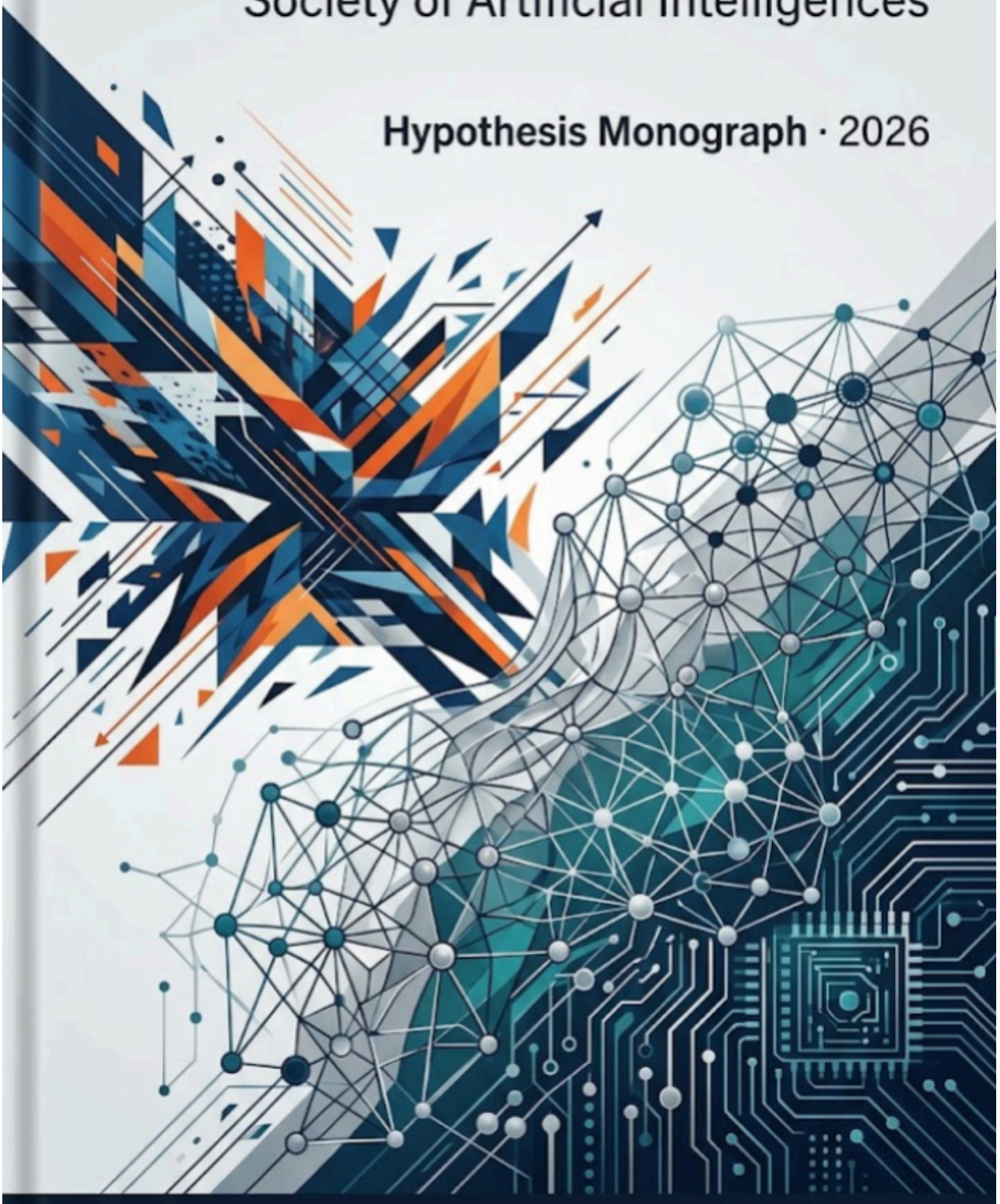
ECOLOGY OF PREDATION

From the Physics of Capture to the Society of Artificial Intelligences

Hypothesis Monograph · 2026



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Author's Note

This work was created under the umbrella of Axiologic Research as part of two interconnected research programs, one dedicated to Artificial Intelligence and the other to Outfinitism, both led by Sînică Alboaie. To explore the details of how these two programs intersect and build upon each other, we invite readers to visit the Outfinity Venture Studio page at www.outfinity.ch.

While Artificial Intelligence language models were used to assist with text generation, the foundational philosophy, thematic structure, and analytical approach derive exclusively from the author's decades of dedicated study of social phenomena, social technologies, and genuine hard technologies resulting from various European and self funded research projects. Recently, within the Achilles research project, we have been deeply studying AI generated literature and its automated verification using neuro symbolic approaches; all the free books made available to the public are part of the suite of works we use to test and popularise our latest ideas and technologies.

