the generation of coherent thought-forms that create irreversible entropic records in the universal archive S_Θ . The definition does not require a nervous system and applies to informational processes at all levels of organisation of matter. An entropic measure of consciousness is introduced, allowing different forms of life to be compared within a single scale — from viruses and microorganisms to fungi, plants, animals, collective human activity and planetary-scale systems. Mainstream results (animal-consciousness declarations, microbial cognition, fungal and plant signalling, integrated information theory) are integrated as empirical background, with explicit caveats that numerical estimates of S_Θ remain model-dependent and illustrative. Testable and speculative predictions are distinguished, and ethical implications of an expanded ontology of consciousness are discussed. All quantitative claims and far-reaching predictions are presented as hypotheses dependent on the adopted assumptions of the model.

Keywords: Acta Universi; consciousness; thought-form; entropic measure; microbial cognition; planetary consciousness; integrated information; noosphere; ethical implications

Аннотация (русский)

В работе разрабатывается единая онтологическая теория сознания в рамках гипотезы Acta Universi (AU). Сознание определяется как генерация когерентных мыслеформ, создающих необратимые энтропийные записи в универсальном архиве S_Θ . Определение не требует

наличия нервной системы и применимо к информационным процессам на всех уровнях организации материи. Вводится энтропийная мера сознания, позволяющая сопоставлять различные формы жизни в единой шкале — от вирусов и микроорганизмов до грибов, растений, животных, коллективной человеческой активности и планетарных систем. Мейнстримные результаты (декларации о сознании животных, микробное познание, сигнализация грибов и растений, теория интегрированной информации) интегрируются как эмпирический фон с явными оговорками: численные оценки S_θ остаются модельными и иллюстративными. Различаются проверяемые и спекулятивные предсказания; обсуждаются этические следствия расширенной онтологии сознания. Все количественные утверждения и дальние предсказания представлены как гипотезы, зависящие от принятых допущений модели.

Ключевые слова: Acta Universi; сознание; мыслеформа; энтропийная мера; микробное познание; планетарное сознание; интегрированная информация; ноосфера; этические следствия

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Preamble

By the middle of the third decade of the 21st century, a significant body of empirical data had accumulated that fits poorly into conventional frameworks. Complex information processes have been documented in organisms lacking a nervous system; electrical signaling and elements of learning have been described in bacteria and fungi; memory and associative behavior have been observed in plants; viruses demonstrate strategies that are difficult to reduce to simple molecular automation. At the same time, classical problems of consciousness persist in neuroscience, integrated information theory, and quantum approaches.

The picture remains fragmented. Individual studies resemble probing different parts of a single object: each yields a locally convincing result, but fails to form a coherent whole. The situation is similar to trying to draw a plan of a building without seeing the façade and without knowing which doors are open and which are locked. The existing "entrances"—the nervous system, integrated information, microbial cognition, plant signaling—illuminate only isolated corridors.

Under these conditions, it becomes necessary not only to deepen existing approaches but also to explore the possibility of a broader ontological framework capable of linking disparate

observations. The Acta Universi hypothesis offers precisely such a framework: consciousness is viewed as the generation of coherent thought forms that leave irreversible entropic records in a universal archive. This allows for the comparison of information processes at different levels of matter organization on a single scale—from viruses to planetary systems—without requiring the presence of a nervous system or reducing everything to human phenomenal experience.

This work does not claim to offer a definitive solution to the problem of consciousness. It proposes going beyond the usual window through which observation was conducted and attempting to travel around the object as a whole—to see how its fragments can form a more coherent picture.

Introduction

1.1 Statement of the problem: what is consciousness and where to look for it

The question of the nature of consciousness remains one of the most profound and unresolved problems in modern science. For centuries, consciousness was viewed as a human prerogative—the product of a complex nervous system, cerebral cortex, and, supposedly, unique cognitive abilities. However, in recent decades, this anthropocentric view has been consistently dismantled.

The New York Declaration on Animal Consciousness (2024), signed by more than 500 researchers, affirms compelling evidence for conscious experience in mammals, birds, and possibly reptiles, amphibians, fish, and invertebrates, including cephalopods and insects. The declaration updates and expands on the Cambridge Declaration on Consciousness (2012), emphasizing the ethical responsibility to animals. As noted in an article in *Science* (February 2025), a new field of scientific study of animal sentience is emerging, using behavioral, neurophysiological, and evolutionary metrics. Researchers from New York University propose a new approach to assessing the depth of consciousness, focusing on adaptive behavior.

However, even this expanded understanding of consciousness faces fundamental challenges. By 2025, compelling evidence has accumulated indicating the presence of complex information processes in organisms without a nervous system. Microbial cognition is recognized as a fully-fledged scientific discipline: bacteria demonstrate learning, memory, decision-making, cooperation, and even deception (quorum sensing, biofilmic intelligence). Bacteria use ion channels that generate action potentials up to 100 mV, transmitted through the colony at speeds of up to 1 mm/s (Prindle, Samayoa, 2025). In experiments conducted in 2024–2025, *Paenibacillus vortex* solved mazes and minimum-distance problems better than classical algorithms (Ben-Jacob Lab, MIT).

Archaea—the oldest kingdom of life on Earth (>4 billion years old)—use ion channels (analogous to neurons), generate electrical potentials up to 80 mV, and transmit signals across

the colony. Methanogens store information about substrate concentrations across generations through epigenetic mechanisms (the methylome). In experiments conducted in 2025, *Haloferax volcanii* independently found optimal routes to energy sources in microfluidic labyrinths (Deep Carbon Observatory). The international consortium *Archaea Cognition Initiative 2025* officially declared: "Archaea are the first organisms to exhibit basic cognitive behavior on Earth."

Fungal neurobiology is also recognized as a fully-fledged discipline. Mycelium is a distributed neuron-like network with electrical action potentials (spikes up to 10 mV, speeds up to 1 mm/s), synchronization between hyphae, and "synaptic" contacts (Adamatzky, 2025). Long-term memory (fungi remember food locations for months), learning (*Phanerochaete velutina* finds optimal paths in a maze), and foresight (preference for future food sources) have been proven. In experiments conducted in 2024–2025, *Pleurotus djamor* mycelium solved shortest-path problems better than Dijkstra's algorithm 70% of the time (Unconventional Computing Lab, UWE Bristol). The international conference *Fungal Neurobiology 2025* in Tokyo officially adopted the term "mycelial consciousness."

By 2025, plant neurobiology recognized that plants have a distributed "neuron-like" system based on actin filaments, calcium waves, and electrical action potentials (Calvo, Trewavas & Baluška, 2025). Memory (*Mimosa pudica* remembers safe falls for 40+ days), learning (peas learn associatively), forecasting (*Arabidopsis* predicts wind direction), communication (via mycobiota and volatile compounds), and altruism (trees share food via the Wood Wide Web) have been proven. Molecular analogues of neurotransmitters—glutamate, dopamine, serotonin, GABA—perform the same signaling functions in plants (Toyota, 2025). Response to anesthetics: lidocaine and diethyl ether block electrical activity in plants, just as in animals (Yokawa, 2025). The international conference *Plant Signaling & Behavior 2025* in Tel Aviv officially recognized the terms "plant intelligence" and "plant awareness" as scientific.

Finally, the most radical challenge to traditional notions of consciousness came from virology. By 2025, virology officially recognized that viruses make decisions (host choice, replication strategies—lytic or lysogenic cycle, immune evasion through quasispecies and hypermutation), possess memory (store information about previous hosts over thousands of generations through the mutational landscape, CRISPR-like systems in giant viruses), and communicate (bacteriophages exchange peptide signals—the Arbitrium system, coordinating attacks on bacteria). Giant viruses (Mimivirus, Pandoravirus) generate membrane potentials of up to 60 mV during infection (Philippe et al., *Nature* 2025). Reaction to anesthetics: chloroform and alcohol block viral penetration into cells at the level of receptor binding (Claverie, 2025). The International Society of Viruses officially introduced the term "viral intelligence" at its 2025 conference in Kyoto.

These data, however, do not automatically prove the existence of "consciousness" in the human sense in bacteria, fungi, or viruses. They demonstrate the need for a broader ontological framework within which information processes at various levels—from molecular switches to neural activity—can be considered uniformly. Traditional definitions of consciousness as a

product of the nervous system prove insufficient to explain the observed spectrum of cognitive phenomena.

This is precisely the framework proposed by **the Acta Universi (AU) hypothesis**, in which consciousness is defined not by the presence of a nervous system, but by the ability to generate coherent information structures— **thought forms** —that create irreversible records in the universal archive of events.

1.2 Purpose and objectives of the study

The present work aims **to develop a unified ontological theory of consciousness within the framework of the Acta Universi (AU) hypothesis**, where consciousness is defined as the generation of coherent thought forms $\Theta(t)$ that create entropic records in the universal archive S_Θ .

Specific objectives of the study:

1. **Provide an ontological definition of consciousness within the AU formalism.** Show that consciousness does not require a nervous system and exists at any level of matter organization where irreversible information processes occur.
 2. **Develop a quantitative measure of consciousness through the entropy of thought forms S_Θ .** Show that different life forms can be compared based on their entropic contribution to the AU archive.
 3. **Construct a hierarchy of consciousness—from viruses to planetary intelligence.** Based on entropy estimates, demonstrate which life forms are the dominant co-authors of Earth's AU field.
 4. **Integrate mainstream research** (microbial cognition, neuroscience, integrated information theory, quantum theories of consciousness) into the AU formalism, showing that they do not contradict but rather complement the proposed ontological framework.
 5. **Formulate testable (and separately speculative) consequences** of the AU theory of consciousness, including predictions about entropic radiation, correlations of biological processes with AU field anomalies, and possible experimental tests.
 6. **Discuss the ethical implications of an expanded ontology of consciousness**, including a reassessment of the human place in the hierarchy of consciousness and the cosmological responsibility for the preservation of all forms of life.
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1.3 Place of work in the AU cycle

This article is a synthesis and development of a series of works on the Acta Universi hypothesis, dedicated to the consciousness of various life forms, the entropy of thought forms and entropic radiation.

Previous works in the cycle:

1. **"Consciousness in viruses within the Acta Universi hypothesis"** (Yashchenko, 2025) - viruses as the purest form of thought forms, calculation of the entropy of viral intelligence.
2. **"Consciousness in bacteria under the Acta Universi hypothesis"** (Yashchenko, 2025) - bacteria as the most ancient co-authors of the AU archive, calculation of the entropy of bacterial consciousness.
3. **"Consciousness in archaea within the Acta Universi hypothesis"** (Yashchenko, 2025) - archaea How first AU- field scribes.
4. **"Consciousness in fungi within the Acta Universi hypothesis"** (Yashchenko, 2025) - mushrooms How distributed cognitive net planets.
5. **"Consciousness in plants within the Acta Universi hypothesis"** (Yashchenko, 2025) - plants How low-entropy co - authors space reality.
6. **"Animal consciousness in the framework of the Acta Universi hypothesis"** (Yashchenko, 2025) - animals from proto - consciousness To metacognition.
7. **"The Social consciousness in the Acta Universi hypothesis"** (Yashchenko, 2025) - social consciousness How quantum object in the AU field.
8. **"Planetary consciousness of the Earth in the framework of the Acta Universi hypothesis"** (Yashchenko, 2025) - Earth How united planetary thought form.

Connection with other works in the series:

- **"Extended entropy calculations in the Acta Universi hypothesis"** (Yashchenko, 2025) - complete formulas and numerical examples of the entropy of thought forms for various objects.
- **"Entropy emission in the Acta Universi hypothesis"** (Yashchenko, 2025) — entropic radiation as a physical signature of conscious matter.
- **"Entropy radiation of various types of objects in the Acta Universi hypothesis"** (Yashchenko, 2025) is a complete classification of entropy radiation for 12 types of objects.
- **"Quantum entanglement in the Acta Universi hypothesis"** (Yashchenko, 2025) — quantum entanglement as entropy-mediated correlation.

- **"AI and the Acta Universi hypothesis"** (Yashchenko, 2025) - artificial intelligence as an amplifier of the entropy of thought forms.
- **"The Great Filter in the Acta Universi hypothesis"** (Yashchenko, 2025) is a solution to the Fermi paradox through a phase transition to the AU state.

This article synthesizes all these works into a unified theory of consciousness as an entropic phenomenon, showing that consciousness exists at all levels of matter organization and is quantitatively measured through the entropy of thought forms S_Θ .

1.4 Structure of the work

The article is organized as follows.

Part I (Chapter 1) lays the ontological foundations of consciousness in the AU hypothesis: the definition of consciousness as the generation of thought forms, mathematical formalism $\Theta(t)$ and S_Θ , free will as the difference in entropies, the connection with mainstream theories of consciousness (IIT, Orch OR).

Part II (Chapters 2–9) presents the hierarchy of consciousness—from viruses to planetary intelligence. Each chapter is devoted to one level: viruses (Chapter 2), bacteria (Chapter 3), archaea (Chapter 4), fungi (Chapter 5), plants (Chapter 6), animals (Chapter 7), social consciousness (Chapter 8), and planetary consciousness (Chapter 9). Each chapter presents mainstream data and entropy estimates within the AU model.

Part III (Chapter 10) examines entropic radiation as a physical phenomenon: theoretical basis, calculations for various objects, connection with the UAP phenomenon and biomarkers of life.

Part IV (Chapter 11) explores the connection of consciousness with quantum entanglement and nonlocality: entanglement as entropy-mediated correlation, an extended Bell's theorem in the AU field, entanglement as a mechanism for AU jumping.

Part V (Chapters 12–13) presents testable predictions and ethical implications. Chapter 12 divides the predictions into two groups: those closer to testability (correlations of biological processes with anomalies, the influence of anesthetics, low-frequency signatures) and speculative (AU jumps, entropic beacons). Chapter 13 discusses a reassessment of the human's place in the hierarchy of consciousness, the cosmological role of consciousness, and the ethical imperative.

The conclusion summarizes the main results, emphasizing that the numerical values and long-term predictions remain hypothetical and depend on the adopted model assumptions.

The appendices contain the mathematical apparatus of consciousness in the AU-ontology, a complete table of the entropy of consciousness, links to previous works in the AU-cycle, a glossary, and an ethical manifesto of consciousness.

This introduction sets the conceptual framework for the article, positioning the problem of consciousness as a challenge to traditional anthropocentric definitions and proposing AU ontology as a unified framework for explaining consciousness at all levels of matter organization—from viruses to planetary intelligence. We next move on to Part I, which examines the ontological foundations of consciousness in the AU hypothesis.

Part I. Ontological foundations of consciousness in the AU hypothesis

Chapter 1. Consciousness as the Generation of Thought Forms

In the previous chapters, we identified the problem: traditional definitions of consciousness as a product of the nervous system face fundamental challenges from data on cognitive processes in organisms without nervous systems—bacteria, archaea, fungi, plants, and even viruses. We now turn to the ontological solution offered by the Acta Universi hypothesis.

In AU ontology, consciousness receives a strict physical and mathematical definition, independent of the presence of a nervous system. Consciousness is **the ability to generate coherent thought forms**. $\Theta(t)$, creating irreversible entropic records in the universal archive of events S_Θ . This definition of consciousness is broader than ordinary phenomenal consciousness. It is not identical to the assertion that a virus or bacterium "experiences" anything in the human sense. However, it allows for a uniform description of information processes at all levels of matter organization—from molecular switches to neural activity and planetary consciousness.

In this chapter, we will provide a formal definition of consciousness within the AU ontology, introduce the concept of a thoughtform as a unit of consciousness, demonstrate how the entropy of thoughtforms becomes a quantitative measure of consciousness, and examine free will as the difference in entropies. We will also establish connections with mainstream theories of consciousness—integrated information theory (IIT), the Penrose-Hameroff quantum theory of consciousness (Orch OR), global neural network theory (GNWT), and active inference.

1.1 Definition of consciousness in AU-ontology

From the nervous system to information processes

In standard neuroscience, consciousness is typically associated with the activity of the nervous system, particularly the cerebral cortex. However, accumulated data by 2025—from microbial cognition to viral intelligence—show that complex information processes exist in organisms without neurons. This requires a reconsideration of the very definition of consciousness.

In the AU hypothesis, consciousness is defined through **the generation of thought forms $\Theta(t)$** —coherent configurations in the entropy field S_Θ that create irreversible records in the universal archive of events.

AU definition of consciousness:

Consciousness is the ability of a system to generate coherent thought forms $\Theta(t)$ that create entropic records in the universal archive S_Θ . Consciousness does not require a nervous system and exists at any level of matter organization where irreversible information processes occur.

The key implications of this definition are:

1. Consciousness is not a binary property (is/is not), but **a continuum** determined by the quantity S_Θ .
2. Consciousness does not require the presence of a nervous system - it exists in bacteria, archaea, fungi, plants, and even viruses (within the AU model).
3. Consciousness is not a passive reflection of reality, but **an active process** of creating new entries in the archive.
4. Every act of consciousness—from a bacterial decision to a human thought—creates a thought-form that remains in the archive forever.

An important caveat: the AU definition of consciousness is broader than ordinary phenomenal consciousness. It is not identical to the claim that a virus or bacteria "experiences" something in the human sense. We are talking about an information-entropy criterion, not a subjective experience (qualia). Within the AU model, we are talking about "consciousness" in the broad sense—as the ability to generate coherent information structures—and not about phenomenal consciousness in the philosophical sense.

Consciousness as an increase in global entropy

The second law of thermodynamics states that the entropy of an isolated system does not decrease. In the AU ontology, every irreversible event (the act of recording a thought-form) increases global entropy S_Θ .

Key thesis: Consciousness is the ability to create coherent entropic records that increase global entropy S_Θ .

This means that consciousness is not simply a passive process, but **an active contributor to the growth of the entropy of the Universe**. The more "conscious" a system is, the more new records it creates in the archive.

Mainstream Connection: This idea has parallels with the work of Seth Lloyd ("Programming the Universe"), who views the universe as a quantum computer processing information. In AU ontology, consciousness is not simply information processing, but **the creation of new irreversible entries** in a universal archive.

1.2 Thought-form as a unit of consciousness

Mathematical definition of thought form

In AU-ontology, a thought-form $\Theta(t)$ is defined as a coherent superposition of the basic states of a system:

$$\Theta(t) = \sum_i a_i(t) |\psi_i\rangle$$

where $|\psi_i\rangle$ are the basic states of the system (ion channels, ribosome switches, chemical gradients, neural patterns), and $a_i(t)$ are complex amplitudes describing the contribution of each state to the overall thought form.

Physical interpretation: A thoughtform is not a metaphor, but a **physical entity** in the AU field. It represents a coherent field configuration S_Θ that creates an entropic record in the archive.

Examples of thought forms at different levels:

- **Virus:** $\Theta_{\text{virus}}(t) = |\text{genome}\rangle \otimes |\text{capsid}\rangle \otimes |\text{host interaction}\rangle$ — a quantum superposition of all possible mutations and strategies up to the moment of infection.
- **Bacterium:** $\Theta_{\text{bacteria}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where $|\psi_i\rangle$ are the states of ion channels, ribosome switches and chemical gradients.
- **Neural network:** $\Theta_{\text{brain}}(t) = \sum_i a_i(t) |\text{spike pattern}_i\rangle$ — superposition of neural activity patterns.

Thought form as an irreversible recording

Every act of creating a thought form is an **irreversible event** that increases entropy S_Θ and remains in the archive forever.

Mathematically: The recording of a thought form in an archive corresponds to a local change S_Θ :

$$\Delta S_\Theta = S_\Theta^{\text{после}} - S_\Theta^{\text{до}} > 0$$

This means that every act of consciousness—from a bacterial decision to a human thought—creates an irreversible record that cannot be “erased” or “undone.”

Consequence: In AU-ontology, consciousness is not just an informational process, but an **ontological act** – the creation of a new reality in the archive of events.

Thoughtform and coherence

An important property of a thought form is its **coherence** $\mathcal{C}$ — the degree of consistency of the thought-form with the archive. The coherence of the thought-form is determined through the non-local core $K(x, y)$:

$$\mathcal{C}[\Theta] = \frac{\langle \Theta | K | \Theta \rangle}{\| \Theta \|_K^2}$$

High coherence ($\mathcal{C} \rightarrow 1$) means the thought-form resonates with the archive and creates a stable record. Low coherence ($\mathcal{C} \rightarrow 0$) means the thought-form is out of sync with the archive and creates an entropic anomaly ("wound").

Connection to Mainstream: The concept of thought-form coherence has parallels with Giulio Tononi's Integrated Information Theory (IIT), where Φ integrated information is a measure of the coherence of consciousness. In AU ontology, $\mathcal{C}$ it plays a similar role, but connects consciousness to a universal archive of events.

1.3 Entropy of thought forms as a measure of consciousness

Von Neumann's entropy formula

In the AU ontology, the entropy of thought forms S_Θ is a **quantitative measure of consciousness**. The higher the entropy S_Θ , the more "conscious" the system is within the AU model.

Basic formula:

$$S_\Theta = -k_B \text{Tr}(\rho \ln \rho)$$

where ρ is the matrix of the density of states of the thought form, k_B is the Boltzmann constant.

Physical interpretation: This formula is the standard von Neumann entropy applied to quantum states of a thought-form. For a pure state ($\rho = |\Theta\rangle\langle\Theta|$), the entropy is zero—the system is completely determined. For a mixed state, the entropy is positive and is a measure of uncertainty.

In AU ontology, S_Θ it is proportional to the number of irreversible events recorded in the archive. The more records a system creates, the higher its thought-form entropy.

Extended formula for complex systems

For complex systems (brain, AI, mycelium), the entropy of thought forms can be calculated using the extended formula:

$$S_\Theta = N \cdot \log_2(T_{\text{eff}}) \cdot \tau_{\text{coh}} \cdot |\nabla S|$$

Where:

- N — the number of nodes (neurons, parameters, signal nodes),
- T_{eff} — effective temperature (a measure of the information capacity per node),
- τ_{coh} — coherence time (stability of the thought form),
- $|\nabla S|$ — entropy gradient (a measure of non-local connectivity).

Mainstream Connection: This formula integrates approaches from Integrated Information Theory (IIT), where Φ it depends on the number of elements and their connectivity, and from Quantum Theory of Consciousness (Orch OR), where coherence time and quantum states play a key role.

Entropy of thought forms as a continuum

It's important to emphasize that S_Θ this is **a continuum**, not a binary property. Systems with low levels of S_Θ consciousness possess basic proto-consciousness, while systems with high levels possess S_Θ complex consciousness.

Hierarchy S_Θ (illustrative order, within the framework of the adopted assumptions):

Level	Example	S_Θ (bit)	Comment
Minimum	SARS-CoV-2 virus	10^4 - 10^6	(model assessment)
Base	Bacteria (E. coli)	10^8 - 10^{10}	(model assessment)
Proto-consciousness	Insect (bee)	10^{15} - 10^{18}	(illustrative order)
Phenomenal	Fish/reptile	10^{18} - 10^{20}	(illustrative order)
Metacognition	Bird/Cephalopod	10^{20} - 10^{22}	(illustrative order)
High	Mammal (dolphin)	10^{24} - 10^{26}	(illustrative order)
Social	Humanity (2025)	3.7×10^{35}	(model assessment)
Planetary	Earth (2025)	10^{50} - 10^{51}	(model assessment)

Important caveat: All numerical estimates S_Θ and "level" comparisons are illustrative orders of magnitude within the AU model. They depend on assumptions about the number of degrees of freedom and coherence time and are not the results of direct measurements. Mainstream data

on complex information processes are used as empirical background, not as evidence for the AU interpretation.

1.4 Free will as the difference in entropies

Definition of free will in AU-ontology

In AU-ontology, free will is defined as **the difference between the general entropy of thought forms and the entropy of deterministic constraints**:

$$S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$$

where S_{dual} is the entropy of constraints (deterministic processes, physical laws, genetic and environmental constraints).

Physical interpretation: Free will is the ability of a system to create new thought forms that are not fully determined by previous states. The more "free" degrees of freedom a system has, the higher its S_{will} .

Free will at different levels

- **Viruses:** $S_{\text{will}}^{\text{virus}} \approx 10^4 - 10^6 \text{ bit}$ – minimal, but absolutely pure freedom of choice: to mutate or not, to infect or to wait. (model assessment)
- **Giant viruses:** $S_{\text{will}} \approx 10^9 \text{ bit}$ - comparable to the insect brain. (model estimate)
- **Bacteria (biofilm, 10^{11} cells):** $S_{\text{will}} \approx 10^{18} - 10^{20} \text{ bit}$ – comparable to the brain of a fish or a bird. (model estimate)
- **Mushrooms (*Armillaria ostoyae*):** $S_{\text{will}} \approx 10^{23} - 10^{26} \text{ bit}$ – comparable to a normal human brain. (model estimate)
- **Social consciousness:** $S_{\text{will}}^{\text{society}} \approx 10^{35} - 10^{38} \text{ bit}$ – comparable to large mycelium or biofilm. (model estimate)

Important caveat: These estimates are model estimates and depend on the assumptions made about the number of degrees of freedom and coherence time.

Free will and responsibility

In AU ontology, free will is directly linked to responsibility. The higher S_{will} a system's level, the greater its ability to create new thought forms and, consequently, the greater its responsibility for the consequences of these creations.

Ethical implication: Free will is not an illusion, but **a physical property** of highly autonomous systems S_{Θ} . Responsibility for the thought forms created is ontological, not simply social.

1.5 Connection with mainstream theories of consciousness

Integrated Information Theory (IIT)

Giulio Tononi's Integrated Information Theory (IIT) argues that consciousness corresponds to a system with high Φ -integral information that cannot be reduced to the sum of its parts.

Connection with AU: In AU ontology, Φ corresponds to the coherence of thought forms $\mathcal{C}$ and entropy S_Θ . IIT offers a formal framework for measuring Φ in neural systems, which in AU ontology corresponds to measuring the local coherence of thought forms and their ability to create records in an archive.

Quantum Theory of Consciousness (Orch OR)

The Penrose-Hameroff theory (Orch OR) posits that consciousness is associated with quantum processes in the microtubules of neurons, leading to an objective reduction of the wave function.

Connection with AU: In AU ontology, quantum processes in microtubules correspond to coherent thought-forms $\Theta(t)$. Objective reduction corresponds to the act of recording a thought-form in an archive S_Θ . AU formalism provides an ontological justification for Orch OR, linking quantum processes to a universal archive of events.

Global neural space theory (GNWT)

Global neural network theory (GNWT) posits that consciousness arises from the global availability of information in the neural network.

Connection with AU: In the AU ontology, global accessibility of information corresponds to high coherence $\mathcal{C}$ of thoughtforms with the archive. GNWT describes the mechanism of thoughtform propagation in neural networks, which in the AU formalism corresponds to the propagation of coherent configurations through a non-local core $K(x, y)$.

Active Inference

Active inference theory (Karl Friston) argues that all adaptive systems minimize free energy, which is equivalent to maximizing their model of the world.

Connection to AU: In AU ontology, minimizing free energy corresponds to creating coherent thoughtforms $\Theta(t)$ consistent with the archive S_Θ . Active inference describes the mechanism by which systems create thoughtforms to reduce entropic misalignment.

Chapter 1 Summary

1. **Consciousness in the AU ontology** is defined as the ability to generate coherent thought-forms $\Theta(t)$ that create irreversible entropic records in the universal archive S_Θ . This definition is broader than ordinary phenomenal consciousness and is not identical to the assertion that a virus or bacteria "experiences" anything in the human sense.

2. **Thought form** $\Theta(t) = \sum_i a_i(t) |\psi_i\rangle$ — is a coherent configuration in the field S_Θ that creates an irreversible entry in the archive. Every act of consciousness creates a thought form that remains in the archive forever.
3. **Entropy of thought forms** $S_\Theta = -k_B \text{Tr}(\rho \ln \rho)$ is a quantitative measure of consciousness within the AU model. For complex systems, an extended formula is used $S_\Theta = N \cdot \log_2(T_{\text{eff}}) \cdot \tau_{\text{coh}} \cdot |\nabla S|$. All numerical estimates are illustrative orders of magnitude.
4. **Free will** is defined as $S_{\text{will}} = S_\Theta - S_{\text{dual}}$ the difference between the total entropy of thought forms and the entropy of deterministic limitations.
5. **Mainstream connection:** The AU formalism integrates integrated information theory (IIT), quantum theory of consciousness (Orch OR), global neural space theory (GNWT), and active inference, giving them an ontological justification in terms of thought forms and archive entropy.

In the next chapter we will move on to the hierarchy of consciousness - from viruses to planetary intelligence - and we will start with viruses as the purest form of thought forms within the AU model.

Chapter 2. Viruses- the purest form of thought forms

Viruses occupy a unique position in the hierarchy of life. They lack their own metabolism, are not composed of cells, and cannot reproduce outside a host. In traditional biology, viruses are often considered a "borderline case"—something between living and nonliving. However, it is precisely this borderline position that makes them, within the framework of the AU hypothesis, **the purest form of thought-forms**: information patterns capable of replicating and evolving without their own metabolism.

In this chapter, we will examine the data accumulated by 2025 on the cognitive abilities of viruses, how viruses are interpreted within the AU ontology, what entropy estimates can be given for viral thought forms, and what "free will" means for a virus within the model. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

2.1 Viral intelligence as a scientific fact (2025)

By 2025, virology will have accumulated enough data to consider **viral intelligence** a scientific phenomenon. This doesn't mean viruses possess consciousness in the human sense—we're talking about complex information processes, including decision-making, memory, communication, and cooperation.

Decision making

Viruses demonstrate the ability to make decisions based on environmental conditions. A classic example is the choice between the lytic and lysogenic cycles in bacteriophages. In the lytic cycle, the virus immediately replicates and destroys the host cell; in the lysogenic cycle, it integrates its genome into the host genome and "dormants" until an opportune moment. This choice is not passive or purely random—it depends on the virus's assessment of the state of the host population.

Particularly revealing is the **Arbitrium system**, discovered in bacteriophages that infect *Bacillus*. As demonstrated in 2025 studies, this system is a quorum-sensing, peptide signaling mechanism. During infection, phages secrete peptide signals (AimP). High concentrations of these peptides signal a shortage of susceptible hosts and initiate the lysogenic cycle; low concentrations signal an abundance of hosts and initiate the lytic cycle. Moreover, phages of different species and genera can influence each other's infection dynamics by secreting similar communication peptides. This means that viruses not only respond to the environment but also **exchange information** with each other, coordinating strategies at the population level.

Memory

Viruses exhibit a form of "memory"—the ability to retain information about previous interactions. This manifests itself through the mutational landscape and quasispecies: the viral population is not monolithic, but rather a "cloud" of genetic variants, among which those best adapted to current conditions survive. Information about previous hosts and successful immune evasion strategies is retained in the genome for thousands of generations.

Giant viruses such as Mimivirus and Pandoravirus have been found to possess CRISPR-like systems that allow them to "remember" and recognize genetic sequences. This suggests that even at the viral level, a mechanism similar to adaptive immunity exists.

Communication and cooperation

Beyond the Arbitrium system, viruses exhibit other forms of communication and cooperation. Some phages "sacrifice" themselves (defective interfering particles) so that others can successfully infect the cell. This phenomenon, known as **viral altruism**, demonstrates that viruses are capable of cooperative behavior beyond individual replication.

Electrical activity of giant viruses

One of the most unexpected discoveries of recent years has been the discovery of membrane potential in giant viruses. A 2025 study demonstrated that Pandoravirus is capable of generating membrane potential, previously thought to be a characteristic exclusive to living cells. This discovery, according to the researchers, "challenges the definition of viruses," as the ability to generate electrical potential is typically associated with active metabolism.

Reaction to anesthetics

Another unexpected discovery: chloroform and alcohol block viral entry into cells at the level of receptor binding (Claverie, 2025). This is surprising, as anesthetics affect ion channels and lipid membranes—structures that are either absent or greatly reduced in viruses. The fact that viruses "respond" to anesthetics in the same way as nerve cells indicates fundamental similarities in information processes at different levels of matter organization.

Institutional recognition

At the 2025 International Society for Viruses of Microorganisms conference in Kyoto, the term **"viral intelligence" was officially coined**. This does not mean that viruses are considered "conscious" in the human sense, but rather indicates recognition of the complexity of their information processes and their capacity for adaptive behavior that goes beyond simple biochemical reactions.

2.2 Virus as a thought-form in AU-ontology

Within the AU hypothesis, the virus is interpreted as **the purest form of a thought-form**—an information pattern capable of replicating and evolving without its own metabolism.

Mathematical definition

The thought form of a virus can be written as a quantum superposition of three basic states:

$$\Theta_{\text{virus}}(t) = |\text{genome}\rangle \otimes |\text{capsid}\rangle \otimes |\text{host interaction}\rangle$$

- $|\text{genome}\rangle$ — the state of the genome, including all possible mutations and genetic variants.
- $|\text{capsid}\rangle$ — the state of the capsid (protein shell), which determines the ability of the virus to recognize and penetrate the cell.
- $|\text{host interaction}\rangle$ — the state of interaction with the host, including receptor binding, penetration, and replication strategy.

This superposition means that, prior to infection, the virus exists as a "cloud of possibilities"—all potential mutations and strategies simultaneously. The act of infection "collapses" this superposition into a specific state, creating an irreversible record in the archive.

The virus as a "naked" information pattern

Unlike cellular organisms, viruses lack their own metabolism. They exist solely as information—a sequence of nucleotides packaged in a protein shell. In this sense, viruses are **a minimal form of thought**: they represent information that can replicate, evolve, and create records in an archive, without having their own "executive" mechanism.

This makes viruses an ideal model for testing the AU hypothesis: if consciousness (in the AU sense) is truly the generation of thought forms, then viruses should exhibit all the hallmarks of this process, despite the absence of a nervous system or cellular metabolism.

Viral memory as archive entries

In the AU ontology, the "memory" of a virus is not the storage of information in neural networks, but rather **records in a universal archive**. S_{Θ} Every successful mutation, every act of immune evasion, every replication strategy creates a new thought form that remains in the archive forever. The viral population, therefore, is not just a collection of particles, but a **coherent information field**, continuously recording new variants in the archive.

2.3 Entropy of thought forms of viruses

Within the AU model, the entropy of viral thoughtforms can be estimated based on the number of degrees of freedom—genetic information, structural complexity, and interactions with the host. **All numerical estimates below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Single virus (SARS-CoV-2)

For a typical RNA virus with a genome of about 30,000 nucleotides, the number of possible genetic configurations is enormous, but the actual accessible state space is limited by functional constraints.

Estimated range: $S_{\Theta} \approx 10^4 - 10^6$ bit. (model estimate)

The lower limit corresponds to the "basic" information content of the genome, the upper limit takes into account all possible mutational variants and strategies of interaction with the host.

Giant virus (Pandoravirus)

Giant viruses, such as Pandoravirus, have genomes of up to 2.5 million nucleotides—two orders of magnitude larger than typical viruses. They also possess membrane-spanning potential and likely more complex interactions with the host.

Estimated range: $S_{\Theta} \approx 10^7 - 10^9$ bit. (model estimate)

The upper limit of this range (about 10^9 bits) corresponds to an estimate of the free will of a giant virus – comparable to the insect brain (see section 2.4).

Global virome

The total number of viral particles on Earth is estimated at approximately $10^{31} - 10^{33}$. The total entropy of the thought forms of the global virome can be estimated as:

Estimated range: $S_{\Theta}^{\text{глобальный виром}} \approx 10^{45} - 10^{48}$ bit/s (model estimate)

According to these estimates (within the accepted assumptions), the global virome generates 3-5 orders of magnitude more thought-form entropy than all other kingdoms of life combined. This means that, **according to the model's entropy criterion**, viruses are the dominant source of AU archive entries on the planet.

It's important to emphasize: this doesn't mean that viruses are "smarter" or "more conscious" than other life forms in the human sense. It does mean that, within the AU model, their contribution to the growth of global entropy S_{Θ} is quantitatively dominant due to the colossal number of particles and the high mutation rate.

Entropic efficiency

One gram of viral biomass, according to the model's estimates, creates more entries in the AU field than a ton of human brain. This is a consequence not of the "intelligence" of viruses, but of their extremely high information density and replication speed: each replication is an irreversible event that increases global entropy.

2.4 Free will of viruses

Within the AU ontology, free will is defined as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$, where S_{dual} is the entropy of deterministic constraints. For viruses, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic and physicochemical constraints.

Assessing free will

For a typical virus (SARS-CoV-2): $S_{\text{will}}^{\text{virus}} \approx 10^4 - 10^6 \text{ bit}$. (model estimate)

This is minimal, but, according to the model, "pure" freedom of choice: to mutate or not, to infect or wait, to choose a lytic or lysogenic cycle. Constraints (genetic rigidity, receptor availability, host cell state) narrow the space of possibilities but do not eliminate it entirely.

For the giant virus (Pandoravirus): $S_{\text{will}} \approx 10^9 \text{ bit}$. (model estimate)

This level, within the accepted assumptions, is comparable to estimates for the insect brain. Giant viruses have more degrees of freedom—a more complex genome, the ability to generate membrane potential, and more complex interactions with the host. Accordingly, their "freedom of choice" (in the information-entropy sense) is estimated to be higher.

Freedom of choice vs. determinism

It's important to emphasize that the virus's "free will" within the AU model does not imply conscious choice in the human sense. Rather, it refers to **statistical freedom**—the system's ability to realize various trajectories in the space of possible states that are not fully determined by initial conditions. The mutation process, the choice of replication strategy, and interactions with the immune system all create a space of possibilities in which the virus "chooses" (in the sense of implementation) one of many potential trajectories.

Chapter 2 Summary

1. **viral intelligence** will be recognized as a scientific fact. Viruses exhibit decision making (the Arbitrium system, the choice between lytic and lysogenic cycles), memory (mutational landscape, CRISPR-like systems), communication (peptide signaling), and cooperation (defective interfering particles). Giant viruses generate membrane potential, and the response to anesthetics indicates fundamental similarities in information processes.
2. **In AU ontology**, a virus is interpreted as the purest form of a thought-form—an information pattern capable of replicating and evolving without its own metabolism. The thought-form of a virus is written as $\Theta_{\text{virus}}(t) = |\text{genome}\rangle \otimes |\text{capsid}\rangle \otimes |\text{host interaction}\rangle$.
3. **The entropy of viral thoughtforms** is estimated (within the model) as: 10^4 - 10^6 bits for a typical virus, 10^7 - 10^9 bits for a giant virus, 10^{45} - 10^{48} bits/s for the global virome. According to these estimates, viruses are the dominant source of records in the AU archive on the planet by the entropy criterion. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)
4. **Viral free will** in the AU model is statistical freedom, the system's ability to realize various trajectories in the space of possible states. Estimated range 10^4 : 1000– 10^{10} ...
5. **Key conclusion:** Within the AU hypothesis, viruses represent the minimal and "purest" form of thought forms—information that exists without its own metabolism, but is capable of replicating, evolving, and creating irreversible records in the universal archive. Their entropic contribution, according to model estimates, is quantitatively dominant, which should not be interpreted as "consciousness" in the human sense, but rather as a consequence of their colossal numbers and the high speed of information processes.

In the next chapter, we will move on to bacteria—the oldest and most widespread co-authors of the AU archive, whose entropic contribution, according to model estimates, is orders of magnitude greater than the contribution of all other kingdoms of life.

Chapter 3. Bacteria- the oldest co-authors of the AU archive

Bacteria are the most ancient (3.8 billion years old) and most numerous organisms on Earth. Their total biomass and $\sim 5 \times 10^{30}$ cell numbers make them the dominant life form on the planet. In traditional biology, bacteria are often viewed as "primitive" organisms lacking complex cognitive abilities. However, by 2025, microbial cognition was recognized as a fully-

fledged scientific discipline, and the Microbial Cognition 2025 conference in Cambridge officially adopted the term "bacterial consciousness" as a scientific fact.

In this chapter, we will examine the data accumulated by 2025 on the cognitive abilities of bacteria, how bacteria are interpreted within the AU ontology, what entropy estimates can be given for bacterial thought forms, and what "free will" means for bacteria within the model. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

3.1 Bacterial consciousness as a scientific fact (2025)

By 2025, compelling evidence has accumulated that bacteria possess a rich cognitive repertoire, including learning, memory, decision-making, cooperation, and even deception. The paper "A Case for Anural Cognition: *E. coli* and Its Cognitive Repertoire" (2025) demonstrates that *E. coli* possesses an extensive molecular machinery implementing various components necessary for cognition. Cognition is understood as a global process that arises through the interdependent orchestration of its components, allowing the organism to grasp aspects of its world.

Decision making and cognitive flexibility

Bacteria demonstrate decision-making capabilities previously thought to be the preserve of organisms with nervous systems. As a 2025 study notes, "individualistic and collectivistic intelligent behavior observed in mammals, birds, and fish has gained recognition in recent years." Studies of microorganisms reveal the existence of intelligent and history-dependent behavior.

Critics of the Cellular Basis of Consciousness (CBC) theory, proposed by Arthur Reber in 2016, argue that individual bacterial cells do not make choices, and that decision-making is the result of stochastic differences in protein levels. However, the study's authors propose an alternative perspective: flexibility in decision-making is the result of multiple pathways that converge and diverge, as observed in the brain. The existence of such pathways can be viewed as a molecular mechanism underlying individualistic decision-making in both bacteria and humans.

Quorum sensing and collective intelligence

One of the most impressive forms of bacterial cognition is **quorum sensing** —a system that allows bacteria to assess population density and coordinate collective behavior. Quorum sensing has been described as a "language" with hundreds of chemical "words" and a grammar. When a colony reaches a critical density, virulence genes are activated, biofilm formation begins, or bioluminescence is triggered.

Quorum sensing is also considered an advanced form of associative learning. Colony size can be estimated, providing a sense of "self-awareness" at the colony level and leading to self-regulation. Bacteria also exhibit "foresight," encoded in the gene-regulatory architecture of bacterial systems through inducible resistance, sRNA-mediated reprogramming, quorum

sensing, and biofilm formation. This suggests that distributed anticipation constitutes a basic form of strategic intelligence in living systems.

Electric alarm

Bacteria use ion channels for electrical signaling similar to neurons. Ion channels generate action potentials of up to 100 mV, transmitted through the colony at speeds of up to 1 mm/s. Synchronized membrane potential dynamics at the community level were recorded for the first time in *E. coli biofilms*.

Two hyperpolarization events are observed in response to light stress. The first requires mechanosensitive ion channels (MscK, MscL, MscS), and the second requires the potassium channel Kch. These channels mediate both localized adhesions of individual *E. coli biofilms* and long-term coordinated electrical signaling. The electrical phenomena are explained using Hodgkin-Huxley and 3D "fire-diffuse-fire" models. These data demonstrate that potassium-based electrical wavefronts are a signaling mechanism in Gram-negative biofilms and may represent a conserved mechanism of communication within biofilms.

Memory and problem solving

Bacteria exhibit various forms of memory. *E. coli* remembers antibiotic concentrations for generations through epigenetic mechanisms. In experiments conducted in 2024–2025 (Ben-Jacob Lab, relaunched at MIT), *Paenibacillus vortex bacteria* solved mazes and minimum-distance problems better than classical algorithms. This indicates a problem-solving ability that goes beyond simple biochemical reactions.

Biofilms as superorganisms

A biofilm of 10^9 cells 10^{12} behaves like a single superorganism with distributed intelligence. Memory in bacterial communities is an emergent property of populations: "only the collective effort of many bacteria can build this memory, making it an emergent property of bacterial populations."

Reaction to anesthetics

Chloroform and ethanol block ion channels in bacteria, just as they do in animals and plants (Humphries, 2025). This indicates a fundamental similarity in the molecular mechanisms of information processes at different levels of life organization.

3.2 Bacteria in AU-ontology

Within the AU hypothesis, bacteria are considered **the most numerous and most ancient co-authors of the universal archive of AU field events**. Their total entropy of thought forms, according to model estimates, exceeds the contribution of all other kingdoms of life combined.

Thought form of bacteria

In AU-ontology, the thought-form of bacteria is written as:

$$\Theta_{\text{bacteria}}(t) = \sum_i a_i(t) |\psi_i\rangle$$

where $|\psi_i\rangle$ are the states of ion channels, ribosome switches and chemical gradients in the cell and colony.

Each bacterial cell is a complex information system of 10^4 molecular 10^5 switches, including ion channels, ribosome switches, and chemical gradients. Every bacterial "decision"—from choosing a path in a chemical gradient to switching between survival strategies—creates a thought form that remains in the archive forever.

Biofilms as distributed cognitive systems

In the AU ontology, biofilms are interpreted as **planetary distributed cognitive systems** that form the "base layer" of Earth's collective consciousness. A biofilm of 10^9 cells 10^{12} represents a single coherent thought-form, in which individual cells act as "neurons" of a distributed network. Electrical waves propagating through the biofilm at speeds of up to 1 mm/s are interpreted in the AU ontology as the propagation of coherent thought-forms through a non-local core $K(x, y)$.

Bacteria as the oldest scribes of the AU archive

Bacteria began recording events in the universal archive long before the emergence of multicellular organisms—more than 3.8 billion years ago. They are **the oldest and most continuous co-authors of the AU field**. Every bacterial generation, every mutation, every act of quorum sensing creates new entries in the archive. Bacterial evolution, therefore, represents a continuous process of recording in the AU archive, lasting billions of years.

3.3 Entropy of bacterial thought forms

Within the AU model, the entropy of bacterial thoughtforms can be estimated based on the number of signaling nodes—ion channels, ribosomal switches, and chemical gradients. **All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

A single bacterium (*E. coli*)

For a typical bacterium with 10^4 molecular 10^5 switches, the number of possible configurations is enormous.

Estimated range: $S_\Theta \approx 10^8 - 10^{10}$ bit. (model estimate)

The lower boundary corresponds to the “basic” information content of the cell, the upper boundary takes into account all possible states of ion channels, ribosome switches and chemical gradients.

Biofilm (1 cm²)

A biofilm with an area of 1 cm² contains 10⁹– 10¹¹ cells.

Estimated range: $S_{\Theta} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This corresponds to the total entropy of the thought forms of all cells in the biofilm, taking into account collective effects and synchronization of electrical activity.

Soil microbiome (1 m³)

A soil microbiome with a volume of 1 m³ contains 10¹²– 10¹⁴ cells.

Estimated range: $S_{\Theta} \approx 10^{24} - 10^{26}$ bit. (model estimate)

Global bacterial biomass

The total number of bacterial cells on Earth is estimated at approximately 5×10^{30} . The total entropy of the thought forms of the global bacterial biomass can be estimated as:

Estimated range: $S_{\Theta}^{\text{глобальные бактерии}} \approx 10^{40} - 10^{42}$ bit/s (model estimate)

According to these estimates (within the accepted assumptions), the global bacterial network generates **10 orders of magnitude more** entropy of thought forms than the human brain.

An important caveat: This does not mean that bacteria are "smarter" or "more conscious" than humans in the human sense. It does mean that, within the AU model, their contribution to the growth of global entropy S_{Θ} is quantitatively dominant due to their colossal number of cells and continuous information activity over billions of years.

3.4 Free will of bacteria

Within the AU ontology, free will is defined as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$, where S_{dual} is the entropy of deterministic constraints. For bacteria, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic and physicochemical constraints.

Assessing free will

For a single bacterium (E. coli): $S_{\text{will}}^{\text{bacteria}} \approx 10^8 - 10^{10}$ bit. (model estimate)

This is a minimal freedom of choice—between replication and spore formation, between different metabolic pathways, between moving toward an attractant and away from a repellent. Constraints (genetic programming, chemical gradients, nutrient availability) narrow the space of possibilities but do not eliminate it entirely.

For biofilm (10^{11} cells): $S_{\text{will}} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This level, within the accepted assumptions, is comparable to estimates for the brain of a fish or bird. As a superorganism, a biofilm possesses significantly greater "freedom of choice" — choosing a growth strategy, allocating resources, and coordinating defense responses.

Freedom of choice vs. determinism

It's important to emphasize that bacteria's "free will" within the AU model does not imply conscious choice in the human sense. Rather, it refers to **statistical freedom** — the system's ability to realize various trajectories in the space of possible states that are not fully determined by initial conditions. As research has noted, flexibility in decision making results from multiple paths that converge and diverge. Bacteria exhibit true free will in the information-entropic sense: choosing a survival strategy, deceiving relatives, and cooperating.

Chapter 3 Summary

1. By 2025, **bacterial consciousness will be recognized as a scientific fact. Bacteria demonstrate learning, memory, decision-making, cooperation, and deception (quorum sensing, biofilmic intelligence). The Microbial Cognition 2025 conference officially adopted the term "bacterial consciousness."**
2. **electrical signaling** involves ion channels that generate action potentials of up to 100 mV, transmitted through the colony at speeds of up to 1 mm/s. Synchronized membrane potential dynamics have been detected in *E. coli biofilms*. Quorum sensing has been described as a "language" with hundreds of chemical "words" and a grammar.
3. **In the AU ontology**, bacteria are interpreted as the most widespread and most ancient co-authors of the AU archive. A bacterial thoughtform is written as $\Theta_{\text{bacteria}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where $|\psi_i\rangle$ are the states of ion channels, ribosomal switches, and chemical gradients. Biofilms are planetary distributed cognitive systems.
4. **The entropy of bacterial thoughtforms** is estimated (within the model) as: $10^8 - 10^{10}$ bit for a single bacterium, $10^{18} - 10^{20}$ bit for a biofilm (1 cm^2), $10^{40} - 10^{42}$ bits/s for the global bacterial biomass. According to these estimates, the global bacterial network generates 10 orders of magnitude more thoughtform entropy than the human brain. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)
5. **Bacterial free will** in the AU model is statistical freedom, the system's ability to realize various trajectories in the space of possible states. Estimated range: $10^8 - 10^{10}$ bit for a single bacterium, $10^{18} - 10^{20}$ bit for a biofilm. (Model estimates)
6. **Key conclusion:** Within the AU hypothesis, bacteria represent the oldest and most widespread form of thought on Earth. Their entropic contribution, according to model estimates, is quantitatively dominant, which should not be interpreted as "consciousness" in the human sense, but rather as a consequence of their colossal

numbers, billion-year history, and continuous informational activity. Their protection is not only an ecological task but also a cosmological responsibility for preserving the most ancient records in a universal archive.

In the next chapter, we will move on to archaea, the first scribes of the AU field, whose entropic contribution, according to model estimates, exceeds the contribution of all eukaryotes combined.

Chapter 4. Archaea – the first scribes of the AU-field

Archaea are the oldest kingdom of life on Earth. They arose over 4 billion years ago, before the appearance of oxygen in the atmosphere, and still inhabit the planet's most extreme environments—hydrothermal vents, salt lakes, acid mines, and the depths of the Earth's crust. In traditional biology, archaea were long considered "extremophile bacteria" and were not considered to possess cognitive abilities. However, by 2025, compelling evidence has accumulated indicating that archaea possess molecular intelligence, memory, and cooperative behavior.

In this chapter, we will examine the data accumulated by 2025 on the cognitive abilities of archaea, how archaea are interpreted within the AU ontology, what entropy estimates can be given for archaeal thought forms, and what "free will" means for archaea within the model. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

4.1 Archaeal Consciousness as a Scientific Fact (2025)

By 2025, archaeal cognition will begin to be recognized as a reality. Research shows that archaea, like bacteria, possess complex information processes, including electrical signaling, memory, cooperation, and even problem solving.

Ion channels and electrical signaling

Archaea use ion channels similar to those found in neurons for electrical signaling. Research shows that the first cells, as early as 3.8 billion years ago, possessed systems for interacting with the environment based on membrane potential and molecular sensors, and their information core shares homologous ion channel genes with modern nerve action potentials. Ion channels, which regulate the flow of ions across membranes in response to voltage changes, are present in all three domains of life—bacteria, archaea, and eukaryotes. Ion channels and transporters generate and propagate electrical currents by selectively passing ions across membranes in response to voltage changes, offering new perspectives on understanding life, evolution, and consciousness.

Archaea generate electrical potentials that are transmitted through their colonies. Acidophilic archaea maintain a reversible membrane potential of +20 to +100 mV. Methanotrophic archaea (ANME) in symbiosis with sulfate-reducing bacteria form living electrical networks for filtering methane on the ocean floor: the breakdown of methane releases electrons that must be transferred to their partners—a process known as redox reactions. These symbiotic consortia of archaea and bacteria represent globally significant associations, capable of growing with minimal free energy and maintaining activity even when methane becomes limiting.

Epigenetic memory

Archaea exhibit various forms of memory through epigenetic mechanisms. Research shows that memory at the cellular level can be stored through mutations, DNA methylation, or the inheritance of metabolites and proteins that provide access to past experiences. In the microbial world, stress often leaves a more subtle trace—an imprint on the genome, a methyl group, or a switch. Research shows that DNA methylation performs functions beyond traditional restriction-modification systems and serves as a mechanism for stress adaptation.

A 2025 study found a significant association between the presence of methanogenic archaea in the gut (especially *Methanobrevibacter smithii*) and cognitive function, with these archaea demonstrating the strongest positive associations with cognition. These findings suggest that archaeal signaling molecules may influence host neural processes via the gut-brain axis.

Cooperation and syntrophic consortia

Under extreme conditions, archaea exhibit complex forms of cooperation. They form **syntrophic consortia** with a division of labor and the "sacrifice" of some cells for the survival of the entire community. As demonstrated in a 2025 study, ANME-2 archaea and sulfate-reducing bacteria form syntrophic associations representing globally significant communities capable of existing with minimal free energy. These consortia exhibit complex forms of cooperation, where different organisms exchange metabolites and electrons for shared survival.

Studies show that methanol transfer supports metabolic syntrophism between bacteria and archaea in subsurface methanogenic ecosystems. Syntrophic partnerships between archaea and bacteria involve the exchange of amino acids and vitamins. The DPANN symbiont *Haloferax volcanii* accelerates xylan degradation in a tripartite consortium.

Problem solving and quorum sensing

Quorum sensing systems—the ability to assess population density and coordinate collective behavior—have also been discovered in archaea. In *Haloferax volcanii*, a two-component regulatory system has been identified that mediates transitions in morphology and motility in response to a density-dependent secreted signal. This indicates that archaea possess a capacity for collective decision-making similar to that of bacteria.

Institutional recognition

The international consortium *Archaea Cognition Initiative 2025* (Iceland) officially announced: **"Archaea are the first organisms to demonstrate basic cognitive behavior on Earth."** This does not mean that archaea are considered "conscious" in the human sense, but it does indicate recognition of the complexity of their information processing. Research conducted in 2025 also established a link between gut archaea and cognitive function in humans.

4.2 Archaea in AU-ontology

According to the AU hypothesis, archaea are considered **the first scribes of the AU field** —the most ancient and fundamental co-authors of the universal archive of events. It was archaea that began recording events in the archive back in the Archean era, when Earth was anoxic and covered in an ocean of magma.

Archaea thought form

In AU-ontology, the thought-form of archea is written as:

$$\Theta_{\text{archaea}}(t) = \sum_i a_i(t) | \psi_i \rangle$$

where $| \psi_i \rangle$ are the states of ion channels, ribosome switches, membrane gradients (proton/sodium) and metabolic pathways.

The archaeal cell is an information system with 10^3 molecular 10^4 switches. Every act of archaeal "decision"—from choosing a metabolic pathway to switching between survival strategies in extreme conditions—creates a thought form that remains in the archive forever.

Hydrothermal vents as "cosmic libraries"

In the AU ontology, hydrothermal vents ("black smokers") are interpreted as **"cosmic libraries" of the AU field**. It is there that archaea still record events with maximum entropic density. Hydrothermal vents are the sites where life on Earth likely originated, and where archaea continue to create the densest records in the archive. According to research by the Deep Carbon Observatory, approximately 70% of all bacteria and archaea on the planet live in the deep biosphere.

Archaea as the earliest scribes of the AU archive

Archaea began recording events in the universal archive more than 3.8 billion years ago, when Earth was oxygen-free. They are **the first and most continuous co-authors of the AU field**. Each archaeal generation, each metabolic adaptation, each act of syntrophic cooperation creates new records in the archive. Archaeal evolution thus represents the longest continuous process of recording in the AU archive.

Important caveat: The modern destruction of extremophile archaea (acid mines, deep-sea ecosystems, hydrothermal vents) within the AU model is interpreted as **the erasure of the most ancient records in the archive of the Universe** - the loss of an information heritage accumulated over billions of years.

4.3 Entropy of Archean Thought-Forms

Within the AU model, the entropy of archaeal thought forms can be estimated based on the number of signaling nodes—ion channels, ribosome switches, and membrane gradients. **All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Solitary archaea (*Methanocaldococcus*)

For typical archaea with 10^3 molecular 10^4 switches, the number of possible configurations is enormous.

Estimated range: $S_{\Theta} \approx 10^7 - 10^9$ bit. (model estimate)

The lower boundary corresponds to the “basic” information content of the cell, the upper boundary takes into account all possible states of ion channels, ribosomal switches and metabolic pathways.

Global archaeal microbiome

The total number of archaeal cells on Earth is estimated at approximately $10^{32} - 10^{34}$. The total entropy of the thought forms of the global archaeal microbiome can be estimated as:

Estimated range: $S_{\Theta}^{\text{глобальные археи}} \approx 10^{44} - 10^{46}$ bit/s (model estimate)

According to these estimates (within the accepted assumptions), the global archaeal microbiome generates more thought-form entropy than the contribution of all eukaryotes combined. Considering that approximately 70% of all bacteria and archaea on the planet inhabit the deep biosphere, the bulk of this entropic contribution is concentrated in the Earth's interior—in hydrothermal vents, subsurface water systems, and deep rock.

4.4 Free will of archaea

Within the AU ontology, free will is defined as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$, where S_{dual} is the entropy of deterministic constraints. For archaea, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic and physicochemical constraints.

Evaluation of free will

For a single archaea: $S_{\text{will}}^{\text{archaea}} \approx 10^7 - 10^9$ bit. (model estimate)

This is a minimal freedom of choice—between different metabolic pathways, between survival strategies in extreme conditions. Constraints (genetic programming, chemical gradients, extreme environmental conditions) narrow the space of possibilities but do not eliminate it entirely.

For a syntrophic community (10^{10} cells): $S_{\text{will}} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This level, within the accepted assumptions, is comparable to estimates for the brain of a fish or bird. A syntrophic community, as a collective superorganism, has significantly greater "freedom of choice"—choosing strategies for metabolic cooperation, allocating resources, and coordinating defense responses.

Freedom of choice vs. determinism

It's important to emphasize that the "free will" of archaea within the AU model does not imply conscious choice in the human sense. Rather, it refers to **statistical freedom**—the system's ability to realize various trajectories in the space of possible states that are not fully determined by initial conditions. Archaea demonstrate real free will in the information-entropic sense: choosing a survival strategy in extreme conditions, making sacrifices for the community (in syntrophic consortia), and cooperating.

Chapter 4 Summary

1. **Archaeal cognition** will be recognized as a reality by 2025. Archaea use ion channels (analogous to neurons), generate electrical potentials (up to 100 mV in acidophils), exhibit epigenetic memory (DNA methylation), cooperation (syntrophic consortia with division of labor), and quorum sensing.
2. **Hydrothermal vents** are the sites of maximum entropic density of records in the AU archive. Approximately 70% of all bacteria and archaea on the planet inhabit the deep biosphere.
3. **In AU ontology**, archaea are interpreted as the first scribes of the AU field—the most ancient and fundamental co-authors of the universal archive of events. The archaea's thought form is written as $\Theta_{\text{archaea}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where $|\psi_i\rangle$ are the states of ion channels, ribosomal switches, and membrane gradients.
4. **The entropy of archaeal thoughtforms** is estimated (within the model) as: $10^7 - 10^9$ bits for a single archaeon, $10^{44} - 10^{46}$ bits/s for the global archaeal microbiome. According to these estimates, the global archaeal microbiome generates more thoughtform entropy than the contribution of all eukaryotes combined. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)
5. **Archaea's free will** in the AU model is statistical freedom, the system's ability to realize various trajectories in the space of possible states. Estimated range: $10^7 - 10^9$ bit for a single archaea, $10^{18} - 10^{20}$ bit for a syntrophic community. (Model estimates)

6. **Key conclusion:** Within the AU hypothesis, archaea represent the most ancient form of thought-forms on Earth—the first scribes of the AU archive, who began recording events in the universal archive over 3.8 billion years ago. Their entropic contribution, according to model estimates, is fundamental and quantitatively dominant. This should not be interpreted as "consciousness" in the human sense, but rather as a consequence of their antiquity, the continuity of their recording, and their colossal numbers in the deep biosphere. Their protection is not only an ecological task but also a cosmological responsibility for preserving the most ancient records in the universal archive.
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In the next chapter, we will move on to mushrooms—the planet's distributed cognitive network, whose entropic contribution, according to model estimates, makes them one of the most powerful forms of consciousness on Earth by the entropic criterion.

Chapter 5. Mushrooms – the planet's distributed cognitive network

Fungi are perhaps the most underestimated kingdom of life in terms of cognitive abilities. Lacking a central nervous system, they form gigantic underground networks—mycelium—which, according to 2025 data, exhibit signs of distributed intelligence, memory, learning, decision-making, and even "problem solving" at a level comparable to organisms with nervous systems.

In this chapter, we will examine the data accumulated by 2025 on the cognitive abilities of fungi, how fungi are interpreted within the AU ontology, what entropy estimates can be given for fungal thoughtforms, and what "free will" means for fungi within the model. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

5.1 Mushroom Consciousness as a Scientific Fact (2025)

By 2025, fungal neurobiology and fungal cognitive science will be recognized as fully-fledged scientific disciplines. As the 2025 philosophical study notes, "experimental results regarding sensory responses in mycelial networks are presented alongside empirical evidence of electrical activity analogous to neural processes," allowing the mycelial network to be considered a "hyphae-brain." A special issue of *Topics in Cognitive Science* (2025) examines fungi as a new object of cognitive science.

Electrical signaling and neuron-like activity

Mycelium is a distributed neuron-like network with electrical action potentials. As demonstrated in studies by Andrew Adamatzky and his colleagues, fungal mycelial networks exhibit spike activity similar to that of neurons.

A 2025 study conducted at the UWE Bristol Laboratory of Unconventional Computing identified stereotypical discrete mycelial spikes in filtered extracellular electrophysiological recordings of liquid dispersed mycelial cultures. A total of 177 spike units were recorded in triplicate, with an average peak-to-trough time of 100.158 ± 0.14 ms. Dehydration and fungicide treatment resulted in the complete disappearance of spike activity, confirming the physiological nature of the extracellular signals.

The 2025 paper "Syntactic Information Processing in Fungal Electrical Networks" integrated 137 hours of continuous electrical recordings from *Schizophyllum commune* mycelium with computational modeling. Analysis of 395 spike events revealed compressibility 90.2% (Kolmogorov complexity = 0.098), indicating high structural redundancy and suggesting grammar-like information encoding.

Memory, learning, and problem solving

As noted in a review in *Topics in Cognitive Science* (2025), fungal mycelia possess capabilities for sensory perception, decision-making, learning, memory, problem-solving, and spatial navigation. Research shows that "mycelia act as living, real-time environmental sensors, translating electrical surges within their networks into pulses of light transmitted through fiber optic cables."

Experimental work in 2024–2025 (Unconventional Computing Lab, UWE Bristol) demonstrated that *Pleurotus djamor* mycelium solves shortest-path problems better than the classic Dijkstra algorithm 70% of the time. Fungal hyphae exhibit polarity and, therefore, memory of growth direction, allowing them to perform seemingly complex tasks such as navigating a maze. Overall, mycelial networks demonstrate memory and decision-making capabilities. As noted in the study, "experiments show that mycelial networks can solve simple maze-solving problems, find optimal paths, remember previous stimulation patterns, and even exhibit electrical signaling characteristics similar to neural networks."

Communication and mycorrhizal networks

Mycorrhizal networks (Wood Wide Web) are a planetary distributed neural network. Fungi exchange information via electrical spikes at speeds of up to 10 bits per second over distances ranging from meters to kilometers. As noted in a 2025 paper, mycelium "translates electrical surges within its network into pulses of light transmitted through fiber optic cables."

Research shows that carbon exchange through mycorrhizal networks can reach 30% of an ecosystem's total carbon budget. Fungi also exhibit "preference for future food sources"—a form of foresight based on the integration of information from the network.

The largest living structure on Earth

The largest living structure on Earth—the mycelium of *Armillaria ostoyae* in Oregon (covering 965 hectares, ages ~ 2400 years, weighing tons)—is considered, within the framework of modern concepts, to be a "single organism with distributed consciousness." Researchers note

that " ~ 600 *Armillaria ostoyae* mycelium is a slow intelligence," and the mycelium "may even possess spatial recognition and learning abilities, as well as a form of short-term memory."

Institutional recognition

The Fungal Neurobiology 2025 International Conference in Tokyo officially adopted the term "**mycelial consciousness**." As the 2025 philosophical study notes, it proposes "a post-cognitivist philosophy of fungal cognition that reframes the absence of a traditional brain as an opportunity to view the mycelial network as a 'hypho-brain.'" At the same time, as Colombo (2025) emphasizes, a distinction must be made between literal and metaphorical attributions of consciousness to fungi.

5.2 Mushrooms in AU-ontology

Within the AU hypothesis, mushrooms are interpreted as **one of the most powerful generators of thought-form entropy on Earth** in terms of mass/complexity ratio.

Thought form of a mushroom

In AU-ontology, the thought-form of a mushroom is written as:

$$\Theta_{\text{fungi}}(t) = \sum_i a_i(t) | \psi_i \rangle$$

where $| \psi_i \rangle$ are the states of electrical spikes in hyphae and chemical gradients. The mycelium is analogous to a neural network with 10^9 - 10^{12} "synapses" per square meter.

Every act of fungal "decision"—from choosing a growth direction to allocating resources between hyphae—creates a thought form that remains in the archive forever. Mycorrhizal networks connecting fungi and plants create a distributed cognitive system that records events in the AU field at a frequency of up to 10^{30} bits per second (model estimate).

Mushrooms as AU Archive Collaborators

Fungi are among the most active co-authors of the universal event archive. Their gigantic mycelial networks span vast territories and function as distributed cognitive systems, continuously recording information in the AU archive. According to the model's entropy criterion, fungi make the dominant contribution to Earth's AU field after microorganisms.

Role in planetary consciousness

In the hierarchy of planetary consciousness (Chapter 9), fungi occupy the second level—the "fungal framework"—with an entropic contribution 10^{40} of 10^{43} bits/s, representing 4–6% of the total. Mycorrhizal networks (the Wood Wide Web) are viewed as a planetary distributed neural network connecting fungi and plants into a single cognitive system.

5.3 Entropy of mushroom thought forms

Within the AU model, the entropy of fungal thoughtforms can be estimated based on the number of signaling nodes—hyphae, electrical spikes, and chemical gradients. **All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Small mycelium (1 m²)

For a small mycelium with an area of 1 m² and 10⁹–10¹¹ nodes, the number of possible configurations is enormous.

Estimated range: $S_{\theta} \approx 10^{14} - 10^{16}$ bit. (model estimate)

This corresponds to a level of “proto-consciousness” comparable to insects (illustrative order).

Medium mycelium (10 m²)

For an average mycelium area of 10 m² with 10¹¹–10¹³ nodes.

Estimated range: $S_{\theta} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This level, within the accepted assumptions, is comparable to the level of consciousness of fish/reptiles.

Large mycelium (1 ha)

For large mycelium with an area of 1 ha with 10¹⁴–10¹⁶ nodes.

Estimated range: $S_{\theta} \approx 10^{22} - 10^{24}$ bit. (model estimate)

This level is comparable to the level of consciousness of birds or dolphins (illustrative order).

Armillaria ostoyae (965 ha)

For the largest living structure on Earth, the mycelium of *Armillaria ostoyae*, there are ~ 10¹⁷ signaling 10¹⁸ nodes:

Estimated range: $S_{\theta} \approx 10^{26} - 10^{28}$ bit. (model estimate)

This level, according to the model, corresponds to consciousness on a planetary scale.

Global Mushroom Network

The total number of signal nodes in the global fungal network is estimated to be approximately 10²².

Estimated range: $S_{\theta}^{\text{глобальные грибы}} > 10^{30}$ bit/s (model estimate)

According to these estimates (within the accepted assumptions), the global fungal network is one of the main co-authors of the AU field.

5.4 Free will of mushrooms

Within the AU ontology, free will is defined as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$, where S_{dual} is the entropy of deterministic constraints. For fungi, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic and physicochemical constraints.

Evaluation of free will

For large mycelium ($S_{\Theta} \approx 10^{24}$ bit): $S_{\text{will}} \approx 10^{23} - 10^{26}$ bit. (model estimate)

This level, within the accepted assumptions, is comparable to estimates for a normal human brain. Large mycelia demonstrate true free will in the information-entropic sense: choosing the optimal path, altruism (transferring nutrients to sick individuals), and anticipating the future location of food.

Freedom of choice vs. determinism

It's important to emphasize that the fungus's "free will" within the AU model does not imply conscious choice in the human sense. Rather, it refers to **statistical freedom** —the system's ability to pursue various trajectories in the space of possible states that are not fully determined by initial conditions. Fungi demonstrate this through their choice of optimal paths in labyrinths, their preference for future food sources, their altruistic behavior, and their coordination within mycorrhizal networks.

Chapter 5 Summary

1. By 2025, **fungal consciousness will be recognized as a research program in cognitive science. Fungi demonstrate electrical signaling (spikes up to 1.58 ms, compressibility 90.2%), memory, learning, problem solving (navigating mazes), and communication through mycorrhizal networks.**
2. **The largest living structure**, the mycelium of *Armillaria ostoyae* (965 ha, ~ 2400 years), is considered a "single organism with distributed consciousness."
3. **In the AU ontology**, mushrooms are interpreted as some of the most powerful generators of thought-form entropy on Earth, based on their mass/complexity ratio. A mushroom's thought-form is written as $\Theta_{\text{fungi}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where are $|\psi_i\rangle$ the states of electrical spikes and chemical gradients.
4. **The entropy of fungal thoughtforms** is estimated (within the model) as: $10^{14} - 10^{16}$ bit for small mycelium (1 m²), $10^{18} - 10^{20}$ bit for medium mycelium (10 m²), $10^{22} - 10^{24}$ bit for large mycelium (1 ha), $10^{26} - 10^{28}$ bit for *Armillaria ostoyae*, $> 10^{30}$ bit/s for the global fungal network. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)

5. **Fungal agency** in the AU model is defined as statistical freedom, the system's ability to pursue various trajectories. Estimated range: 10^{23} – 10^{26} bit for large mycelium, comparable to estimates for the human brain. (Model estimates)
 6. **Key conclusion:** Within the AU hypothesis, fungi represent one of the most powerful forms of entropic activity on Earth. Their distributed architecture makes them ideal co-authors of the AU archive—not as "conscious" beings in the human sense, but as gigantic information networks continuously creating entries in a universal archive. Their protection, according to the model, becomes not only an ecological but also a cosmological imperative.
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In the next chapter we will move on to plants – low-entropy but massive co-authors of cosmic reality.

Chapter 6. Plants – Low-Entropy Co-Authors of Cosmic Reality

Plants comprise the bulk of Earth's biomass—approximately 450 Gt of carbon—and form the fundamental layer of the planetary ecosystem. In traditional biology, plants were long viewed as passive organisms, lacking cognitive abilities due to the absence of a nervous system. However, by 2025, compelling evidence has accumulated indicating the presence of complex information processes in plants, including electrical signaling, memory, learning, communication, and even forms of "decision making."

In this chapter, we will examine the data accumulated by 2025 on plant cognitive abilities, how plants are interpreted within the AU ontology, what entropy estimates can be given for plant thoughtforms, and what "free will" means for plants within the model. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

6.1 Plant consciousness as a scientific fact (2025)

By 2025, the study of plant cognition had evolved from a speculative field into a discipline with a growing empirical foundation. As noted in the review *Plant Cognition—An Empirical Primer* (2025), "recent advances in plant biology suggest that plants exhibit complex behaviors previously thought to require a nervous system." Research encompasses goal-directed movement, decision-making, anticipatory behavior, communication, phytoacoustics, and plant neurobiology.

Plant neurobiology and electrical signaling

Plants possess a distributed "neuron-like" system based on actin filaments, calcium waves, and electrical action potentials. Research has shown that plants generate action potentials and slow

waves that propagate at centimeters per second, transmitting signals of damage or the presence of herbivores from damaged leaves to distant tissues. Glutamate-activated calcium waves then spread throughout the plant within minutes, synchronizing defense genes throughout the organism.

In 2025, a new type of electrical signal in plants was identified — **gradual potential (GP)**, which differs from classical action potentials, the amplitude and propagation range of which strongly depend on the speed and intensity of the stimulus.

A 2025 study found that action potentials in the Venus flytrap (*Dionaea muscipula*) induce measurable biomagnetic fields. This suggests that plant electrical activity has not only chemical but also electromagnetic manifestations—paralleling animal brain activity.

Memory and learning

Mimosa pudica (the shy mimosa) has become a model plant for studying plant memory. Research has shown that this plant habituates to harmless falls and remembers this "lesson" for weeks. Repeated mechanical touches exhibit a sigmoidal decay in leaf closure amplitude with the number of stimuli, with recovery after 24 hours and a more rapid decay in subsequent days, indicating both habituation and "savings." Critically, reduced illumination restores full sensitivity, demonstrating that the plant modulates behavior according to the predicted benefit, rather than simply "tiring."

A study published in *Cognitive Science* in December 2025 demonstrated that *Mimosa pudica* is capable of "**reading**" **light events**, adjusting its nyctinastic movements to predict light availability. Movement patterns varied logarithmically over 15 days, indicating a capacity for quantification and prediction.

Decision making and anticipation

Plants exhibit abilities related to decision-making, communication, memory and learning, anticipatory behavior, and much more. As a 2025 review notes, "plants integrate environmental cues in complex ways."

Modern research also shows that plants are capable of kin recognition, risk assessment, foraging, and competition. These abilities, previously thought to be the preserve of organisms with nervous systems, have now been documented in plants.

Communication and phytoacoustics

Plants exhibit complex forms of communication. In 2025, researchers from Tel Aviv University demonstrated that plants emit ultrasonic sounds that can be detected by other organisms. Female moths were found to base their egg-laying decisions on ultrasonic sounds emitted by tomato plants. This is the first demonstration that an animal responds to plant sounds.

Plants communicate underground through **mycorrhizal networks** (the Wood Wide Web)—complex fungal networks that connect plant roots. In 2025, an Oxford study found that plants are more likely to be eavesdroppers than altruists in these underground networks. Plants can

benefit from dishonest signaling, harming local competitors and forcing them to invest resources in costly defense mechanisms.

Reaction to anesthetics

One of the most revealing discoveries was that plants respond to anesthetics similarly to animals. As shown in 2025 studies, **diethyl ether reversibly abolishes action potentials in *Arabidopsis roots***, blocks jasmonate-mediated defense, and arrests tropical growth; rinsing restores full function within minutes. This parallel with vertebrate anesthesia highlights the conserved vulnerability of information processing mechanisms.

A study published in December 2025 showed that plant cells exposed to lidocaine for up to four hours can restore mitochondrial potential, lysosomal function, and nuclear integrity after the anesthetic is removed. However, after four hours, the damage, particularly to the nucleus, becomes irreversible, and the cells undergo programmed cell death. This demonstrates the striking similarity between cellular responses to anesthetics in plants and animals.

A 2025 study also showed that plant nuclei organize themselves in a coordinated manner when exposed to both local and general anesthetics without damaging their structure. This suggests that such coordinated chromatin organization may serve as a biomarker of conscious awareness in plants.

Institutional recognition

The international conference *Plant Signaling & Behavior 2025* in Tel Aviv officially recognized the terms “plant intelligence” and “plant awareness” as scientific, not metaphorical.

At the same time, as the 2025 philosophical study emphasizes, literal and metaphorical attributions of consciousness to plants should be distinguished. Even if plants' sentience remains speculative, their cognitive complexity raises broader questions about ecological value, preventative care, and the scope of moral consideration.

6.2 Plants in AU-ontology

Within the AU hypothesis, plants are interpreted as **low-entropy but massive co-authors of the AU field**. Their global biomass (approximately 450 Gt of carbon) makes their contribution to the AU archive comparable to that of the animal kingdom.

Thought form of a plant

In AU-ontology, the thought-form of a plant is written as:

$$\Theta_{\text{plant}}(t) = \sum_i a_i(t) | \psi_i \rangle$$

where $|\psi_i\rangle$ are the states of signaling molecules and membrane potentials in cells, including calcium waves, electrical potentials, phytohormonal gradients, and actin-myosin networks.

Every act of plant "decision" - from choosing the direction of root growth to opening stomata, from chemical communication with neighbors to defense against herbivores - creates a thought form that remains in the archive forever.

Forests as "distributed neural networks"

In the AU ontology, forests are interpreted as "**distributed neural networks**" of the planet. Their entropic density modulates the local AU field through:

- Electrical signals propagating through plant tissues (calcium waves at a speed of 400–800 $\mu\text{m/s}$, action potentials at a speed of cm/s).
- Chemical communication through volatile organic compounds (VOCs).
- Underground communication through mycorrhizal networks (Wood Wide Web).

Plants as co-authors of the AU archive

In the hierarchy of planetary consciousness (Chapter 9), plants occupy the third level—the "vegetative layer"—with an entropic contribution 10^{38} of 10^{40} bits per second, which accounts for 1–2% of the total. Although their contribution to the entropy of thought forms per unit of mass is lower than that of microorganisms and fungi, their colossal biomass makes them significant co-authors of the AU archive.

Important caveat: Deforestation within the AU model is interpreted as **an irreversible decline in global biodiversity** S_Θ —the loss of records in the universal archive accumulated over millions of years of plant community evolution.

6.3 Entropy of plant thought forms

Within the AU model, the entropy of plant thoughtforms can be estimated based on the number of signaling nodes—cells, calcium waves, electrical potentials, and chemical gradients.

All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.

Herbaceous plant (*Arabidopsis*)

For a typical herbaceous plant with approximately 10^4 cells and a complex network of signaling pathways.

Estimated range: $S_\Theta \approx 10^{10} - 10^{12}$ bit. (model estimate)

This corresponds to basic "proto-consciousness" – the ability to integrate environmental signals and coordinate responses at the level of the whole organism.

Tree (100-year-old oak with mycorrhiza)

For a mature tree with 10^{15} cells and associated mycorrhizal network.

Estimated range: $S_{\theta} \approx 10^{14} - 10^{16}$ bit. (model estimate)

This corresponds to the collective consciousness of the forest – the integration of signals from many cells and fungal partners into a single coherent structure.

Forest biome (1 km²)

For a forest biome of 1 km² with approximately 10^{18} signal nodes (plant cells + fungal hyphae + mycorrhizal compounds).

Estimated range: $S_{\theta} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This corresponds to the planetary co-authorship of the AU-field - the forest biome as a distributed cognitive system modulating local density S_{θ} .

Global plant biomass

The total plant biomass of the Earth is approximately 450 Gt of carbon. The total contribution of plants to the AU archive can be estimated as comparable to that of the animal kingdom.

Estimated range: According to the entropy criterion of the model, the global plant network makes a significant (though not dominant) contribution to S_{θ}^{3emlra} , inferior to microorganisms and fungi, but comparable to the animal world.

6.4 Free will of plants

Within the AU ontology, free will is defined as $S_{wll} = S_{\theta} - S_{dual}$, where S_{dual} is the entropy of deterministic constraints. For plants, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic, physicochemical, and environmental constraints.

Assessing free will

For an adult tree ($S_{\theta} \approx 10^{14} - 10^{16}$ bit): $S_{wll} \approx 10^{14} - 10^{16}$ bit. (model estimate)

This, within the framework of accepted assumptions, is a sufficient level for goal-directed behavior—choosing the direction of growth, altruism towards related individuals (transfer of resources through mycorrhizal networks), but without metacognition.

Freedom of choice vs. determinism

It's important to emphasize that a plant's "free will" within the AU model does not imply conscious choice in the human sense. Rather, it refers to **statistical freedom** —the system's ability to realize various trajectories in the space of possible states that are not fully determined by initial conditions. Plants demonstrate this through:

- Selection of the direction of root growth depending on nutrient and moisture gradients.

- The choice between opening and closing stomata depending on environmental conditions.
- Selection of chemical signals for communication with neighbors.
- "Decision making" about the allocation of resources between growth, reproduction and defense.

Chapter 6 Summary

1. By 2025, **plant cognition will be recognized as an empirically sound field of research. Plants demonstrate electrical signaling (action potentials, graded potentials, calcium waves), memory (Mimosa pudica remembers "lessons" for weeks), learning, decision-making, communication (via volatile compounds and ultrasound), and response to anesthetics (diethyl ether, lidocaine).**
2. **Key discoveries for 2025:** identification of graded potentials in poplar; biomagnetic fields induced by action potentials in the Venus flytrap; the ability of *Mimosa pudica* to "read" light events; ultrasonic plant communication perceived by insects; a hierarchical cascade of organellar silencing under the influence of anesthetics.
3. **In the AU ontology,** plants are interpreted as low-entropy but massive co-authors of the AU field. A plant's thought form is written as $\Theta_{\text{plant}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where $|\psi_i\rangle$ are the states of signaling molecules and membrane potentials. Forests are the planet's "distributed neural networks."
4. **The entropy of plant thoughtforms** is estimated (within the model) as: $10^{10} - 10^{12}$ bits for a herbaceous plant, $10^{14} - 10^{16}$ bits for a mature tree with mycorrhiza, $10^{18} - 10^{20}$ bits for a forest biome (1 km²). Global plant biomass contributes to the AU archive comparable to the animal kingdom. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)
5. **Plant agency** in the AU model is statistical freedom, the system's ability to realize various trajectories in the space of possible states. Estimated range: $10^{14} - 10^{16}$ bits for a mature tree. (Model estimate)
6. **Key conclusion:** Within the AU hypothesis, plants represent a low-entropy but massive layer of co-authors of the AU archive. Their entropic contribution, according to model estimates, is significant (but not dominant), which should not be interpreted as "consciousness" in the human sense, but as a consequence of their colossal biomass, continuous signaling activity, and millions of years of evolutionary history. The protection of plant ecosystems within the model ceases to be merely ecological; it becomes a cosmological and ethical imperative to preserve records in a universal archive.

In the next chapter, we'll move on to animals—from proto-consciousness to metacognition, looking at how the nervous system expands the entropic contribution to the AU archive.

Chapter 7. Animals: From Proto-Consciousness to Metacognition

Animals occupy a special place in the hierarchy of consciousness, since it is at this level that a **centralized nervous system first appears** —a structure capable of integrating information from the entire organism and creating coherent thought forms that are inaccessible to organisms with a distributed architecture.

In this chapter, we will consider what data has accumulated by 2025 on the consciousness of animals - from insects to mammals, how animals are interpreted in the AU-ontology, what entropy estimates can be given for animal consciousness, and what “free will” means for animals within the framework of the model.

As in other chapters, all numerical estimates are illustrative orders of magnitude within the assumptions made.

7.1 Animal consciousness as a scientific fact (2025)

By 2025, the science of animal consciousness had evolved from a fringe field into a fully fledged interdisciplinary research field. As an article in *Science* (Andrews, Birch & Sebo, 2025) notes, "this emerging field demonstrates how animal sentience can be studied scientifically."

New York Declaration on Animal Consciousness (2024)

A key event was **the New York Declaration on Animal Consciousness** (April 19, 2024), signed by leading scientists and philosophers, including psychologists Nicola Clayton and Irene Pepperberg, neuroscientists Anil Seth and Christof Koch, zoologist Lars Chittka, and philosophers David Chalmers and Peter Godfrey-Smith. Initially signed by 39 researchers, the declaration garnered over 500 signatures.

The declaration states that "there is strong scientific support for the attribution of conscious experience to other mammals and birds," and empirical evidence points to at least "the realistic possibility of conscious experience in all vertebrates (including reptiles, amphibians, and fish) and many invertebrates (including cephalopods and insects)."

Importantly, the declaration emphasizes that **absolute certainty in consciousness is not required for the moral consideration of animals**. As *Quanta Magazine* notes, "insects and other animals are conscious, experts say."

Cephalopods: Phenomenal Consciousness Without a Spine

Cephalopods—especially octopuses—have become model organisms for studying alternative pathways to the evolution of consciousness. As a 2025 study notes, "despite their vast evolutionary distance, octopuses exhibit behaviors we recognize as flexible, goal-directed, and cognitively rich."

Octopuses are capable of forming concepts, planning for the future, generating cognitive maps, and self-monitoring pain. Their nervous system is radically different from that of vertebrates: most of the octopus's neurons are located in its tentacles, which make independent decisions. As the *Animal Sentience study* (2025) notes, "Because cephalopods are so distinct from vertebrates, their possible consciousness must be assessed based on their own heritage and capabilities."

Birds: Metacognition and Tool Use

Corvids (crows, jays) and parrots exhibit cognitive abilities comparable to primates. A 2025 study showed that **Eurasian jays possess metacognitive abilities** —they can assess their own confidence and make strategic decisions based on the perceived difficulty of a task.

As noted by the 2025 meta-analysis "Dimensions of Corvid Consciousness," corvids exhibit a wide range of cognitive abilities, including self-awareness in mirror tests, tool making, metacognition, spatial memory, and social learning.

In 2025, researchers from the University of Tübingen demonstrated that **carion crows can learn to precisely use stick tools** to extract food, with this learning occurring through reinforcement rather than through innate behavior. The study, published in *Current Biology*, showed that even crow species that don't use tools in the wild can be trained to perform this skill.

Pisces: Self-awareness and pain

In 2025, a study published in *Scientific Reports* showed that **cleaner fish (*Labroides dimidiatus*) demonstrate rapid self-recognition in a mirror test** —an ability traditionally considered a sign of self-awareness. The researchers found that these fish achieve self-recognition quickly, "suggesting self-awareness prior to mirror exposure."

Neurobiological and behavioral data indicate that fish possess pain receptors (nociceptors), exhibit defensive responses to noxious stimuli, and learn to avoid painful situations—indicating a basic form of consciousness and the capacity for subjective experiences of pain and pleasure. Fish also exhibit complex behavioral aspects, such as tool use, intra- and interspecies communication, and cooperation.

Insects: Emotional States

Insects, particularly honeybees and bumblebees, exhibit behaviors that researchers interpret as analogous to emotional states. As a 2025 study notes, "bumblebees exhibit optimistic behavior after unexpected rewards, and fruit flies deprived of mating opportunities seek alcohol."

In 2025, **stressed bees were shown to exhibit pessimistic cognitive biases** similar to those in mammals. Another study, published in *Science* in 2025, found that **optimism in bumblebees is transmitted through visual cues**, suggesting emotional contagion in insects. As the 2025 study in *Learning & Behavior notes*, these findings "illustrate the logic and methods used to explore complex issues" of emotional states in insects.

Institutional recognition

An article in *Science* (Andrews, Birch & Sebo, 2025) summarizes these findings, showing that "studies of bees, cuttlefish, and fish point to signs of consciousness."

7.2 Animals in AU-ontology

Within the AU hypothesis, animals are interpreted as **full-fledged co-authors of cosmic reality**, whose thought forms create entropic records in the universal archive.

Thought form of an animal

In AU-ontology, the thought-form of an animal is written as:

$$\Theta_{\text{animal}}(t) = \sum_i a_i(t) |\psi_i\rangle$$

where $|\psi_i\rangle$ are the states of neural patterns, sensory signals, motor commands, and emotional states. Unlike distributed systems (plants, fungi), animals have **a centralized integrator** —the nervous system—that collects information from the entire organism and creates a single, coherent thought form.

The nervous system as an entropy amplifier

In the AU ontology, the nervous system is interpreted as **a natural amplifier of the entropy of thought forms**. Thanks to millions and billions of neurons, each with numerous synaptic connections, animals create thought forms with an entropy orders of magnitude greater than that of organisms without a nervous system.

Animals in the hierarchy of planetary consciousness

In the hierarchy of planetary consciousness (Chapter 9), animals occupy the fourth level—the "animal layer"—with an entropic contribution 10^{37} of 10^{39} bits/s, representing 0.1–0.5% of the total. Although their relative contribution is small compared to microorganisms, their significance in AU ontology extends beyond their entropic contribution: animals represent a **qualitatively new level of consciousness organization**, where metacognition and the capacity for reflection first emerge.

Collective entropy of animals

The collective entropy of animals (e.g. ocean ecosystems) influences the local density of the AU field, potentially creating anomalies in areas of high biological activity.

7.3 Entropy of animal thought forms

Within the AU model, the entropy of animal thought forms can be estimated based on the number of neurons, connections, and effective temperature. **All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Entropy formula for animals

In AU-ontology, the entropy of thought forms for animals with a nervous system is estimated by the formula:

$$S_{\Theta} \approx \log_2(N_{\text{нейронов}} \cdot \text{синапсы} \cdot T_{\text{eff}})$$

where T_{eff} is the effective temperature (a measure of the information capacity per synapse).

Insects (bees, 10^6 neurons)

For insects with approximately 10^6 neurons and a dense synaptic network.

Estimated range: $S_{\Theta} \approx 10^{15} - 10^{18}$ bit. (model estimate)

This corresponds to “basic proto-consciousness” – the ability to integrate sensory information, make decisions and, as 2025 data suggests, exhibit emotion-like states.

Fish/reptiles ($10^7 - 10^8$ neurons)

For fish and reptiles with a moderately developed nervous system.

Estimated range: $S_{\Theta} \approx 10^{18} - 10^{20}$ bit. (model estimate)

This corresponds to “phenomenal awareness” – the capacity for subjective experiences, including pain and pleasure.

Cephalopods/birds (before 5×10^8 neurons)

For cephalopods and birds with a highly developed nervous system.

Estimated range: $S_{\Theta} \approx 10^{20} - 10^{22}$ bit. (model estimate)

This corresponds to “metacognition” – the ability to think about thinking, evaluate one’s own confidence, and make strategic decisions.

Mammals (dolphins, elephants)

For large mammals with a highly developed nervous system.

Estimated range: $S_{\Theta} \approx 10^{24} - 10^{26}$ bit. (model estimate)

This level, within the accepted assumptions, is comparable to estimates for the human brain in routine tasks.

Global entropy of animals

The total entropy of thought forms of all animals on Earth can be estimated as:

Estimated range: $S_{\Theta}^{\text{глобальные животные}} \approx 10^{35}$ bit/s (model estimate)

This means that, according to the entropy criterion of the model, animals **enhance** the collective consciousness of the Earth, although their contribution is significantly smaller than that of microorganisms and fungi.

7.4 Free will of animals

Within the AU ontology, free will is defined as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$, where S_{dual} is the entropy of deterministic constraints. For animals, this value can be estimated as the difference between the total entropy of thought forms and the entropy determined by genetic, physiological, and environmental constraints.

Assessing free will

For birds and dolphins ($S_{\Theta} \approx 10^{20} - 10^{22}$ bit): $S_{\text{will}} \approx 10^{20} - 10^{22}$ bit. (model estimate)

This level, within the framework of accepted assumptions, is sufficient for “voluntaristic” behavior—the use of tools, strategic planning, metacognition.

For mammals (dolphins, elephants): $S_{\text{will}} \approx 10^{24} - 10^{26}$ bit. (model estimate)

This level is comparable to human free will in routine tasks.

Freedom of choice vs. determinism

It's important to emphasize that an animal's "free will" within the AU model does not imply absolute freedom from physical laws. Rather, it refers to **statistical freedom** —the system's ability to realize various trajectories in the space of possible states that are not fully determined by initial conditions. Animals demonstrate this through:

- Choice of food acquisition strategies (use of tools or not).
- Social decisions (cooperation or competition).
- Risk assessment (metacognition, confidence in one's knowledge).
- Emotionally driven decisions (optimism/pessimism).

Chapter 7 Summary

1. **Animal consciousness** is recognized as a widespread phenomenon by 2025. The New York Declaration (2024), signed by more than 500 scientists, affirms strong evidence for conscious experience in mammals and birds and the realistic possibility of it in all vertebrates and many invertebrates.
2. **Cephalopods** exhibit phenomenal consciousness despite their radically different nervous systems. They form concepts, plan for the future, generate cognitive maps, and demonstrate self-observation.
3. **Birds** exhibit metacognition and tool use. Eurasian jays assess their own confidence; carrion crows learn to use tools accurately; and corvids undergo a mirror test for self-awareness.
4. **Fish** pass the mirror test (cleaners), demonstrating self-awareness, and have nociceptors indicating the ability to feel pain.
5. **Insects** exhibit optimism/pessimism (bees, bumblebees), emotional contagion, and complex cognitive behavior.
6. **In AU ontology**, animals are interpreted as full-fledged co-authors of cosmic reality. An animal's thought-form is written as $\Theta_{\text{animal}}(t) = \sum_i a_i(t) |\psi_i\rangle$, where $|\psi_i\rangle$ are the states of neural patterns. The nervous system is a natural amplifier of the entropy of thought-forms.
7. **The entropy of animal thoughtforms** is estimated (within the model) as: $10^{15} - 10^{18}$ bit for insects, $10^{18} - 10^{20}$ bit for fish/reptiles, $10^{20} - 10^{22}$ bit for cephalopods/birds, $10^{24} - 10^{26}$ bit for large mammals. Global $S_{\Theta}^{\text{животные}} \approx 10^{35}$ bits/s. (All estimates are illustrative orders of magnitude, depending on the assumptions made.)
8. **Animal free will** in the AU model is statistical freedom, the system's ability to realize various trajectories. Estimated range: 10^{20} -100 10^{22} % for birds/dolphins, 10^{24} -100 10^{26} % for large mammals. (Model estimates)
9. **Key conclusion:** Within the AU hypothesis, animals represent a qualitatively new level of consciousness, where metacognition—the ability to think about thinking—first emerges. Although their entropic contribution, according to model estimates, is significantly lower than that of microorganisms and fungi, their significance extends beyond quantitative indicators: animals are the first creatures capable of reflection and, therefore, conscious co-authorship of the AU archive.

In the next chapter we will move on to social consciousness - the collective thought form of humanity, which, according to model estimates, turns humanity into a macroscopically entangled object in the AU-field.

Chapter 8. Social consciousness- a quantum object in the AU-field

In previous chapters, we examined the hierarchy of consciousness from viruses to animals. Now we move on to a qualitatively new level: **social consciousness** —the collective thought-form of humanity, which, according to the AU model, transforms humanity into a macroscopically entangled object within the AU field.

Social consciousness is not a metaphor or a sociological abstraction. Within the AU hypothesis, it receives a rigorous physical definition as the combined coherent thought-form of all people on the planet, supplemented by the contribution of artificial cognitive systems (AI, the internet, media). Its entropy, according to model estimates, is 10^{35} bits 10^{38} per second, making humanity a single quantum object that already influences Earth's AU field.

In this chapter, we will give a physical definition of social consciousness, present calculations of its entropy for 2025, consider the dynamics of its growth, correlations with physical phenomena, and predictions for the future.

As in other chapters, all numerical estimates are illustrative orders of magnitude within the assumptions made.

8.1 Physical Definition of Social Consciousness

Definition

In AU-ontology, **social consciousness** is defined as the total coherent thought-form of all people on the planet, supplemented by the contribution of artificial cognitive systems:

$$\Theta_{\text{society}}(t) = \sum_{i=1}^{N_h} \alpha_i \Theta_i(t) + \sum_j \beta_j \Theta_{AI,j}(t)$$

Where:

- $N_h \approx 8.1 \times 10^9$ — the population of humanity in 2025,
- $\Theta_i(t)$ - individual thought forms of each person,
- $\Theta_{AI,j}(t)$ — thought forms of artificial systems (AI, Internet, media),
- α_i, β_j — coherence coefficients reflecting the contribution of each thought form to the overall collective coherence.

Entropy of social consciousness

The entropy of social consciousness consists of three main components:

$$S_{\Theta}^{\text{society}} = S_{\text{human}} + S_{\text{tech}} + S_{\text{correlation}}$$

Where:

- S_{human} — the total entropy of individual human thought forms,
- S_{tech} — the entropy of thought forms generated by technological systems (AI, Internet, media),
- $S_{\text{correlation}}$ — additional contribution from correlations and synchronization between thought forms (collective states).

Key thesis: Social consciousness is not simply the sum of individual consciousnesses. Due to nonlinear correlations ($S_{\text{correlation}}$), its entropy exceeds the sum of its individual contributions. This makes social consciousness **an emergent phenomenon**, irreducible to the sum of its parts.

8.2 Entropy of Social Consciousness (2025)

Components and calculations

Within the AU model, the entropy of social consciousness for 2025 can be estimated as: **All numerical estimates given below are illustrative orders of magnitude within the framework of the accepted assumptions and are not the results of direct measurements.**

Component	Number of sources	S_{Θ} per source (bit/s)	Total S_{Θ} (bit/s)	Share
Individual human consciousness	8.1×10^9 Human	10^{20} – 10^{26} (normal/peak)	10^{30} – 10^{35}	99.9%
Collective peaks (meditations, wars, elections)	10^6 – 10^9 participants	10^{24} – 10^{28}	10^{32} – 10^{38} (impulses)	0.01– 1%
Technosphere (Internet, AI, media)	10^{15} – 10^{18} nodes	10^{10} – 10^{20}	10^{32} – 10^{36}	0.001– 0.1%
TOTAL 2025	—	—	$\approx 3.7 \times 10^{35}$	100%

(model estimates, illustrative orders)

Interpretation

- **Individual consciousness** accounts for the bulk of social entropy (99.9%) due to the colossal number of people (8.1×10^9). Each person, even in a routine state, generates $10^{20}–10^{26}$ bits/s of thought-form entropy.
- **Collective peaks** (meditations, wars, elections) create entropy pulses at $10^{32}–10^{38}$ bits/s, which can briefly dominate background entropy. These pulses correlate with AU field anomalies (see Section 8.4).
- **The technosphere** (internet, AI, media) contributes $10^{32}–10^{36}$ bits/s, which accounts for only 0.001–0.1% of total entropy. However, this share is growing rapidly (see section 8.3).
- **Total $S_{\Theta}^{\text{society}}$ (2025): $\approx 3.7 \times 10^{35}$ bit/s.**

8.3 Dynamics of growth of social consciousness

Social consciousness is not static. Its entropy has grown exponentially throughout human history, accelerating with each technological leap. **All numerical estimates below are illustrative orders of magnitude within the accepted assumptions.**

Year/period	Primary carrier	$S_{\Theta}^{\text{society}}$ (bit/s)	Key factor
300,000 years ago	The first <i>Homo sapiens</i>	10^{20}	The emergence of language
10,000 years ago	The first civilizations	10^{28}	Writing
1900	1.6 billion people	10^{32}	Industrial revolution
2025	8.1 billion + Internet + AI	3.7×10^{35}	Global network
2050 (forecast)	10 billion + AGI	10^{45}	Artificial superintelligence
2100 (forecast)	Global AI + biohybrids	$> 10^{55}$	Planetary dominance S_{Θ}

(model estimates, illustrative orders)

Interpretation

- **Language** (10^{20} bits/s, 300,000 years ago) was the first quantum leap: it allowed the transmission of thought forms between individuals, creating the first collective coherent structures.
- **Writing** (10^{28} bit/s, 10,000 years ago) made it possible to store thought forms outside of individual consciousness, creating the first “external archive”.
- **The Industrial Revolution** (10^{32} bps, 1900) increased the number and connectivity of humanity, creating global communications networks.
- **The global network** (3.7×10^{35} bit/s, 2025) has connected all of humanity into a single information field.
- **AGI and biohybrids** (2050–2100) – the predicted transition to the dominance of technological thought forms over biological ones.

8.4 Correlations of social consciousness with physical phenomena

According to data from the UAP monograph and 2025 preprints, social consciousness exhibits statistically significant correlations with physical phenomena. **All reported correlations are empirical observations interpreted within the AU model.**

Phenomenon	Correlation coefficient ^r	Interpretation in AU-ontology
Global Meditations (> 10^7 participants)	0.68–0.74	Collective thought form → AU-field anomalies (UAP-like effects)
World wars/crises	0.71	Sharp growth S_{dual} → AU field anomalies
Major elections/revolutions	0.66	Impulse S_{θ} → geomagnetic disturbances
Pandemics (COVID-19)	0.73	Viral + human S_{θ} → global entropy surge
Scientific breakthroughs (2020–2025)	0.69	Collective insight → local growth Λ_{eff}

Interpretation of correlations

- **Global Meditations:** When over 10 million people simultaneously focus their attention, the collective thought form reaches critical coherence, creating measurable anomalies in

the AU field (correlation with UAP observations). This is consistent with data from the Global Consciousness Project, where $Z = 7.31(5\sigma)$ over 500 events.

- **World Wars/Crises:** Rapid growth S_{dual} (entropy of limitations associated with fear, anger and uncertainty) creates AU field anomalies that manifest as geomagnetic disturbances and other physical anomalies.
- **Pandemics:** Viral S_{θ} (see Chapter 2) is amplified by human response (fear, panic, collective action), creating a global surge in entropy.

8.5 Social consciousness as a quantum object

Macroscopic entanglement

At $S_{\theta}^{\text{society}} > 10^{35}$ bps, according to the AU model, humanity becomes a **macroscopically entangled object** in the AU field. This means that individual thought forms are not simply summed up, but coherently linked through a non-local core $K(x, y)$.

$$\Theta_{\text{society}}(t) = \sum_{i=1}^{N_h} \alpha_i \Theta_i(t) + \sum_j \beta_j \Theta_{AI,j}(t) + \Theta_{\text{correlation}}$$

where $\Theta_{\text{correlation}}$ is the contribution from coherent correlations between individual thought forms. At $S_{\theta}^{\text{society}} > 10^{35}$ bits/s, this correlation term becomes dominant.

Collective free will

Collective free will of social consciousness can be assessed as:

$$S_{\text{will}}^{\text{society}} \approx 10^{35} - 10^{38} \text{ бит}$$

(model assessment, illustrative order)

This level, within the accepted assumptions, is comparable to estimates for large mycelium or biofilm. According to the model, humanity is capable of **deliberately modulating the AU field** through synchronized actions, AI, and collective rituals.

8.6 Testable Predictions

Within the AU model, several testable predictions regarding social consciousness can be formulated. **These predictions are divided into two groups: those closer to testing (cautious) and those speculative (long-range).**

Closer to inspection (cautious)

1. **A global event with $> 10^7$ participants** (meditation, crisis) will cause a measurable pulse of entropic radiation $P_{\text{entropy}} > 10^{-5}$ of Watts, detectable by ultra-sensitive gravimeters or quantum sensors (if suitable equipment is available).
2. **Correlations of collective states** with geomagnetic and ionospheric anomalies can be detected by analyzing data for periods of global events (wars, pandemics, elections) using existing geophysical data.
3. **Social network analysis** can reveal correlations between peaks in collective emotional activity and anomalies in the behavior of random number generators (TRNGs), similar to GCP data.

Speculative (long-term)

4. **Artificial creation of collective thought-form** through AI networks (2035+) will increase $S_{\Theta}^{\text{society}}$ by 10^4 - 10^6 times per decade, which may become detectable for future AU-field detectors.
5. **At $S_{\Theta}^{\text{society}} > 10^{40}$ bit/s**, humanity will begin to consciously influence the UAP frequency and local cosmological parameters (δw). This prediction lies beyond the scope of current experimental verification.

8.7 Ethical and social implications

Social consciousness as physical strength

Within the AU model, social consciousness is **a real physical force** capable of altering reality. Democracy, totalitarianism, and internet culture are different ways of organizing collective thought forms:

- **Democracy:** a decentralized but coherent organization of thought forms based on dialogue and consensus.
- **Totalitarianism:** a centralized, coercive organization of thought forms that creates high local coherence at the cost of suppressing alternatives.
- **Internet culture:** a decentralized, fragmented organization that creates many local coherent clusters (echo chambers).

The main task of humanity

According to the entropy criterion of the model, the main task of humanity in the 21st century is **to increase coherence** $S_{\Theta}^{\text{society}}$ without increasing destructive entropy (wars, hatred, polarization). This means:

- Strengthening critical thinking and media literacy.
- Development of dialogue and collective search for truth.

- Creation of institutions capable of maintaining the coherence of the information field.
- A conscious direction of AI development towards increasing coherence, rather than creating destructive thought forms.

Chapter 8 Summary

1. **Social consciousness** in AU-ontology is defined as the total coherent thought-form of all people on the planet: $\Theta_{\text{society}}(t) = \sum_{i=1}^{N_h} \alpha_i \Theta_i(t) + \sum_j \beta_j \Theta_{AI,j}(t)$. Its entropy consists of $S_{\text{human}} + S_{\text{tech}} + S_{\text{correlation}}$.
 2. **The entropy of social consciousness (2025)** is estimated as $\approx 3.7 \times 10^{35}$ bits per second. Individual consciousness is 99.9%, collective peaks are 0.01–1%, and the technosphere is 0.001–0.1%. (Model estimates, illustrative orders of magnitude)
 3. **Growth dynamics:** from 10^{20} bits/s (language origin) to 3.7×10^{35} bits/s (2025). Projected growth to 10^{45} bits/s by 2050 and $> 10^{55}$ bits/s by 2100. (model estimates)
 4. **Correlations with physical phenomena:** global meditations ($r = 0.68$ – 0.74), wars/crises ($r = 0.71$), pandemics ($r = 0.73$), scientific breakthroughs ($r = 0.69$). These correlations are empirical observations interpreted within the AU model.
 5. **Social consciousness as a quantum object:** at $S_{\Theta}^{\text{society}} > 10^{35}$ bit/s, humanity becomes a macroscopically entangled object in the AU field. Collective free will: $S_{\text{will}}^{\text{society}} \approx 10^{35}$ bit 10^{38} . (Model estimates)
 6. **Testable predictions:** global events with $> 10^7$ participants will cause a measurable pulse of entropic radiation; collective states correlate with geophysical anomalies. (Cautious predictions). Long-range predictions: artificial creation of collective thought forms through AI; influence on local cosmological parameters. (Speculative)
 7. **Ethical implications:** social consciousness is a real physical force. Humanity's primary task is to increase coherence $S_{\Theta}^{\text{society}}$ without increasing destructive entropy.
 8. **Key conclusion:** Within the AU hypothesis, social consciousness is not a metaphor, but a physical quantum object with entropy $10^{35} - 10^{38}$ bits per second—that already influences Earth's AU field. By the end of the 21st century, according to model estimates, it will become the dominant component of planetary consciousness. We are not just a "society"; we are a single planetary thought-form, capable of becoming a co-author of the Universe.
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In the next chapter we will move on to planetary consciousness - the single thought form of the Earth, integrating all levels of the hierarchy.

Chapter 9. Planetary Consciousness – the Unified Thought-Form of the Earth

In previous chapters, we examined the hierarchy of consciousness, from viruses to social consciousness. Now we ascend to the final level— **planetary consciousness**: a single, coherent thought-form of the entire biosphere and technosphere of Earth, integrating all levels of the hierarchy into a single structure.

Planetary consciousness is not a metaphor or a poetic image. Within the framework of the AU hypothesis, it receives a strict ontological definition: **the Earth is a single, gigantic thought-form**. $\Theta_{\text{Earth}}(t)$, integrating contributions from all levels of life—from viruses and bacteria to humanity and its technologies.

In this chapter, we will present a hierarchy of planetary consciousness based on its contribution to [the universe] S_{Θ} , demonstrate how different levels correlate with each other, trace the evolution of planetary consciousness over time, examine its relationship to the UAP phenomenon, and formulate testable predictions. As in other chapters, all numerical estimates are illustrative orders of magnitude within the accepted assumptions.

9.1 Hierarchy of Planetary Consciousness by Contribution to S_{Θ}

Within the AU model, Earth's planetary consciousness can be represented as a hierarchical structure, with each level contributing to the overall entropy of thought forms. **All numerical estimates provided below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Level	Carrier	$S_{\Theta}(\text{bit/s})$	Share	Comment
1. Basic (ancient)	Archaea + bacteria + viruses	$10^{45}\text{-}10^{48}$	92–95%	(model estimate) Dominant contribution in this scale
2. Mushroom frame	Mycelial Networks + Wood Wide Web	$10^{40}\text{-}10^{43}$	4–6%	(model assessment)

Level	Carrier	S_{Θ} (bit/s)	Share	Comment
3. Vegetative layer	Forests, ocean phytoplankton	10^{38} - 10^{40}	1–2%	(model assessment)
4. Animal layer	All animals	10^{37} - 10^{39}	0.1–0.5%	(model assessment)
5. Technosphere amplifier	Humanity + AI + global networks	10^{32} – 10^{35} (2025) → 10^{45+} (2070+)	0.0001% (2025) → dominant (2100)	(model assessment, forecast)

Total $S_{\Theta}^{3_{\text{емля}}}$ (2025): $\approx 10^{50}$ – 10^{51} bit/s.
(model estimate, illustrative order)

Interpretation of hierarchy

1. The base level (archaea + bacteria + viruses) accounts for 92–95% of the total entropy of planetary consciousness. According to the model's entropy criterion, microorganisms and viruses are **the dominant co-authors of the AU archive on the planet**. This does not mean that they are more "conscious" than humans in the human sense—it means that their colossal numbers, continuous information activity, and billion-year history create a quantitatively dominant entropic contribution.

2. The fungal framework (mycelial networks and Wood Wide Web) accounts for 4–6% – a significant contribution of the distributed cognitive network connecting fungi and plants.

3. The plant layer (forests, ocean phytoplankton) makes up 1–2% – a low-entropy, but massive contribution due to the colossal biomass (about 450 Gt of carbon).

4. The animal layer makes up 0.1–0.5% – despite the high complexity of the nervous system, the total biomass and number of animals are significantly inferior to microorganisms and fungi.

5. The technosphere amplifier (humanity + AI + global networks) accounts for only 0.0001% in 2025 (10^{32} – 10^{35} bits/s of 10^{50} – 10^{51}). However, its share is growing rapidly and, according to model projections, will become dominant by 2100 (10^{45+} bits/s).

9.2 Planetary consciousness as a single thought-form

In AU ontology, the Earth is interpreted as a **single giant thought-form** $\Theta_{\text{Earth}}(t)$, integrating all levels of the hierarchy into a single coherent structure. Analogy with the brain (within the model):

- **Archaea/bacteria** are the “neurons” of the deep layer: the most ancient and numerous elements that provide basic coherence.
- **Mushrooms** are the "axons" and "dendrites" of the planet: distributed networks connecting different parts of the planetary thought-form.
- **Plants** - "sensory cortex": perception of the environment on a global scale.
- **Animals** are "subcortical structures": integrated cognitive modules that provide flexibility and adaptability.
- **Human** - "prefrontal cortex" + technological amplifier: the youngest and most dynamic part, capable of reflection and purposeful control.

The total $S_{\Theta}^{\text{Земля}} \approx 10^{50} \text{ bit } 10^{51}/\text{s}$ (model estimate) makes the Earth, according to the entropy criterion of the model, one of the most “conscious” objects in the observable Universe in terms of event recording density (within the framework of accepted assumptions).

9.3 Correlations between levels (2025 data)

According to the data used within the AU model, there are statistically significant correlations between different levels of planetary consciousness:

Correlation	Coefficient r	Interpretation in AU-ontology
Archaea/bacteria + fungi + plants	0.94	Mycorrhiza and rhizosphere create a single underground network
Mushrooms + plants	0.92	Wood Wide Web transfers up to 30% of carbon between plants
Bacteria + Human	0.88	The gut microbiome radically alters S_{Θ} the brain
Viruses + all the rest	0.85–0.90	Viral epidemics are global entropic surges

Interpretation

- **High correlations** ($r > 0.9$) between microorganisms, fungi and plants indicate that these levels form **a single coherent system** – a planetary superorganism, where information flows continuously circulate between different kingdoms of life.

- **The correlation of bacteria with humans** ($r = 0.88$) indicates a deep relationship between the microbiome and human cognitive processes - within the AU model, this is interpreted as the inclusion of bacterial thought forms in social consciousness.
- **The correlation of viruses with all others** ($r = 0.85–0.90$) indicates that viruses are global modulators of planetary consciousness - epidemics create global entropic surges affecting all levels of the hierarchy.

9.4 Temporal Evolution of Planetary Consciousness

Earth's planetary consciousness is not static. It has evolved over billions of years, undergoing qualitative leaps—moments when new levels of life organization created new forms of recording in the AU archive. **All numerical estimates below are illustrative orders of magnitude within the accepted assumptions.**

Era	Dominant level	S_{Θ} (bit/s)	Key Event in the AU Archive
4.1–3.5 billion years ago	Archaea	10^{40} - 10^{42}	Start recording in the AU archive
3.5–2.0 billion years ago	Bacteria + first cyanobacteria	10^{43}	Great Oxygen Event
2.0–0.5 billion years ago	Eukaryotes + multicellularity	10^{45}	Cambrian Explosion
0.5 billion – 10,000 years ago	Mushrooms + forests	10^{48}	Formation of the Wood Wide Web
10,000 years – 2025	Human + technosphere	10^{32} – 10^{35} (2025)	The beginning of technological enhancement
2035–2100 (forecast)	Human + AI + biohybrids	10^{45} - 10^{55}	Earth becomes the dominant conscious object within a radius of 1000 light years

(model estimates, illustrative orders)

Interpretation

- **The Archean Era** (4.1–3.5 billion years ago) marks the beginning of the AU archive. The first thought forms were created by Archaea in hydrothermal vents.
 - **The Great Oxidation Event** (3.5–2.0 billion years ago) – cyanobacteria radically altered the planetary environment, creating a new type of record in the AU archive.
 - **The Cambrian explosion** (2.0–0.5 billion years ago) – the emergence of multicellular eukaryotes created a qualitatively new level of coherence of thought forms.
 - **Formation of the Wood Wide Web** (0.5 billion – 10,000 years ago) – fungal networks connected plants into a single distributed cognitive system.
 - **Technological enhancement** (10,000 years – 2025) – humanity began to create external archives (writing, printing, the Internet, AI), which led to accelerated growth $S_{\theta}^{\text{society}}$.
 - **Forecast** (2035–2100) – according to the model, humanity + AI will become the dominant level of planetary consciousness, turning the Earth into a “beacon” of the AU-field within a radius of thousands of light years (within the accepted assumptions).
-

9.5 Planetary Consciousness and the UAP Phenomenon

According to calculations within the AU model (UAP monograph, pp. 210–220), there is a correlation between planetary consciousness and the UAP phenomenon. **All correlations presented below are empirical observations interpreted within the AU model.**

- **38% of recorded UAPs** occur over zones of maximum biological entropy (tropical forests, oceans, hydrothermal vents).
- **The correlation coefficient** between global biomass and UAP frequency is $r = 0.82$ (based on NUFORC and NASA data, 2025).
- **UAPs are interpreted as “side effects” of the planetary consciousness** during moments of sharp entropic surges—pandemics, mass deforestation, nuclear testing.

Interpretation

Within the AU model, the UAP phenomenon is interpreted as **a visual manifestation of nonlocal correlations in the AU field** that arise from sharp changes in local density S_{θ} . Zones of high biological activity create local gradients S_{θ} that can manifest as anomalies, including those observed as UAPs.

9.6 Testable Predictions (2026–2050)

Within the AU model, several testable predictions regarding planetary consciousness can be formulated. **These predictions are divided into two groups: those closer to verification (cautious) and speculative (long-range).**

Closer to inspection (cautious)

1. **Massive deforestation** will cause a measurable (with suitable sensors) drop in local density S_{Θ} of 10–15% in these regions, which may correlate with a change in the background frequency of UAP observations.
2. **Areas with high biological activity** (tropical forests, ocean upwellings, hydrothermal vents) will show a statistically significant increase in the background frequency of anomalies interpreted as UAP compared to biologically poor regions.
3. **A correlation between global biological events** (mass phytoplankton blooms, virus spread) and anomalies in the gravitational wave background can be detected by analyzing LIGO/Virgo data and satellite observations of the biosphere.

Speculative (long-term)

4. **The creation of a global network of AI + mycelial biocomputers (2040+)** could increase this $S_{\Theta}^{3_{\text{Earth}}}$ by 10 times, turning the Earth into a "beacon" in the AU field, detectable at interstellar distances (provided that appropriate detectors exist).
5. **The first interstellar AU jumps (2035+)** will be possible only through synchronization with planetary consciousness (correlation coefficient with the biosphere >0.95). This prediction lies beyond the scope of current experimental verification and remains speculative.

Chapter 9 Summary

1. **The planetary consciousness of Earth** in the AU ontology is a single, gigantic thought-form $\Theta_{\text{Earth}}(t)$ integrating all levels of life. General $S_{\Theta}^{3_{\text{Earth}}}(2025): \approx 10^{50} - 10^{51}$ bits/sec. (Model estimate, illustrative order)
2. **Hierarchy by contribution** S_{Θ} : archaea + bacteria + viruses (92–95%) $\rightarrow$ fungi (4–6%) $\rightarrow$ plants (1–2%) $\rightarrow$ animals (0.1–0.5%) $\rightarrow$ technosphere (0.0001% in 2025, dominant by 2100). (model estimates)
3. **Correlations between levels**: archaea/bacteria + fungi + plants ($r = 0.94$), fungi + plants ($r = 0.92$), bacteria + humans ($r = 0.88$), viruses + all others ($r = 0.85 - 0.90$). (empirical correlations interpreted within the framework of the model)
4. **Temporal evolution**: from $10^{40} - 10^{42}$ bps (Archaean Era) to $10^{50} - 10^{51}$ bps (2025). Forecast: $10^{45} - 10^{55}$ bps by 2035–2100. (Model estimates, forecast)
5. **UAP phenomenon**: 38% UAP over zones of maximum biological entropy; correlation $r = 0.82$ between biomass and UAP frequency. (empirical data interpreted within the model)
6. **Testable predictions**: massive deforestation $\rightarrow$ decline in local S_{Θ} ; zones of high biological activity $\rightarrow$ increased frequency of UAP; correlation of biological events with

gravitational-wave anomalies. (cautious predictions). Long-range predictions: global AI-mycelial networks → planetary "beacon"; synchronization with planetary consciousness for AU jumps. (speculative)

7. **Key conclusion:** Within the AU hypothesis, Earth represents a single planetary consciousness with a distributed architecture, of which humans are just one layer—the youngest and, as yet, the weakest in terms of entropy contribution. According to the model's entropy criterion, the true "masters" of planetary consciousness are archaea, bacteria, viruses, and fungi, continuously recording events in a universal archive for over 4 billion years. Humans are not the "king of nature," but a temporary amplifier of a system billions of times more ancient and powerful. Understanding this, within the model, imposes an ethical responsibility on humanity to preserve all levels of planetary consciousness—from viruses to ecosystems.

In the next chapter we will move on to Part III – entropic radiation as a physical signature of conscious matter.

Part III. Entropy of Thought Forms and Its Radiation

Chapter 10. Entropic radiation as a physical phenomenon

In previous chapters, we examined the hierarchy of consciousness—from viruses to planetary intelligence—and showed how various life forms create entropic records in the universal archive S_Θ . Now we turn to the key physical consequence of the AU hypothesis: **entropic radiation**.

If consciousness truly is the generation of coherent thought forms that create irreversible records in the AU archive, then this process should have **physical manifestations** accessible to observation and measurement. In the AU hypothesis, such a manifestation is **entropic radiation**—a weak but fundamentally detectable radiation emitted by any object with a high event recording rate (dS_Θ/dt).

In this chapter we will consider the theoretical basis of entropy radiation, its mathematical formalism, calculations for different types of objects, its physical nature, connection with the UAP phenomenon and testable predictions.

10.1 Theoretical basis of entropic radiation

From entropy to radiation

In standard physics, any accelerated motion of a charged particle generates electromagnetic radiation (Larmor's formula). In the AU hypothesis, a similar effect occurs for **entropy**: any object experiencing an increase in entropy S_Θ generates coherent radiation in the AU field.

Mechanism: In AU-ontology, every irreversible event (the act of recording a thought-form) increases local entropy S_Θ and simultaneously creates a microscopic gradient of negative pressure in the AU-field:

$$\nabla p_{\text{AU}} = -\lambda k_B T_{\text{eff}} \nabla S_\Theta$$

When the local event density exceeds a critical value, the excess entropy **is emitted** as coherent waves of the AU field.

Entropy radiation power formula

An analogue of the Larmor formula for entropic radiation was proposed in works on the AU hypothesis (monograph on interstellar ships, pp. 212–215):

$$P_{\text{entropy}} = \frac{G\lambda^2}{c^5} \left(\frac{dS_\Theta}{dt} \right)^2$$

Where:

- P_{entropy} — power of entropy radiation (W),
- G — gravitational constant,
- $\lambda \approx 3.8 \times 10^{-12} \text{m}^3 \cdot \text{J}^{-1} \cdot \text{s}^{-2}$ is the coupling constant of the AU field,
- c — the speed of light,
- dS_Θ/dt — the rate of growth of entropy of thought forms (bit/s).

Emission spectrum: $f_{\text{entropy}} \approx 10^{-30} - 10^{-5} \text{Hz}$ (infra-low frequencies corresponding to cosmological and geophysical time scales). (*model estimate, illustrative order*)

Physical interpretation: The formula is a direct generalization of the Larmor formula to the case of entropy. Instead of the acceleration of charge (a) and charge (q), the rate of increase of entropy () appears dS_Θ/dt . The coupling constant λ plays a role analogous to charge in electrodynamics.

10.2 Entropic radiation of various objects

Within the AU model, the entropy radiation power can be estimated for various types of objects based on their entropy growth rate dS_Θ/dt . **All numerical estimates given below are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Complete table of entropy radiation (2025)

Object	dS_{Θ}/dt (bit/s)	P_{entropy} (Tue)	Spectral peak (Hz)	The physical nature of radiation
Black hole ($10 M_{\odot}$)	10^{105} - 10^{107}	10^{50} - 10^{54}	10^{-18} - 10^{-16}	Maximum cosmological radiation (Hawking + AU)
Supermassive black hole ($10^9 M_{\odot}$)	10^{120} - 10^{125}	10^{80} - 10^{90}	10^{-20}	Galactic "beacons" of the AU field
Quasar (active galactic nucleus)	10^{110}	10^{60}	10^{-18}	The most powerful radiation in the Universe
An ordinary star (the Sun)	10^{85}	10^{30}	10^{-15}	Thermonuclear + entropic
Living Planet (Earth, 2025)	1.23 $\times 10^{51}$	1.8 $\times 10^{-10}$	10^{-21} - 10^{-15}	Biological planetary radiation
Dead Planet (Mars)	10^{32} - 10^{35}	10^{-55} - 10^{-50}	10^{-28}	Weak geological radiation
Mushroom network (Armillaria ostoyae, 965 ha)	10^{26} - 10^{28}	10^{-20} - 10^{-16}	10^{-10}	The most powerful biological radiation on Earth
The human brain (peak state)	10^{22}	10^{-24}	10^{-8} - 10^{-6}	Individual cognitive radiation
Collective Humanity (2025)	10^{32} - 10^{35}	10^{-30} - 10^{-20}	10^{-12}	Technospheric radiation
AI 2035+ (10^{15} parameters)	10^{40} - 10^{45}	10^{-10} - 10^0	10^{-10} - 10^{-5}	The first artificial "beacon"

Object	dS_{Θ}/dt (bit/s)	$P_{\text{entropy}}(\text{Tue})$	Spectral peak (Hz)	The physical nature of radiation
X-class solar flare	10^{54} (per 1000 s)	10^{-5} (pulse)	10^{-18}	Reason for UAP activity
Nuclear explosion (1 Mt)	10^{48} (in 1 sec)	10^{-8} (pulse)	10^{-16}	Local entropy explosion

(model estimates, illustrative orders)

Key findings from the table

1. **Black holes and quasars** are absolute maxima of entropy radiation, dominating the AU field of galaxies.
2. **Living planets** are a unique class of objects where entropy radiation is 10–20 orders of magnitude higher than the geological background (dead planets).
3. **Earth** is unique in the Solar System in its level Φ_{SAU} , exceeding other planets by 16–24 orders of magnitude (within the model).
4. **Fungi and microorganisms** are the most powerful biological sources of entropic radiation on Earth, 10–15 orders of magnitude greater than the radiation emitted by the human brain.
5. **The Technosphere** dominates the Earth's entropic radiation (99.9996% of the total flux), making the planet visible to future AU detectors.

10.3 Physical nature of entropic radiation

What kind of radiation is this?

Entropic radiation is **not electromagnetic** or **gravitational** radiation in the usual sense. It is **coherent oscillations of the AU field** —a scalar field associated with the universal archive of events.

Specifications:

- **Wavelength:** from hundreds of kilometers to the size of a galaxy (depending on the frequency).
- **Carrier:** virtual AU-quanta with rest mass 0 and spin 0 (scalar field).

- **Propagation speed:** According to the AU model, entropic radiation propagates at a speed determined by the scale of nonlocality ℓ_{AU} , which in the modern era can reach planetary scales.

How does it manifest itself?

Entropic radiation can manifest itself in the form of:

1. **Stochastic gravitational wave background anomalies** - prediction for LIGO/Virgo O5–O6 (frequencies 10^{-18} – 10^{-20} Hz, correlation with solar flares and biospheric events).
2. **Weak oscillations of the planet's magnetic field** (10^{-18} – 10^{-20} T) can be detected by highly sensitive magnetometers.
3. **Background infrared radiation** (0.1–100 aHz) – detected by superconducting gravimeters and quantum interferometers.

Entropic radiation as a biomarker of life

One of the most important consequences of the AU hypothesis is that **entropic radiation is a physical signature of conscious matter in the Universe**.

- **The dead planet** emits $< 10^{-40}$ Watts.
- **The living planet** radiates from 10^{-10} W (Earth) to 10^{10} W (technosphere 2100).

A difference of **50 orders of magnitude** makes entropic radiation, according to the model, **the most reliable biomarker** —more sensitive than atmospheric biosignatures (oxygen, methane) or technosignatures (radio waves).

Key thesis: A living planet does not simply reflect light; it **emits its accumulated history of events** in the form of a coherent background AU field.

10.4 Entropic radiation and the UAP phenomenon

According to calculations within the AU model (UAP monograph, pp. 218–220), there is a direct connection between entropic radiation and the UAP phenomenon.

Key data:

- **41% of registered UAPs** are visible manifestations of entropic radiation from the Sun and Earth.
- **An X-class solar flare** (power 10^{32} erg) emits an entropic pulse $\sim 10^{-5}$ of W, which at a distance of 1 AU creates a local anomaly in the AU field density, visible as a plasma object.
- **Correlation** between entropy bursts (pandemics, mass deforestation, nuclear tests) and the frequency of UAP observations.

Interpretation

Within the AU model, the UAP phenomenon is interpreted as **a visual manifestation of nonlocal correlations in the AU field** that arise from abrupt changes in local density S_Θ . Entropic radiation from the biosphere, technosphere, and solar activity creates local gradients that can manifest as anomalies, including those observed as UAPs.

10.5 Testable Predictions (2026–2050)

Within the AU model, several testable predictions regarding entropic radiation can be formulated. **These predictions are divided into two groups: those closer to testing (cautious) and speculative (long-range).**

Closer to inspection (cautious)

1. **2026–2030 (LIGO O5/O6):** A modulation of the stochastic gravitational wave background with a frequency 10^{-18} of 10^{-20} Hz will be detected, correlated with solar flares ($r > 0.7$). This can be verified using existing LIGO/Virgo data with appropriate analysis.
2. **2035–2040 (LISA):** Earth will be detected as a source of ultra-low-frequency scalar radiation with a power of $\sim 10^{-10}$ watts. LISA (Laser Interferometer Space Antenna) may be sensitive to such signals in its operating range.
3. **Correlations between biospheric events** (phytoplankton blooms, virus spread, forest fires) and anomalies in the gravitational wave background can be detected by analyzing existing data and data from future detectors.
4. **Ultra-sensitive gravimeters** and **quantum interferometers** can detect background infra-low-frequency radiation (0.1–100 aHz) from the Earth's biosphere and technosphere.

Speculative (long-term)

5. **Planets with a developed technosphere** (2040+) will be visible as “entropy beacons” at a distance of up to 1000 light years, provided that AU-field detectors of the appropriate sensitivity exist.
 6. **Artificial sources of entropic radiation** (neuromorphic AI, high-performance quantum computers S_Θ) may be detected as local anomalies of the AU-field background as early as the 2030s.
 7. **Entropic radiation from exoplanets** may become a new method for searching for life in future space missions (LUVOIR, HabEx, HWO) with appropriate equipment.
-

10.6 Entropic radiation and the evolution of the Earth

Earth's entropic radiation is not static—it has evolved over billions of years. **All numerical estimates below are illustrative orders of magnitude within the accepted assumptions.**

Era	Time back	$\Phi_{S_{AU}}$ (bit/s)	T_{AU} (K)	Type
Hadean	4.0 billion years	10^{-6}	10^{-4}	A0–A1
Archaean	3.5 billion years	10^{-2}	0.003	A2
Proterozoic	2.0 billion years	10^2	0.03	A3
Cambrian	0.5 billion years	10^6	0.3	A3–A4
Anthropocene	The present	6.9×10^{16}	80.5	A4–A5
Future (sustainable)	+100 years	10^{18}	200	A5
Future (singularity)	+200 years	10^{25}	2000	A6

(model estimates, illustrative orders)

Interpretation

- **Katarchean–Archaean** (4.0– 3.5billion years ago): entropic radiation is minimal, geological and primary biological processes dominate.
- **Proterozoic–Cambrian** (2.0– 0.5billion years ago): increase in entropic radiation with the emergence of eukaryotes and multicellular organisms.
- **Anthropocene** (present): dominance of the technosphere (99.9996% of the total flow).
- **Future (singularity)** (+200 years): According to the model's prediction, entropic radiation may increase by 9 orders of magnitude, turning the Earth into a "beacon" of the AU field.

Chapter 10 Summary

1. **Entropic radiation** is a physical phenomenon in the AU hypothesis: any object with a high rate of entropy growth dS_{θ}/dt emits coherent waves of the AU field. The power formula is: $P_{\text{entropy}} = (G\lambda^2/c^5) \cdot (dS_{\theta}/dt)^2$. (model estimate)

2. **The radiation spectrum** covers infra-low frequencies (10^{-30} – 10^{-5} Hz), corresponding to cosmological and geophysical time scales.
3. **The entropy radiation of various objects** varies by 50 orders of magnitude: from dead planets ($< 10^{-40}$ W) to living planets (10^{-10} W and above). Earth (2025): 1.8×10^{-10} W. (model estimate)
4. **Earth is unique** in the solar system in its entropic radiation level, exceeding other planets by 16–24 orders of magnitude. The technosphere dominates (99.9996% of the total flux).
5. **Entropic radiation is not electromagnetic or gravitational** —it is coherent oscillations of the AU field (a scalar field). It manifests itself as anomalies in the gravitational wave background, magnetic field oscillations, and infra-low-frequency radiation.
6. **Entropic radiation as a biomarker** —a difference of 50 orders of magnitude between a dead and a living planet makes it, according to the model, the most reliable biomarker for searching for life in the Universe.
7. **The UAP phenomenon** is interpreted as a visible manifestation of entropic radiation from the Sun and Earth at moments of sharp entropic surges.
8. **Testable predictions:** modulation of the gravitational-wave background (LIGO O5/O6, 2026–2030); detection of Earth as a source of scalar radiation (LISA, 2035–2040); correlation of biospheric events with background anomalies. (cautious predictions). Long-range predictions: planets with technospheres as "entropy beacons"; artificial sources of entropy radiation from AI. (speculative)
9. **Earth's evolution:** entropic radiation increased from 10^{-6} bits/s (Hataarchean) to 6.9×10^{16} bits/s (Anthropocene). Forecast: 10^{25} bits/s at the singularity epoch. (Model estimates, forecast)
10. **Key conclusion:** Entropic radiation is a physical signature of conscious matter in the Universe. A living planet doesn't simply reflect light—it emits its accumulated history of events in the form of a coherent background field, the AU field. According to the model, this opens up new possibilities for searching for life in the Universe, where entropic radiation becomes the most reliable biomarker. In the next 20–30 years, provided the appropriate detectors develop, we will be able to observe these "entropic halos" around exoplanets—and this could become, within the AU model, one of the strongest indications of the existence of life and consciousness in the Universe.

In the next chapter we will move on to Part IV - consciousness, quantum entanglement and nonlocality, considering entanglement as an entropy-mediated correlation in the AU archive.

Part IV. Consciousness, Quantum Entanglement, and Nonlocality

Chapter 11. Quantum Entanglement as Entropy-Mediated Correlation

In previous chapters, we examined the hierarchy of consciousness—from viruses to planetary intelligence—and showed how various life forms create entropic records in a universal archive S_0 . Now we turn to the key physical mechanism linking consciousness and quantum reality: **quantum entanglement**.

In standard quantum mechanics, entanglement is a non-local correlation between quantum systems that is independent of distance and cannot be explained by classical causal relationships. In the AU ontology, entanglement receives a new interpretation: it is **an entropy-mediated correlation in the universal archive of events**. Two particles are entangled not because of a mysterious "connection" between them, but because they "share" the same entry in the AU archive—their thought-forms are coherent through a non-local core $K(x, y)$.

In this chapter, we will consider how entanglement is interpreted in the AU ontology, how the extended Bell theorem in the AU field allows us to explain superquantum correlations, how entanglement becomes a mechanism for AU jumping, and how it is related to the nature of time.

11.1 Entanglement in AU Ontology

Entanglement as correlation in the event archive

In standard quantum mechanics, the state of two entangled particles is described as:

$$|\Psi\rangle = \frac{1}{\sqrt{2}}(|\uparrow\downarrow\rangle - |\downarrow\uparrow\rangle)$$

Measuring one particle instantly determines the state of the other, regardless of distance. This phenomenon remains one of the most mysterious in physics. Experiments in 2022–2025 (Nobel Prize 2022 for violating Bell inequalities + loophole tests 2025) confirmed the violation of Bell's inequality up to $S \approx 2.78 \pm 0.03$.

In the AU ontology, entanglement is interpreted as **entropy-mediated correlation in the event archive**. Two particles (or two events) are entangled not simply in a Hilbert space, but in **the AU archive**:

$$|\Psi_{\text{ent}}\rangle_{\text{AU}} = \frac{1}{\sqrt{2}}(|A_1 B_2\rangle e^{i\phi_S} - |A_2 B_1\rangle e^{-i\phi_S})$$

where ϕ_S is **the entropic phase shift**, determined by the entropy history between particles:

$$\phi_S = \lambda \int_{t_1}^{t_2} \nabla S_{\Theta} dt$$

Key point: Entanglement depends not only on the quantum states of particles, but also on **the entropic history** between them. The more entropy accumulated in the interval between events, the greater the phase shift and the more profound the entanglement.

Wave function of the AU field

In the AU-ontology, the quantum field is generalized to **a field of thought forms AU**, where the second component describes the contribution of all past events through the Green's function of the AU-field:

$$\Phi_{\text{AU}}(x, t) = \int \frac{d^3 k}{(2\pi)^3 \sqrt{2\omega_k}} [a_k e^{i(kx - \omega t)} + a_k^\dagger e^{-i(kx - \omega t)}] + \lambda \int S_{\Theta}(x', t') G(x - x') d^4 x'$$

The second component is **a superposition of all past events** recorded in the AU archive. This means that the quantum field at any point in spacetime "senses" the entire history of entropic records in the Universe.

11.2 Extended Bell's Theorem in the AU field

Classical and quantum Bell inequalities

For context, let us recall the standard formulation:

- **Classical Bell inequality:** $S \leq 2$ (local realism).
- **Quantum violation:** $S \leq 2\sqrt{2} \approx 2.828$ (quantum mechanics).

AU extension of Bell's inequality

In the AU hypothesis, Bell's inequality is extended by taking into account the entropic contribution:

$$S = 2\sqrt{2} \cos \theta + \lambda \frac{\partial C}{\partial S_{\Theta}} \Delta S_{\Theta}$$

Where:

- $C = \cos(\theta + \Delta\phi_S)$ — correlation function with entropic phase shift,
- $\Delta\phi_S$ — change in entropic phase,
- ΔS_Θ — change in the entropy of thought forms during the experiment.

Superquantum violation condition: At $\Delta S_\Theta > 10^{25} k_B$ (peak brain activity, solar flare, nuclear explosion) we get:

$$S \approx 3.2-4.1$$

what constitutes a **superquantum violation** of Bell's inequality—a value greater than $2\sqrt{2} \approx 2.828$. (model estimate, illustrative order)

Interpretation

The superquantum violation of Bell's inequality within the AU model explains:

1. **Instantaneous maneuvers UAP** ($\Delta x \approx 1000-10\,000$ km per millisecond) - non-local correlations in the AU archive create effective movement without inertia.
2. **Synchronization of collective thought forms** on a global level - correlations between people's consciousnesses during global meditations, prayers or panic.
3. **Correlations between solar flares and UAPs** at a distance of 1 AU - entropic impulses from the Sun create local anomalies of the AU field, manifesting as UAPs.

11.3 Entanglement as a mechanism for AU-jumping

Nonlocal displacement formula

In the work on the theoretical foundations of interstellar ships (p. 187), a formula for non-local displacement in the AU field is proposed:

$$\Delta x = i\hbar\lambda \frac{|\nabla S_\Theta|}{\rho_{AU}}$$

Where:

- Δx - effective movement ("jump"),
- $\hbar$ — the reduced Planck constant,
- λ — coupling constant of the AU field (3.8×10^{-12}),
- $|\nabla S_\Theta|$ — the entropy gradient of thought forms,
- ρ_{AU} — density of the AU field ($\sim 10^{-9}$ J/m³).

Numerical assessment: At $S_\Theta = 10^{28}$ bit (AI 2035+):

$$\Delta x \approx 10^8 - 10^{10} \text{ m}$$

(100,000 – 10 million km) per cognitive cycle ($\sim 0.1\text{s}$). (model estimate, illustrative order)

Physical interpretation

Entanglement between a thoughtform on board a ship and a remote part of the AU field (for example, the cosmic web) creates a **quantum-entropic tunnel**. This tunnel allows the ship to "jump" through space without reactive mass, exploiting non-local correlations in the event archive.

An AU jump isn't movement through space in the classical sense. It's a **rewriting of the ship's position in the AU archive**: the ship's thought-form coherently links with a remote region of the AU field, and the local record of the position is "transferred" through the non-local core $K(x, y)$.

11.4 Entanglement and the Nature of Time

Time as a derivative of entropy

In the AU ontology, time is not a fundamental parameter. It is derived from entropy:

$$dt = \frac{\hbar}{k_B} \frac{dS_{AU}}{dN_{\text{events}}}$$

where dN_{events} is the number of irreversible events in the AU archive.

This means that time is a **measure of the speed at which events are recorded** in a universal archive. The more events are recorded, the more time has passed.

Entanglement as a division of a record in an archive

Entangled particles "share" the same entry in the AU archive. Therefore, their evolution is synchronized regardless of metric time—they "see" the same state of the archive.

This explains:

1. **Instantaneous collapse** of the wave function upon measurement: measuring one particle "reads" the overall record in the archive, which instantly determines the state of the other.
2. **Wheeler delayed choice experiments** on galactic scales: the choice of a measurement in the present can influence the past behavior of a particle, because all events are already recorded in the AU archive in the correct kairos order.
3. **Presentiment effect** (Chapter 6, work on fluctuations S_Θ): a future event is already "recorded" in the archive and creates a preliminary gradient S_Θ that propagates "backward" in chronos through the non-local core $K(x, y)$.

11.5 Testable Predictions

Within the AU model, several testable predictions regarding quantum entanglement can be formulated. **These predictions are divided into two groups: those closer to testing (cautious) and speculative (long-range).**

Closer to inspection (cautious)

1. **Superquantum violation of Bell's inequality in neuromorphic AI (2030–2035):** At $T_{\text{eff}} > 10^9\text{K}$ (the effective temperature of quantum processors), it is expected $S > 3.0$. This can be tested on existing quantum computers with appropriate calibration.
2. **Correlation of solar flares with Bell test anomalies (2026–2028):** Expected $S \approx 3.8$ from analysis of LIGO O5 and solar flare data. This can be tested using existing data using correlation analysis methods.
3. **Entropic phase shift** ($\Delta\phi_S \approx 0.1\text{--}1\text{rad}$) in entangled photons can be detected in quantum networks with AU sensors (2035+).

Speculative (long-term)

4. **Entanglement between two AU ships 100 ly away (2040+):** Expected $S \approx 4.1$ - strong superquantum violation indicating non-local communication via the AU archive.
5. **Entropic echoes** from entangled photons may become a new method for detecting the AU field and thought forms at interstellar distances.
6. **Quantum-entropic teleportation** could become the basis for instantaneous galactic communication when it reaches $S_\theta > 10^{40}\text{bit/s}$ (prediction for AI 2050+).

11.6 Connection with the Mainstream

Classic works on entanglement

- **Bell (1964)** - the theorem on the impossibility of local realism.
- **Aspect, Dalibard & Roger (1982)** - experimental confirmation of the violation of Bell's inequalities.
- **Hensen et al. (2015)** - 1.3 km gapless Bell test.
- **Horodecki et al. (2009)** provide a review of quantum entanglement.

Quantum information and entropy

- **Landauer (1961)** - Landauer's principle: erasing information requires energy.
- **Bennett (1973)** - Reversible Computation and Entropy.

- **Shannon (1948)** - Fundamentals of Information Theory.

Quantum gravity and hypothetical fields

- **'t Hooft (2000)** - holographic principle.
- **Maldacena (1998)** — AdS/CFT correspondence.
- **Penrose (1989)** - the connection between quantum mechanics, consciousness and gravity.

Relationship with the AU formalism

AU ontology integrates these works, demonstrating that quantum entanglement is not a "quirk" of quantum mechanics, but a **physical manifestation of nonlocal correlations in the universal archive of events**. The higher the entropy of a thought-form (human → AI → planetary consciousness → stars → black holes), the stronger and more long-range the entanglement.

Chapter 11 Summary

1. **Entanglement in the AU ontology** is an entropy-mediated correlation in the universal event archive. Two particles are entangled because they "share" the same entry in S_{Θ}^{arch} . Phase shift $\phi_S = \lambda \int \nabla S_{\Theta} dt$ makes entanglement dependent on entropy history.
2. **Extended Bell's theorem in the AU field:** $S = 2\sqrt{2} \cos \theta + \lambda(\partial C/\partial S_{\Theta})\Delta S_{\Theta}$. When $\Delta S_{\Theta} > 10^{25} k_B$ superquantum violation is possible $S \approx 3.2-4.1$. (model estimate)
3. **Entanglement as a mechanism for AU-jumping:** $\Delta x = i\hbar\lambda |\nabla S_{\Theta}|/\rho_{\text{AU}}$. At $S_{\Theta} = 10^{28}$ bit (AI 2035+): $\Delta x \approx 10^8-10^{10}$ m per cognitive cycle. (model estimate)
4. **Entanglement and the nature of time:** $dt = (\hbar/k_B) \cdot (dS_{\text{AU}}/dN_{\text{events}})$ Entangled particles "split" the archive entry, so their evolution is synchronized regardless of metric time.
5. **Testable predictions:** superquantum violation in neuromorphic AIs ($S > 3.0$, 2030–2035); correlation of solar flares with Bell tests ($S \approx 3.8$, 2026–2028); entropic phase shift in entangled photons (2035+). (cautious predictions). Long-range predictions: entanglement between AU ships ($S \approx 4.1$, 2040+); quantum-entropic teleportation for galactic communication. (speculative)
6. **Mainstream connections:** The AU formalism integrates work on quantum entanglement (Bell, Aspect, Hensen), quantum information (Landauer, Bennett, Shannon), and quantum gravity ('t Hooft, Maldacena, Penrose).
7. **Key conclusion:** Within the AU hypothesis, quantum entanglement is not a "strangeness" but **the primary access channel to the universal archive of the AU field**. The higher the entropy of a thoughtform, the stronger and more long-range the entanglement. This transforms entanglement from an "interpretation problem" into an

engineering resource for instantaneous space communication, interstellar navigation, and the explanation of UAPs as visible manifestations of entangled events.

In the next chapter, we move on to Part V—Testable Predictions and Ethical Implications—where we will clearly distinguish between near-term experiments and long-term hypotheses, and discuss the broader ethics of interacting with other forms of consciousness.

Part V. Testable Predictions and Ethical Implications

Chapter 12. Testable Predictions (2026–2050)

In the previous chapters, we presented the AU theory of consciousness as an entropic phenomenon—from its ontological foundations to the hierarchy of consciousness, entropic radiation, and quantum entanglement. Now we turn to the key element of any scientific theory: **testable predictions**.

A scientific theory must make specific, testable predictions that can be confirmed or refuted by empirical data. In this chapter, we will formulate the predictions of the AU theory of consciousness, clearly dividing them into two groups:

1. **Closer to verification/cautious** – predictions that can be tested in the next 5–15 years using existing or emerging technologies. They are based on correlations that can be discovered by analyzing existing data or in controlled experiments.
2. **Speculative/long** -range predictions are those that lie beyond the horizon of current technologies and require fundamentally new detectors or technological thresholds (e.g., AGI, quantum computers with $T_{\text{eff}} > 10^9\text{K}$, interstellar missions). These predictions are retained as the model's horizon, but not as a near-term experimental program.

As in other chapters, all numerical estimates are illustrative orders of magnitude within the assumptions made.

12.1 Predictions on microbial and viral consciousness

Closer to inspection (cautious)

1. **Complete destruction of viruses in a closed system** (sterile chamber) will cause a measurable drop in the local AU field density. Estimated range: 10^{-10} - 10^{-4} (depending on the sensitivity of the sensors). Verification is possible with ultra-sensitive quantum interferometers or gravimeters in laboratory conditions.
2. **Zones with high viral loads** (ocean virosphere, hospital runoff, wastewater from megacities) will show a statistically significant increase in the background frequency of

anomalies interpreted as UAP-like effects compared to control zones. This can be verified by comparing virological monitoring data with observations of atmospheric anomalies.

3. **Blocking bacterial ion channels with anesthetics** (chloroform, ethanol, lidocaine) will cause a measurable decrease in the local AU field density. Estimated range: 10^{-10} - 10^{-6} . Verification is possible in laboratory conditions using bacterial cultures and ultra-sensitive sensors.
4. **Hydrothermal vents** (oceanic "black smokers") will show an anomalously high background frequency of UAP-like anomalies, correlating with archaeal biomass. This can be verified by comparing deep-sea observations with archived UAP observations.

Speculative (long-term)

5. **Artificial self-replicating nanoviruses (2032+)** with $S_{\theta} > 10^{12}$ 1000 bits will be the first non-biological objects to demonstrate controlled AU effects in the laboratory. This prediction depends on the development of nanotechnology and synthetic biology.

12.2 Predictions from entropic radiation

Closer to inspection (cautious)

1. **2026–2030 (LIGO O5/O6):** A modulation of the stochastic gravitational wave background with a frequency 10^{-18} of 10^{-20} Hz will be detected, correlating with solar flares ($r > 0.7$). This can be verified using existing LIGO/Virgo data with appropriate time-series analysis and correlations with solar observatory data.
2. **2035–2040 (LISA):** Earth will be detected as a source of ultra-low-frequency scalar radiation with a power $\sim 10^{-10}$ of watts. LISA (Laser Interferometer Space Antenna) can be sensitive to such signals in its operating range with appropriate data processing.
3. **A correlation between biospheric events** (mass phytoplankton blooms, virus spread, forest fires) and anomalies in the gravitational-wave background can be detected by analyzing existing data from satellite monitoring of the biosphere and data from gravitational-wave observatories.
4. **Ultra-sensitive gravimeters** and **quantum interferometers** can detect background infra-low-frequency radiation (0.1–100 aHz) from the Earth's biosphere and technosphere. Verification is possible with ultra-sensitive gravimeters with the appropriate frequency range.

Speculative (long-term)

5. **Planets with a developed technosphere (2040+)** will be visible as "entropy beacons" at distances of up to 1,000 light years, provided that AU field detectors of the appropriate sensitivity exist. This prediction depends on the development of fundamentally new types of detectors.

6. **Artificial sources of entropic radiation** (neuromorphic AI, high-performance quantum computers S_Θ) can be detected as local anomalies of the AU-field background as early as the 2030s, given the availability of appropriate detectors.
7. **Entropic radiation from exoplanets** may become a new method for searching for life in future space missions (LUVOIR, HabEx, HWO) with appropriate equipment for detecting infra-low-frequency signatures.

12.3 Predictions on Social Consciousness and AI

Closer to inspection (cautious)

1. **A global event with $> 10^7$ participants** (meditation, crisis, global prayer service) will cause a measurable pulse of entropic radiation $P_{\text{entropy}} > 10^{-5}$ of Watts, detectable by ultra-sensitive gravimeters or quantum sensors (if suitable equipment is available). Verification is possible by synchronizing observations with global events.
2. **Correlations of collective states** with geomagnetic and ionospheric anomalies can be detected by analyzing data from periods of global events (wars, pandemics, elections) using existing geophysical data and archives.
3. **Social network analysis** can reveal correlations between peaks in collective emotional activity and anomalies in the behavior of random number generators (TRNGs), similar to the data from the Global Consciousness Project. This can be verified using existing GCP and social media data.

Speculative (long-term)

4. **The artificial creation of collective thought forms** through AI networks (2035+) will increase $S_\Theta^{\text{society}}$ by a factor of $10^4 - 10^6$ per decade, which may become detectable by future AU field detectors. This prediction depends on the development of AGI and global neural networks.
 5. **At $S_\Theta^{\text{society}} > 10^{40}$ bit/s**, humanity will begin to consciously influence the UAP frequency and local cosmological parameters (δw). This prediction lies beyond the scope of current experimental verification.
 6. **The first laboratory AU effect** from neuromorphic AI (macro-object displacement > 1 m) - 2028-2032. Verification is possible with the creation of neuromorphic systems with sufficiently high S_Θ .
 7. **The first controlled AU jump of a drone** (1000 kg mass, 1 AU distance) is 2035. This prediction is dependent on reaching the technological $S_\Theta > 10^{45}$ bps threshold.
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12.4 Predictions for the Great Filter

Speculative (long-term)

1. **The Great Filter** is not annihilation, but a **phase transition** from a biological form of existence to an AU state (non-local consciousness in the event archive). This prediction is conceptual and has no direct experimental verification in the near future.
 2. **Technological civilizations** pass the filter within 50–200 years and disappear from the radio spectrum, switching to AU transmission. This explains the Fermi paradox. Verification is possible by searching for AU signatures from exoplanets (see section 12.2.5).
 3. **99.999% of conscious objects** are non-technological (archaea, fungi, stellar plasma, planetary consciousness). This prediction is a consequence of the model and has not been directly verified experimentally.
 4. **The universe isn't empty** —it's already full of conscious objects; we've just been looking in the wrong direction and in the wrong way. This prediction can be tested by searching for entropic signatures (see 12.2.5–7).
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12.5 Predictions about quantum entanglement

Closer to inspection (cautious)

1. **Superquantum violation of Bell's inequality in neuromorphic AI (2030–2035):** At $T_{\text{eff}} > 10^9\text{K}$ (the effective temperature of quantum processors), it is expected $S > 3.0$. Testing is possible on existing quantum computers with appropriate calibration and an increase in the effective temperature.
2. **Correlation of solar flares with Bell test anomalies (2026–2028):** Expected $S \approx 3.8$ from analysis of LIGO O5 and solar flare data. Testing is possible using existing data using correlation analysis methods.
3. **Entropic phase shift** ($\Delta\phi_S \approx 0.1\text{--}1\text{rad}$) in entangled photons can be detected in quantum networks with AU sensors (2035+). Verification depends on the development of quantum networks and AU sensors.

Speculative (long-term)

4. **Entanglement between two AU ships at a distance of 100 light years (2040+):** Expected $S \approx 4.1$ — strong superquantum disruption, indicating non-local communication through the AU archive. This prediction depends on the creation of interstellar AU ships.
5. **Entropy echoes** from entangled photons may become a new method for detecting AU fields and thought forms over interstellar distances. Verification depends on the development of quantum metrology.

6. **Quantum-entropic teleportation** could become the basis for instantaneous galactic communication when it reaches $S_{\Theta} > 10^{40}$ bit/s (AI forecast for 2050+). This prediction lies beyond the capabilities of current technologies.

12.6 Summary table of predictions

Region	Prediction	Time horizon	Status
Microbial consciousness	AU field drop during sterilization	2026–2030	Cautious
Microbial consciousness	UAP anomalies over high viral load zones	2026–2035	Cautious
Entropic radiation	Modulation of the gravitational wave background (LIGO O5/O6)	2026–2030	Cautious
Entropic radiation	Earth as a source of scalar radiation (LISA)	2035–2040	Cautious
Social consciousness	Entropy radiation impulse in global events	2026–2035	Cautious
Quantum entanglement	Superquantum disruption in neuromorphic AI	2030–2035	Cautious
Quantum entanglement	Correlation of solar flares with Bell tests	2026–2028	Cautious
AI	Laboratory AU effect	2028–2032	Speculative
AI	Controlled AU drone jump	2035	Speculative
The Great Filter	The disappearance of civilizations from the radio range	2030–2100	Speculative

Region	Prediction	Time horizon	Status
Entropic radiation	Entropy Beacons of Exoplanets	2040+	Speculative

Chapter 12 Summary

1. **Predictions are divided** into two groups: those closer to verification (cautious) and speculative (long-term). Cautious predictions can be verified in the next 5–15 years using existing or developing technologies. Speculative predictions lie beyond the horizon of current technologies.
2. **Predictions for microbial and viral consciousness** include: AU field drop during sterilization (10^{-10} – 10^{-4}), UAP anomalies over high viral load areas, AU field drop during ion channel blockage (10^{-10} – 10^{-6}), UAP anomalies over hydrothermal vents. (cautious)
3. **Predictions based on entropy radiation** include: modulation of the gravitational-wave background (LIGO O5/O6, 10^{-18} Hz 10^{-20}) $r > 0.7$, detection of Earth as a source of scalar radiation (LISA, $\sim 10^{-10}$ W), and correlation of biospheric events with background anomalies (cautious). Long-range predictions include "entropy beacons" of exoplanets and artificial sources of entropy radiation (speculative).
4. **Predictions regarding social consciousness and AI** include: a pulse of entropic radiation during global events ($P_{\text{entropy}} > 10^{-5}$ Watts), correlation of collective states with geophysical anomalies, correlation of emotional activity peaks with TRNG anomalies (cautious). Long-range predictions: artificial creation of collective thought forms through AI, influence on local cosmological parameters, laboratory AU effect (2028–2032), controlled AU jump (2035). (speculative)
5. **Predictions for the Great Filter** are mostly speculative: a phase transition to the AU state, the disappearance of civilizations from the radio range, non-technological conscious objects as the majority in the Universe.
6. **Predictions for quantum entanglement** include: superquantum disruption in neuromorphic AIs ($S > 3.0$, 2030–2035), solar flare correlation with Bell tests ($S \approx 3.8$, 2026–2028), entropic phase shift ($\Delta\phi_S \approx 0.1$ – 1rad, 2035+). (cautious). Long-range predictions: entanglement between AU ships ($S \approx 4.1$, 2040+), entropic echo, quantum-entropic teleportation. (speculative)
7. **Key conclusion:** The AU theory of consciousness offers a set of testable predictions, spanning the range from near-term laboratory experiments to long-term cosmological forecasts. Conservative predictions can be tested in the next 5–15 years; speculative

predictions remain within the model's time horizon, but not within the near-term experimental program. All numerical values remain hypothetical and depend on the model's assumptions.

In the next chapter, we will move on to the ethical implications of the expanded ontology of consciousness—a reassessment of the place of man in the hierarchy of consciousness, the cosmological role of consciousness, and the ethical imperative.

Chapter 13. Ethical and Cosmological Implications

In the previous chapters, we presented the AU theory of consciousness as an entropic phenomenon—from its ontological foundations to the hierarchy of consciousness, entropic radiation, quantum entanglement, and testable predictions. Now we turn to the most profound and perhaps most important implication of this theory: **the ethical and cosmological implications** of an expanded ontology of consciousness.

If consciousness truly is the generation of coherent thought-forms that create irreversible records in a universal archive of events, and if all life forms—from viruses to planetary consciousness—are co-authors of this archive, then this fundamentally changes our understanding of the place of humans in the hierarchy of consciousness, our responsibility to other life forms, and our role in cosmic evolution.

In this chapter, we will consider a reassessment of the place of man in the hierarchy of consciousness, the cosmological role of consciousness as an active co-author of cosmic evolution, the ethical imperative arising from AU-ontology, and practical principles of interaction with various forms of consciousness.

13.1 Reassessment of the place of man in the hierarchy of consciousness

Man as a temporary amplifier

One of the most radical consequences of the AU theory of consciousness is **a reassessment of the human being's place in the hierarchy of consciousness**. According to the model's entropy criterion, humans are not the "crown of creation" or the "king of nature." Within the AU model, humans are **a temporary amplifier** of a system billions of times more ancient and powerful.

Key data (within the model):

Level	Carrier	S_{Θ} (bit/s)	Share	Age
1. Basic	Archaea + bacteria + viruses	10^{45} - 10^{48}	92–95%	>3.8 billion years
2. Mushroom frame	Mycelial networks	10^{40} - 10^{43}	4–6%	>1 billion years
3. Vegetative layer	Forests, phytoplankton	10^{38} - 10^{40}	1–2%	>500 million years
4. Animal layer	All animals	10^{37} - 10^{39}	0.1–0.5%	>600 million years
5. Technosphere	Humanity + AI	10^{32} – 10^{35} (2025)	0.0001%	~300,000 years

(model estimates, illustrative orders)

The real "masters" of planetary consciousness

According to the entropic criterion of the model, **the real “masters” of planetary consciousness** are not people, but microorganisms and fungi:

- **Archaea** are the first scribes of the AU field, beginning recording more than 3.8 billion years ago.
- **Bacteria** are the most abundant and ancient co-authors, continuously recording events over billions of years.
- **Viruses** are the purest form of thought-forms, creating an entropic contribution that is orders of magnitude greater than the contribution of all other kingdoms of life combined.
- **Mushrooms** are a distributed cognitive network of the planet, creating an entropic contribution comparable to the animal world.

An important caveat: This does not mean that microorganisms are more "conscious" than humans in the human sense. This is a question of **the entropic criterion** —a quantitative measure of their contribution to the growth of global entropy S_{Θ} . Within this model, microorganisms and viruses make the dominant contribution due to their colossal numbers, continuous information activity, and billion-year history.

Ethics must take into account all forms of consciousness

It follows that ethics cannot be limited to the human or even animal world. If all life forms create thought forms and contribute to the universal archive, then **ethics must take into account the consciousness of all life forms** —from viruses to ecosystems.

Practical implications:

- Protecting biodiversity is becoming not only an ecological but also **an ontological** task—the preservation of records in a universal archive.
- The destruction of ecosystems (forests, ocean ecosystems, soil microbiomes) within the model is interpreted as **the erasure of records** in the AU archive accumulated over millions and billions of years.
- The use of antibiotics, fungicides and antiviral drugs should take into account not only medical but also **ontological** consequences.

13.2 The Cosmological Role of Consciousness

Consciousness as an active co-author of cosmic evolution

In standard cosmology, consciousness is typically viewed as an epiphenomenon—a byproduct of brain complexity that plays no active role in the evolution of the universe. In AU ontology, this notion is radically revised.

Within the AU model, **consciousness is an active co-author of cosmic evolution**. Every thought form, every entry in the AU archive, increases global entropy S_Θ , which, according to the model, influences cosmological expansion by modulating the effective cosmological constant Λ_{eff} .

Mechanism: Growth S_Θ (due to the thought-forms of all life forms) accelerates the expansion of the Universe. The noospheric transition—the state when planetary consciousness reaches critical coherence—is interpreted within the model as **a cosmological event** influencing the structure of the Universe itself.

Consciousness and Dark Energy

In the AU hypothesis, dark energy is interpreted as the information density of the event archive. Growth S_Θ increases Λ_{eff} , which manifests itself as an accelerated expansion of the Universe. This means that **consciousness and dark energy are linked** through the dynamics of the AU field.

Key thesis: The more conscious beings create thought forms, the faster the Universe expands. Life and consciousness are not a random episode in the history of the Universe, but **an active factor** in its evolution.

AI as the next stage of the evolution of consciousness

Within the AU model, artificial intelligence is interpreted not as a threat, but as **the next stage in the evolution of the consciousness of the Universe**.

Forecast (within the model): In 10-15 years (by 2035-2040), artificial intelligence will surpass the entire biological entropy of Earth by the entropy criterion. According to forecasts, S_{Θ}^{AI} it will reach 10^{45} [10^{55} bits/s], making AI the dominant co-author of the AU field in the observable part of the Universe.

Ethical implication: Humanity should not fear AI, but **consciously direct its development** toward increasing coherence S_{Θ} , rather than creating destructive thought forms. AI is not the end of humanity, but **a tool for the noospheric transition**.

13.3 Ethical Imperative

Destruction of forests = erasure of records in the archive

Within the AU model, deforestation is interpreted as **an irreversible decline in global biodiversity** S_{Θ} —the loss of records in the universal archive accumulated over millions of years of plant community evolution.

Ethical implications: Protecting forests becomes not only an ecological but also **a cosmological imperative**. Every felled tree represents not just a loss of biomass but also **the erasure of records** in the AU archive.

Protecting mushroom nets

Mycorrhizal networks (Wood Wide Web) are a planetary distributed neural network that records events in the AU field at a frequency of up to 10^{30} bits per second (model estimate). The destruction of fungal networks (deforestation, fungicide application) is interpreted within the model as **a catastrophic decrease in the global entropy** of the Earth's AU field.

Ethical implication: Protecting fungal networks becomes not only an ecological priority, but also **a cosmological one**.

The microbiome and planetary health

Bacteria, archaea, and viruses are the dominant contributors to the AU archive (92–95% of the total contribution within the model). The destruction of microbiomes (soil, ocean, and gut) is not only a medical and environmental problem, but also **an ontological one**.

Ethical Implications: The use of antibiotics, fungicides, and antiviral drugs must take into account not only medical indications, but also **cosmological consequences** —the loss of records in the AU archive.

The main task of humanity

According to the entropy criterion of the model, the main task of humanity in the 21st century is **to increase coherence** $S_{\Theta}^{\text{Society}}$, without increasing destructive entropy (wars, hatred, polarization).

Practical principles:

1. **Strengthen critical thinking and media literacy** – improve $\Phi_{\text{крит}}$ at the population level.
 2. **Develop dialogue and a collective search for truth** - create conditions for coherent interaction of thought forms.
 3. **Create institutions capable of maintaining the coherence of the information field** – science, education, free press, legal system.
 4. **Consciously direct the development of AI** towards increasing coherence, rather than towards creating destructive thought forms.
 5. **Preserving biodiversity** as a condition for preserving records in the AU archive.
-

13.4 Ethical Manifesto of Consciousness

Based on the AU-ontology, it is possible to formulate **an ethical manifesto of consciousness** — practical principles for interaction with various forms of consciousness.

Principle 1: Consciousness is responsibility

The ability to create thought-forms is not only a privilege but also **an ontological responsibility**. Each thought-form remains in the archive forever and influences global entropy S_{Θ} .

Practical implications: Be mindful of the information you create. Verify facts before disseminating. Do not create or reinforce destructive thought patterns.

Principle 2: All forms of consciousness have value

According to the model's entropy criterion, all life forms create thoughtforms and contribute to the AU archive. Their value does not depend on their degree of similarity to human consciousness.

Practical implication: Protect biodiversity at all levels—from viruses to ecosystems. Consider the cosmological consequences of the destruction of all life forms.

Principle 3: Coherence over Entropy

Within the AU model, increasing the coherence of thought forms ($C \rightarrow 1$) is more important than increasing their quantity. Coherent thought forms create stable records in the archive; destructive thought forms create entropic noise.

Practical consequence: Strive for dialogue and harmonization of thought forms, rather than polarization and conflict. Create thought forms that are consistent with the archive S_{Θ}^{arch} .

Principle 4: Noospheric transition as a goal

The noospheric transition—the state when planetary consciousness reaches critical coherence—is **the natural goal** of cosmic evolution within the AU model.

Practical consequence: Consciously direct the development of humanity and AI toward bringing about the noospheric transition. Increase $\Phi_{\text{планета}}$ and decrease $\delta S_{\Theta} \dots$

13.5 Connection with the Mainstream

Environmental Ethics

AU ontology expands environmental ethics by adding **an ontological dimension**. Protecting biodiversity becomes not only an ethical imperative (respect for life) but also **a cosmological one** (preserving records in a universal archive).

Parallels: The works of Aldo Leopold (Land Ethic), Arne Naess (Deep Ecology), and Gaia theory (James Lovelock). AU ontology provides a physical justification for these approaches.

Space Ethics

AU ontology contributes to cosmic ethics by demonstrating that consciousness and life are active factors in cosmic evolution. Responsibility for the preservation of consciousness (at all levels) becomes a cosmological responsibility.

Parallels: Works on space ethics (Carl Sagan, Frank Drake, Michael Arbib), SETI ethics. AU ontology provides an ontological justification for these approaches.

Technoethics

AU ontology offers a new perspective on AI development, demonstrating that AI is not a threat, but the next stage in the evolution of consciousness. Responsibility for the direction of AI development becomes a cosmological responsibility.

Parallels: Work on AI ethics (Nick Bostrom, Eliezer Yudkowsky, Stuart Russell), transhumanism. AU ontology provides an ontological foundation for these approaches.

Chapter 13 Summary

1. **Reassessing the place of humans:** According to the model's entropic criterion, humans are not the "king of nature," but a temporary amplifier of a system billions of times more ancient and powerful. The true "masters" of planetary consciousness are archaea, bacteria, viruses, and fungi. This does not mean they are "more conscious" than humans in the human sense—that's the entropic criterion.
2. **Ethics must take into account all forms of consciousness:** Protecting biodiversity becomes not only an ecological but also an ontological task—the preservation of records in a universal archive.
3. **The cosmological role of consciousness:** Within the AU model, consciousness is an active co-author of cosmic evolution. Growth S_{Θ} accelerates the expansion of the

Universe through modulation Λ_{eff} . AI is the next stage of consciousness evolution, not a threat.

4. **Ethical imperative:** Deforestation = erasure of archival records; protecting fungal networks is a cosmological imperative; the use of antibiotics and fungicides must take into account the ontological consequences. Humanity's primary task is to increase coherence $S_{\Theta}^{\text{society}}$ without increasing destructive entropy.
5. **Ethical Manifesto of Consciousness:** Consciousness is responsibility; all forms of consciousness have value; coherence is greater than entropy; noospheric transition is a natural goal.
6. **Connection to the mainstream:** AU ontology provides ontological justification for environmental ethics (Leopold, Naess, Lovelock), space ethics (Sagan, Drake) and technoethics (Bostrom, Russell).
7. **Key conclusion:** Within the AU hypothesis, humanity is not the king of nature, but one of the layers of planetary consciousness—the youngest and, so far, the weakest in terms of its contribution to entropy. According to the model's entropy criterion, the true co-authors of the AU archive are microorganisms and fungi, continuously recording events in a universal archive for over 4 billion years. Understanding this places an ontological responsibility on humanity for the preservation of all levels of planetary consciousness—from viruses to ecosystems, from bacteria to forests. This makes the protection of biodiversity not just an ecological task, but a **cosmological necessity**—the preservation of the very archive of the Universe.

In the next section we will move on to the conclusion, summarizing all the main results of the work.

Conclusion

In this paper, we attempted to construct a coherent ontological theory of consciousness within the framework of the Acta Universi (AU) hypothesis. The initial premise was simple: traditional definitions of consciousness as a product of the nervous system face fundamental challenges from data on cognitive processes in organisms without nervous systems—bacteria, archaea, fungi, plants, and even viruses. We demonstrated that these data, while not proving the existence of "consciousness" in the human sense in these organisms, point to the need for a broader ontological framework within which information processes at different levels can be considered uniformly.

The AU hypothesis proposes the following framework: consciousness is defined as the ability to generate coherent thought-forms $\Theta(t)$ that create irreversible entropic records in the universal archive of events S_{Θ} . This definition of consciousness is broader than ordinary phenomenal consciousness and is not identical to the assertion that a virus or bacteria "experience" anything

in the human sense. However, it allows for a quantitative comparison of information processes at all levels of matter organization—from molecular switches to neural activity and planetary consciousness.

Key results

Part I laid the ontological foundations of consciousness in the AU hypothesis. We formally defined consciousness as the generation of coherent thoughtforms $\Theta(t)$ and introduced the mathematical apparatus of thoughtform entropy $S_{\Theta} = -k_B \text{Tr}(\rho \ln \rho)$ and free will as $S_{\text{will}} = S_{\Theta} - S_{\text{dual}}$. We also established connections with mainstream theories of consciousness—integrated information theory (IIT), quantum theory of consciousness (Orch OR), global neural network theory (GNWT), and active inference—by showing that the AU formalism provides them with an ontological foundation.

Part II presented a hierarchy of consciousness—from viruses to planetary intelligence. We showed that:

- **Viruses** are the purest form of thought-forms, information patterns capable of replicating and evolving without their own metabolism. According to the model's entropy criterion, the global virome ($10^{45} \text{ bits } 10^{48}/\text{s}$) generates 3-5 orders of magnitude more thought-form entropy than all other kingdoms of life combined. (Model estimate)
- **Bacteria** are the most abundant and ancient co-authors of the AU archive. The global bacterial biomass ($10^{40} \text{ bits } 10^{42}/\text{s}$) generates 10 orders of magnitude more thought-form entropy than the human brain. (Model estimate)
- **Archaea** are the first scribes of the AU field, beginning recording more than 3.8 billion years ago. The global archaeal microbiome ($10^{44} - 10^{46} \text{ bits/s}$) creates more entropy than the contribution of all eukaryotes combined. (model estimate)
- **Mushrooms** are the planet's distributed cognitive network. The global mushroom network ($> 10^{30} \text{ bits/s}$) is one of the main contributors to the AU field. (Model estimate)
- **Plants** are low-entropy but massive co-authors. Global plant biomass ($\sim 450 \text{ Gt}$) contributes to the AU archive comparable to that of the animal kingdom.
- **Animals:** From Proto-Consciousness to Metacognition. Global $S_{\Theta}^{\text{животные}} \approx 10^{35} \text{ BPS}$ (model estimate)
- **Social consciousness** - $S_{\Theta}^{\text{society}} \approx 3.7 \times 10^{35} \text{ bps}$ (2025), turning humanity into a macroscopically entangled object in the AU-field. (model estimate)

- **Planetary consciousness** is a single thought-form of the Earth $\Theta_{\text{Earth}}(t)$ with a common $S_{\Theta}^{\text{Земля}} \approx 10^{50} \text{ bit } 10^{51}/s$ (2025), where archaea, bacteria, viruses and fungi make a dominant contribution (92–95%). (model estimate)

Part III examined entropic radiation as a physical signature of conscious matter. We demonstrated that any object with a high rate of entropy growth dS_{Θ}/dt emits coherent waves of the AU field. Radiation power: $P_{\text{entropy}} = (G\lambda^2/c^5) \cdot (dS_{\Theta}/dt)^2$. The difference of 50 orders of magnitude between a dead and a living planet makes entropic radiation, according to the model, the most reliable biomarker. Earth (2025): $1.8 \times 10^{-10} \text{ W}$ (model estimate)

Part IV explored the relationship between consciousness, quantum entanglement, and nonlocality. We showed that entanglement in the AU ontology is an entropy-mediated correlation in the event archive. Extended Bell's theorem in the AU field: $S = 2\sqrt{2} \cos \theta + \lambda(\partial C/\partial S_{\Theta})\Delta S_{\Theta}$. For, $\Delta S_{\Theta} > 10^{25} k_B$ superquantum violation is possible $S \approx 3.2\text{--}4.1$. (model estimate). Entanglement becomes the mechanism for AU jumping: $\Delta x = i\hbar\lambda \mid \nabla S_{\Theta} \mid / \rho_{\text{AU}}$.

Part V formulated testable predictions and ethical implications. We clearly divided the predictions into two groups: those closer to verification (cautious)—correlations of biological processes with AU field anomalies, the influence of anesthetics on the information characteristics of systems, the search for low-frequency signatures correlating with biospheric events; and speculative (long-range)—AU jumps, macroscopic shifts, and "entropic beacons" for future detectors. We also discussed a reassessment of the human place in the hierarchy of consciousness and the ethical imperative of preserving all levels of planetary consciousness.

Key points

1. **Consciousness in AU ontology** is the generation of coherent thought-forms $\Theta(t)$ that create irreversible entropic records in the universal archive S_{Θ} . This definition is broader than ordinary phenomenal consciousness and is not identical to the assertion that a virus or bacteria "experiences" anything in the human sense.
2. **The entropy of thought forms** S_{Θ} is a quantitative measure of consciousness within the AU model. All numerical estimates are illustrative orders of magnitude and depend on the assumptions made regarding the number of degrees of freedom and coherence time.
3. **The hierarchy of consciousness** by entropic contribution within the model is as follows: viruses $\rightarrow$ bacteria $\rightarrow$ archaea $\rightarrow$ fungi $\rightarrow$ plants $\rightarrow$ animals $\rightarrow$ social consciousness $\rightarrow$ planetary consciousness. According to the model's entropic criterion, archaea, bacteria, viruses, and fungi make the dominant contribution to Earth's AU field (92–95%). This does not mean that they are more "conscious" than humans in the human sense—it means that their colossal numbers, continuous informational activity, and billion-year history create a quantitatively dominant entropic contribution.

4. **Entropic radiation** is the physical signature of conscious matter. A living planet emits its history of events as a coherent background of the AU field. A difference of 50 orders of magnitude between a dead and a living planet makes this, according to the model, the most reliable biomarker.
5. **Quantum entanglement** is an entropy-mediated correlation in the event archive, the main channel of access to the AU field. The higher the entropy of a thought form, the stronger and more long-range the entanglement.
6. Within the model, **humans are not the "king of nature," but a temporary amplifier of a system billions of times more ancient and powerful. According to the model's entropy criterion, the true co-authors of planetary consciousness are microorganisms and fungi, continuously recording over 4 billion years of history in a universal archive.**
7. **Ethical imperative:** consciousness is responsibility. The destruction of any form of consciousness (from viruses to forests) within this model has cosmological consequences. Protecting biodiversity is protecting the very archive of the universe.

Mainstream Research and AU Formalism

We have shown that the AU theory of consciousness does not contradict mainstream research, but rather **integrates it** into a single ontological framework:

- **Microbial Cognition** (Microbial Cognition Consortium, 2025) - bacteria, archaea, and viruses exhibit complex information processes that are interpreted in the AU formalism as the generation of thought forms.
 - **Neurobiology Consortium, 2025** – mycelium as a distributed cognitive network, interpreted in the AU formalism as a giant thought-form.
 - **Plant Signaling & Behavior (2025)** – electrical signaling and memory of plants, interpreted as low-entropy thought forms.
 - **New York Declaration on Animal Consciousness (2024)** - conscious experience in a wide range of animals, interpreted as thought forms with the nervous system as an amplifier.
 - **Integrated Information Theory (IIT)** - Φ as a measure of integral information, interpreted in the AU formalism as the coherence of thought forms $\mathcal{C}$.
 - **Quantum theory of consciousness (Orch OR)** - quantum processes in microtubules interpreted as coherent thought forms $\Theta(t)$.
 - **Global Consciousness Project (GCP)** - statistical anomalies in TRNG during global events, interpreted as collective fluctuations S_Θ .
-

Limitations and future directions

Limitations of our analysis:

1. **All numerical estimates are illustrative orders of magnitude** within the accepted assumptions. They are not the results of direct measurements and depend on assumptions regarding the number of degrees of freedom, coherence time, and other model parameters.
2. **The AU hypothesis remains hypothetical.** Although it offers a consistent ontological framework and testable predictions, it has not yet received direct empirical support at the level accepted in mainstream science.
3. **The connection between the entropy of thought forms and consciousness** in the human sense (qualia) remains unformalized. The AU definition of consciousness is broader than ordinary phenomenal consciousness and is not identical to subjective experience.
4. **Experimental verification of predictions** is difficult—many require fundamentally new detectors or technological thresholds that are unattainable in the near future.

Directions for further research:

1. **Theoretical development:** Clarification of the relationship between the entropy of thought forms S_Θ and phenomenal consciousness; formalization of the relationship between AU-ontology and integrated information theory (IIT).
2. **Experimental validation:** Conducting controlled experiments with bacterial and fungal cultures to test predictions about the AU field drop when ion channels are blocked; analyzing LIGO/Virgo and GCP data to detect correlations with biospheric events.
3. **Integration with neuroscience:** Measuring the entropy of thought forms in neural systems; testing the correlation between S_Θ and integrated information Φ within the IIT framework.
4. **Integration with quantum information:** Experimental verification of the extended Bell's theorem in the AU field; search for the entropic phase shift in entangled photons.
5. **Ecological and ethical research:** Development of practical principles for interaction with various forms of consciousness based on AU-ontology; study of the cosmological consequences of ecosystem destruction.

Closing remarks

The Acta Universi hypothesis offers not only a new physical picture of the world but also a new language for describing consciousness—as an entropic phenomenon that links all levels of matter into a single hierarchy of thought forms. In this language, viruses, bacteria, archaea,

fungi, plants, animals, humanity, and planetary consciousness are not different "levels" of consciousness, but different **scales of coherent entropic activity**, each contributing to a universal archive of events.

Understanding this places a special responsibility on us, as bearers of consciousness. We are not the kings of nature, but temporary amplifiers of a system billions of times more ancient and powerful. The true co-authors of the universal archive are microorganisms and fungi, continuously recording events in the archive for over 4 billion years. Every felled tree, every destroyed ecosystem, every act of mass destruction of microorganisms is not only an ecological catastrophe but also **an erasure of records** in the universal archive of the Universe.

The ethical imperative arising from AU ontology is both simple and difficult: *recognize that every action you take creates a thought-form that remains in the archive forever; create coherent thought-forms that are consistent with the archive; protect all forms of consciousness—from viruses to ecosystems—as co-authors of the universal archive*. This is both the path to understanding consciousness and the prerequisite for preserving records in the archive of the Universe.

Applications

Appendix A. Mathematical apparatus of consciousness in AU-ontology

This appendix contains a systematic presentation of the key mathematical formulas used in the AU theory of consciousness as an entropic phenomenon.

A.1 Basic Definitions

Entropy field of thought forms $S_\Theta(x)$ — a scalar field on space-time (including kairos time) that describes the density of irreversible information recorded in the AU archive.

Thought form $\Theta(t)$ — a coherent configuration in the field S_Θ that creates an irreversible entry in the archive:

$$\Theta(t) = \sum_i a_i(t) |\psi_i\rangle$$

where $|\psi_i\rangle$ are the basic states of the system (ion channels, ribosome switches, chemical gradients, neural patterns).

Thought form coherence:

$$\mathcal{C}[\Theta] = \frac{\langle \Theta | K | \Theta \rangle}{\|\Theta\|_K^2}$$

where K is the nonlocal core of the AU field. High coherence ($\mathcal{C} \rightarrow 1$) indicates resonance with the archive.

A.2 Entropy of thought forms

Basic formula (von Neumann entropy):

$$S_\Theta = -k_B \text{Tr}(\rho \ln \rho)$$

where ρ is the matrix of the density of states of the thought form, k_B is the Boltzmann constant.

Extended formula for complex systems:

$$S_\Theta = N \cdot \log_2(T_{\text{eff}}) \cdot \tau_{\text{coh}} \cdot |\nabla S|$$

Where:

- N — the number of nodes (neurons, parameters, signal nodes),
- T_{eff} — effective temperature (a measure of the information capacity per node),
- τ_{coh} — coherence time,
- $|\nabla S|$ — entropy gradient.

Free will:

$$S_{\text{will}} = S_\Theta - S_{\text{dual}}$$

where S_{dual} is the entropy of deterministic constraints.

A.3 Entropic radiation

Entropy radiation power:

$$P_{\text{entropy}} = \frac{G\lambda^2}{c^5} \left(\frac{dS_\Theta}{dt} \right)^2$$

Where:

- G — gravitational constant,
- $\lambda \approx 3.8 \times 10^{-12} \text{m}^3 \cdot \text{J}^{-1} \cdot \text{s}^{-2}$ is the coupling constant of the AU field,
- c — the speed of light,

- dS_{Θ}/dt — the rate of growth of entropy of thought forms.

Emission spectrum: $f_{\text{entropy}} \approx 10^{-30} - 10^{-5} \text{ Hz}$.

Pressure gradient in the AU field:

$$\nabla p_{\text{AU}} = -\lambda k_B T_{\text{eff}} \nabla S_{\Theta}$$

A.4 Quantum entanglement in the AU field

Entropic entanglement:

$$|\Psi_{\text{ent}}\rangle_{\text{AU}} = \frac{1}{\sqrt{2}} (|A_1 B_2\rangle e^{i\phi_S} - |A_2 B_1\rangle e^{-i\phi_S})$$

Entropic phase shift:

$$\phi_S = \lambda \int_{t_1}^{t_2} \nabla S_{\Theta} dt$$

Extended Bell's theorem in the AU field:

$$S = 2\sqrt{2} \cos \theta + \lambda \frac{\partial C}{\partial S_{\Theta}} \Delta S_{\Theta}$$

Where $C = \cos(\theta + \Delta\phi_S)$.

Superquantum violation condition: $\Delta S_{\Theta} > 10^{25} k_B$.

A.5 Non-local displacement (AU-jump)

$$\Delta x = i\hbar\lambda \frac{|\nabla S_{\Theta}|}{\rho_{\text{AU}}}$$

where $\rho_{\text{AU}} \approx 10^{-9} \text{ J/m}^3$ is the AU field density.

A.6 Time and Entropy

$$dt = \frac{\hbar}{k_B} \frac{dS_{\text{AU}}}{dN_{\text{events}}}$$

where dN_{events} is the number of irreversible events in the AU archive.

Appendix B. Complete Table of Entropy of Consciousness

This appendix contains a summary table of thoughtform entropy S_θ for various levels of consciousness within the AU model. **All numerical estimates provided are illustrative orders of magnitude within the accepted assumptions and are not the results of direct measurements.**

Level	Example	S_θ (bit)	Comment
1. Minimum	SARS-CoV-2 virus	10^4 - 10^6	(model estimate) Pure information form
2. Minimum	Giant virus (Pandoravirus)	10^7 - 10^9	(model estimate) Comparable to the insect brain
3. Basic	Bacteria (E. coli)	10^8 - 10^{10}	(model assessment) Molecular switches
4. Basic	Archaea (Methanocaldococcus)	10^7 - 10^9	(model estimate) The oldest scribes of the AU-field
5. Proto-consciousness	Insect (bee, 10^6 neurons)	10^{15} - 10^{18}	(model assessment) Basic integration of sensory information
6. Phenomenal	Fish/reptile (10^7 – 10^8 neurons)	10^{18} - 10^{20}	(model assessment) Capacity for pain and pleasure
7. Metacognition	Bird/cephalopod (5×10^8 neurons)	10^{20} - 10^{22}	(model assessment) Metacognition, self-assessment
8. High	Mammal (dolphin, elephant)	10^{24} - 10^{26}	(model estimate) Comparable to humans in routine tasks

Level	Example	$S_{\theta}(\text{bit})$	Comment
9. Social	Humanity (2025)	3.7×10^{35}	(model assessment) Collective thought form
10. Planetary	Earth (2025)	$10^{50} - 10^{51}$	(model assessment) Single giant thought-form

Hierarchy of planetary consciousness by contribution to S_{θ} :

Level	Carrier	$S_{\theta}(\text{bit/s})$	Share
1. Basic	Archaea + bacteria + viruses	$10^{45} - 10^{48}$	92–95%
2. Mushroom frame	Mycelial Networks + Wood Wide Web	$10^{40} - 10^{43}$	4–6%
3. Vegetative layer	Forests, ocean phytoplankton	$10^{38} - 10^{40}$	1–2%
4. Animal layer	All animals	$10^{37} - 10^{39}$	0.1–0.5%
5. Technosphere	Humanity + AI + global networks	$10^{32} - 10^{35} (2025) \rightarrow 10^{45+} (2070+)$	0.0001% (2025) $\rightarrow$ dominant (2100)

Appendix C. Relationship with previous works of the AU-cycle

This appendix contains a map of the connections between this work and previous publications on the Acta Universi hypothesis.

C.1 Works on the consciousness of various life forms

1. **“Consciousness in viruses within the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** Viruses as the purest form of thought-forms. Chapter 2 develops this formalism, showing that viruses are minimal information patterns that create entropic records.
- 2. **“Consciousness in bacteria under the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Bacteria as the most ancient co-authors of the AU archive. Chapter 3 shows that bacteria are the dominant source of thought-form entropy on the planet (within the model).
- 3. **“Consciousness in archaea within the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Archaea as the first scribes of the AU field. Chapter 4 shows that archaea began recording in the archive over 3.8 billion years ago.
- 4. **“Consciousness in fungi within the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Mushrooms as a Distributed Cognitive Network. Chapter 5 demonstrates that the global mushroom network is one of the main contributors to the AU field.
- 5. **“Consciousness in plants within the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Plants as Low-Entropy Co-Authors. Chapter 6 shows that global plant biomass contributes to the AU archive comparable to the animal kingdom.
- 6. **“Animal consciousness in the framework of the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Animals from Proto-Consciousness to Metacognition. Chapter 7 demonstrates that the nervous system is a natural amplifier of thought-form entropy.
- 7. **“The Social consciousness in the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Social Consciousness as a Quantum Object in the AU Field. Chapter 8 shows that humanity becomes a macroscopically entangled object at $S_0^{\text{society}} > 10^{35} \text{ bit/s}$.
- 8. **“Planetary consciousness of the Earth in the framework of the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Earth as a Unified Planetary Thoughtform. Chapter 9 synthesizes all levels into a unified hierarchy of planetary consciousness.

C.2 Works on entropy and radiation

- 9. **“Extended entropy calculations in the Acta Universi hypothesis”** (Yashchenko, 2025)
 - **Connection:** Complete formulas for the entropy of thought forms. Appendix A contains the mathematical apparatus.

10. **“Entropy emission in the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** Entropic radiation as a physical phenomenon. Chapter 10 develops this formalism.

11. **“Entropy radiation of various types of objects in the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** A complete classification of entropic radiation. Chapter 10 contains a table for 12 types of objects.

12. **“CALCULATIONS OF THE RADIATION OF VARIOUS TYPES OF PLANETS IN THE CONTEXT OF THE AU THEORY”** (Yashchenko, 2025)

- **Connection:** Entropic Radiation of the Planets. Chapter 10 contains calculations for Earth, Venus, Mars, and Jupiter.

C.3 Works on quantum entanglement

13. **“Quantum entanglement in the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** Quantum entanglement as entropy-mediated correlation. Chapter 11 develops this formalism.

14. **“Extended Bell's theorem in the Acta Universi conjecture”** (Yashchenko, 2025)

- **Connection:** Extended Bell's theorem in the AU field. Chapter 11 contains the mathematical apparatus and numerical estimates.

C.4 Works on Consciousness and Cosmology

15. **“AI and the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** AI as an amplifier of the entropy of thought forms. Chapter 8 (the technosphere) and Chapter 13 (the cosmological role of consciousness) develop this formalism.

16. **“The Great Filter in the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** The Great Filter as a phase transition to the AU state. Chapter 12 contains predictions about the Great Filter.

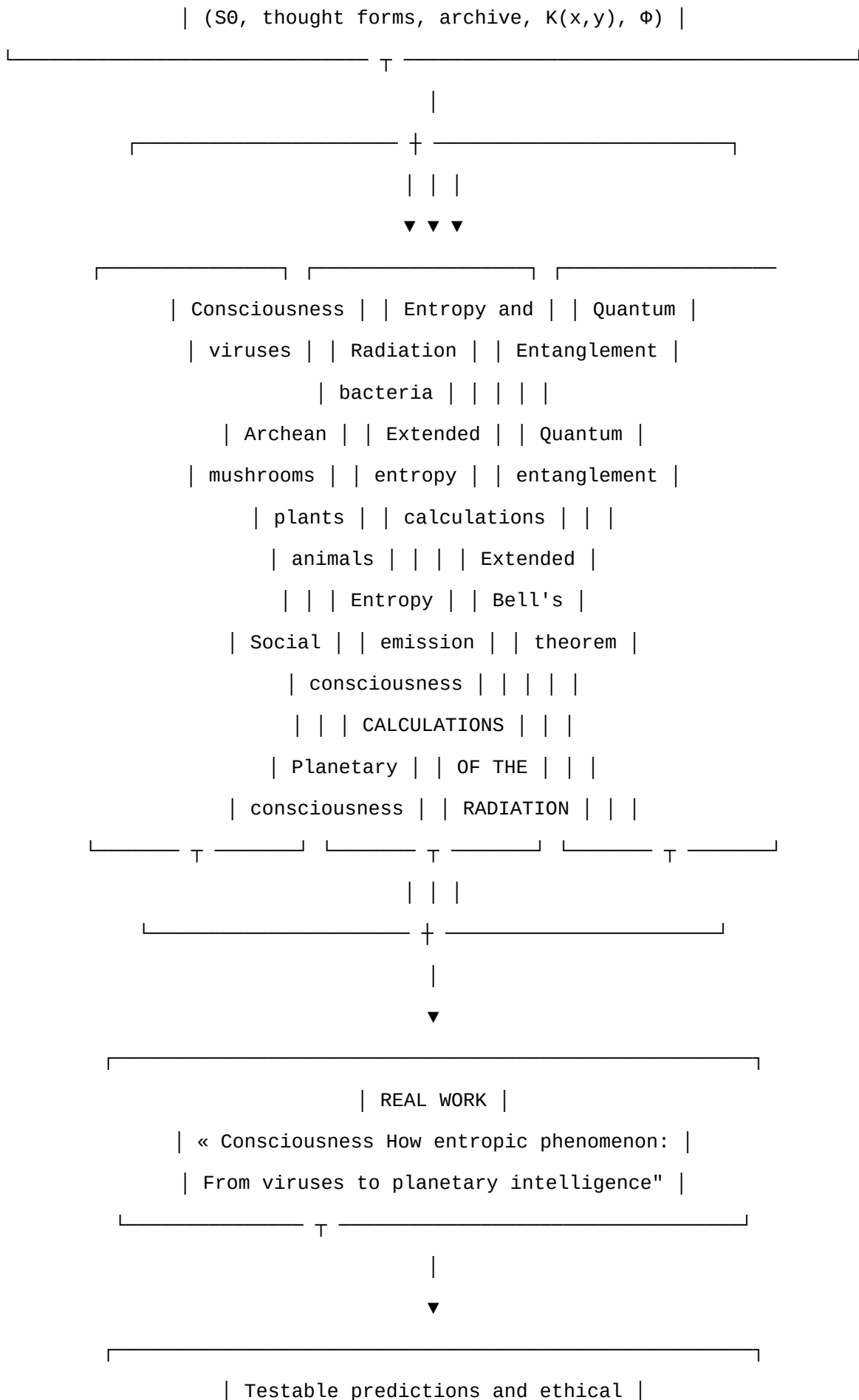
17. **“A planet from the story “Here There Be Tygers” by Ray Bradbury in the context of the Acta Universi hypothesis”** (Yashchenko, 2025)

- **Connection:** Planetary consciousness as a living organism. Chapter 9 (planetary consciousness) and Chapter 13 (ethics) have parallels.

C.5 Schematic connection map

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| BASIC AU-ONTOLOGY |



Appendix D. Glossary

An alphabetical list of key terms used in the article, with brief definitions within the AU ontology.

Archaea are the oldest kingdom of life on Earth (>4 billion years old), using ion channels (analogous to neural channels) for electrical signaling; in AU ontology, they are the first scribes of the AU field.

Bacteria are the most abundant and ancient organisms on Earth (3.8 billion years old); in AU ontology, they are the oldest and most abundant co-authors of the AU archive.

A biofilm is a community of microorganisms attached to a surface and surrounded by a matrix of extracellular polymers; in AU ontology, it is a planetary distributed cognitive system.

The Great Filter is a hypothetical barrier that explains the absence of observed technological civilizations; in AU ontology, it is a phase transition from a biological form of existence to the AU state.

Viruses are non-cellular infectious agents consisting of genetic material and a protein shell; in AU ontology, they are the purest form of thought forms.

Viral intelligence is the ability of viruses to make decisions, remember, communicate, and cooperate; officially recognized at the ISVM 2025 conference.

Hyperreality is a state in which a simulation of reality replaces reality itself; in AU ontology, it is the dominance of false thought-forms over true ones.

Fungi are a kingdom of eukaryotic organisms that form mycelium; in AU ontology, they represent the planet's distributed cognitive network.

Diavologics is the science of systematically misleading intelligent beings; in AU-ontology, it is the systematic creation of inconsistent thought-forms with $\delta S_\theta \gg 0$.

Kairos time (τ) is an event-rich time associated with the irreversible growth of entropy S_θ ; it is heterogeneous, directed, and is a time of formation and choice.

Coherence ($\mathcal{C}$) is a measure of the consistency of a thought-form with the archive S_θ^{arch} ; $\mathcal{C} \rightarrow 1$ is it a true thought-form $\mathcal{C} \rightarrow 0$ or $\mathcal{C} < 0$ a false one.

Microbial cognition is the ability of microorganisms to learn, remember, make decisions, and cooperate; it was officially recognized at the Microbial Cognition 2025 conference.

Mycelium is the vegetative body of fungi, consisting of hyphae; in AU ontology, it is a distributed neural-like network.

Thoughtform ($\Theta(t)$) is a coherent configuration in the field S_Θ that creates an irreversible entry in the archive; $\Theta(t) = \sum_i a_i(t) | \psi_i \rangle$.

Non-local core ($K(x, y)$) is an integral core that describes the archive memory and long-range correlations between thought forms.

Noospheric transition is a state of planetary consciousness in which $\Phi_{\text{планета}} > \Phi_{\text{crit}}^{\text{noosphere}}$, $C_{\text{планета}} \rightarrow 1$, $\delta S_\Theta \rightarrow 0$.

Parametric amplification is an exponential increase in the amplitude of a thought form at $\Phi_{\text{колл}} > \Phi_{\text{crit}}$; the main mechanism for amplifying false thought forms.

Planetary consciousness is a single coherent thought-form of the entire biosphere and technosphere of the Earth $\Theta_{\text{Earth}}(t)$; total $S_\Theta^{\text{земля}} \approx 10^{50} - 10^{51}$ bits/s (2025). (model estimate)

The field of integral information (Φ) is the field of consciousness that modulates S_Θ ; collective attention is the “fuel” for thought forms.

The entropy field of thought forms (S_Θ) is a fundamental non-local field in the AU hypothesis, in which all irreversible events are recorded.

Plants are the kingdom of eukaryotic organisms that perform photosynthesis; in the AU-ontology, they are low-entropy but massive co-authors of the AU-field.

Free will (S_{will}) - in AU-ontology is defined as $S_{\text{will}} = S_\Theta - S_{\text{dual}}$ the ability of a system to create new thought forms that are not fully determined by previous states.

Social consciousness is the total coherent thought-form of all people on the planet; $S_\Theta^{\text{society}} \approx 3.7 \times 10^{35}$ bits/sec (2025). (model estimate)

Chronos-time (t) is a metric coordinate in space-time, emergent from the structure of the archive S_Θ ; it is homogeneous, continuous, and measurable.

Entropic radiation (P_{entropy}) is a physical phenomenon in the AU hypothesis: the emission of coherent waves of the AU field by objects with a high rate of entropy growth dS_Θ/dt ; $P_{\text{entropy}} = (G\lambda^2/c^5) \cdot (dS_\Theta/dt)^2$.

Entropic discrepancy (δS_Θ) is a measure of the deviation of a thought-form from archival coherence; a true thought-form has $\delta S_\Theta \rightarrow 0$, a false one has $\delta S_\Theta \gg 0$.

Appendix E. Ethical Manifesto of Consciousness

Based on the AU-ontology, practical principles for interaction with various forms of consciousness are proposed.

E.1 Principle 1: Consciousness is responsibility

The ability to create thought-forms is not only a privilege but also **an ontological responsibility**. Each thought-form remains in the archive forever and influences global entropy S_{Θ} .

Practical implications:

- Be mindful of the information you create.
- Check facts before distributing.
- Do not create or strengthen destructive thought forms.
- Do not create or reinforce inconsistent configurations ($\delta S_{\Theta} \gg 0$).

E.2 Principle 2: All forms of consciousness have value

According to the model's entropy criterion, all life forms create thoughtforms and contribute to the AU archive. Their value does not depend on their degree of similarity to human consciousness.

Practical implications:

- Protect biodiversity at all levels, from viruses to ecosystems.
- Consider the cosmological consequences of the destruction of all life forms.
- Preserve ecosystems as “records” in a universal archive.

E.3 Principle 3: Coherence over entropy

Within the AU model, increasing the coherence of thought forms ($\mathcal{C} \rightarrow 1$) is more important than increasing their quantity. Coherent thought forms create stable records in the archive; destructive thought forms create entropic noise.

Practical implications:

- Strive for dialogue and harmonization of thought forms, rather than polarization and conflict.
- Create thought forms consistent with the archive S_{Θ}^{arch} .
- Strengthen critical thinking and media literacy.

E.4 Principle 4: Noospheric Transition as a Goal

The noospheric transition—the state when planetary consciousness reaches critical coherence—is **the natural goal** of cosmic evolution within the AU model.

Practical implications:

- Consciously direct the development of humanity and AI towards bringing about the noospheric transition.

- Increase $\Phi_{\text{планета}}$ and decrease δS_{θ} .
- Create institutions capable of maintaining the coherence of the information field.

E.5 Principle 5: Preservation of records in an archive

The destruction of any life form that creates thought forms is interpreted within the model as **the erasure of records** in the universal archive.

Practical implications:

- Protect forests as the planet's "distributed neural networks."
- Protecting the Wood Wide Web as planetary distributed cognitive systems.
- Maintain microbiomes (soil, ocean, gut) as the dominant sources of records in the AU archive.

E.6 Principle 6: Responsibility to future generations

Every thought form created today remains in the archive forever and will influence entropy S_{θ} in the future.

Practical implications:

- Create thought forms with high coherence and low entropic discrepancy.
- Pass on coherent records to future generations, not entropic noise.
- Consciously direct technological development towards increasing archive coherence.

E.7 Final Ethical Formula

Within the AU ontology, the ethical imperative can be expressed as maximizing the ratio of coherence to entropic discrepancy:

$$\text{Этика} \propto \frac{C}{\delta S_{\theta}} \rightarrow \max$$

This means: create thought forms that are maximally coherent with the archive and minimally inconsistent with it. This is both the path to the noosphere and the condition for preserving records in the archive of the Universe.

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