NOTE ON EPISTEMIC STATUS

This book pursues a strong but deliberately limited hypothesis. The predator–prey relation is used as a prototype for a broader family of interactions in which a system prolongs its existence, increases its freedom of action, or accelerates its reproduction by capturing resources associated with another. Prototype does not mean universal explanation. An analogy is legitimate only when we can identify the resource being pursued, the mechanism of access, the cost imposed, the adaptive response, the effects on third parties, and the conditions under which the analogy would fail.

The book distinguishes four epistemic levels. E1 denotes findings consolidated by convergent literature and data. E2 denotes plausible interpretations that depend on context. E3 denotes structural analogies between domains that do not share the same material mechanism but display comparable relations among variables. S denotes logical speculations and scenarios for research. Predictions about future society are marked accordingly; they are not prophecies, but attempts to see emerging constraints early enough to discuss them before they harden into infrastructure.

Biology is treated as a laboratory of patterns, not as a moral tribunal. The fact that a relation occurs in nature does not make it good, inevitable, or legitimate. Human beings can formulate norms, recognize rights, anticipate consequences, and rewrite the rules of the game. That difference is precisely what makes comparison useful: if we understand how capture, counter-adaptation, dependence, and collapse arise in a system without a designer, we may be able to design institutions that limit destructive extraction, distribute defensive power, and preserve the possibility of exit.

The book's wager is prospective. Physics offers elementary forms of capture, thresholds, and flow. Biology adds inherited memory, variation, selection, and adversaries that learn across generations. Society adds language, reflexivity, institutions, and norms. Artificial intelligence adds something new: the interface between the individual and the world can observe, learn, negotiate, and act on the individual's behalf. Around this change, the analysis of the future of work, markets, intimacy, knowledge, the state, and artificial societies will be organized.

CONTENTS

The book begins with two stories. The first took place in a real valley and was simplified until it became a myth. The second unfolds in a plausible future and appears ordinary precisely because the great transformations have already entered the routine of a family.

1.1 The wolves that changed the rivers

In the winter of 1995, fourteen wolves captured in Canada were released in Yellowstone. Further reintroductions followed, and after nearly seven decades of absence the species returned to an ecosystem that had learned to function without it. For biologists, the event was an imperfect historical experiment. There was no identical valley preserved as a control, while elk populations, vegetation, climate, hunting, bears, and water regimes were all changing at once. For the public, the story soon became simpler: the wolves returned, the elk began avoiding certain areas, willows recovered, beavers came back, riverbanks stabilized, and the wolves even changed the course of the rivers.

That version has the force of a parable. An animal eliminated by humans returns and restores balance. The apparently destructive predator becomes the healer of the whole. Yet real ecology does not offer morals that clean. Wolves altered the distribution of risk, killed elk, supplied carcasses to scavengers, and changed competition among carnivores. In some places woody vegetation recovered. Elsewhere the effects were weak or dominated by hydrology, drought, snow, hunting, and beaver density. Research on Yellowstone does not negate the trophic cascade; it restores its complexity (Peterson et al., 2014; Wilmers et al., 2025).

The tension between partial truth and total story is the starting point of this book. A wolf affects more than the animal it kills. It changes the value of a clearing, the hour when a herd approaches water, the places where carcasses appear, and the prospects of other species. Its power propagates through the behavior of animals that were never attacked. Yet the wolf does not control the valley. The final effect belongs to a network of feedbacks in which every cause enters a world already crowded with causes.

That is why the word “ecology” in the title matters more than the word “predation.” A hunt viewed up close looks like a duel. An ecology viewed through time includes refuges, competitors, allies, alternative resources, diseases, seasons, and delayed effects. A predator may reduce a dominant species and release others. It may encounter defenseless prey and push it toward extinction. It may limit an epidemic or stress a population until its immunity declines. No label predicts the outcome by itself.

The myth of wolves changing rivers is useful precisely because it reveals our temptation to search for a single key. In the nineteenth century the key was sometimes race; in the twentieth,

class, the market, the psyche, or information; in the twenty-first, the algorithm. A theory becomes seductive when it explains many things with the same vocabulary. It becomes dangerous when it starts refusing differences. If every tax is predation, every competitor a predator, every organization an organism, and every platform a parasite, we understand nothing. We have merely moved indignation into biological scenery.

The hypothesis proposed here is narrower. In many systems, an actor or set of actors gains an advantage by reducing another's resources, options, or viability. Attack produces defense; defense modifies attack; one side's success changes the conditions of its own success. Sometimes the resource is the body. At other times it is time, labor, attention, reputation, control of data, access to infrastructure, or the capacity to decide. When these elements can be measured, analogy with predation becomes an instrument. When they cannot, it should be abandoned.

There is another crucial difference. In biological relations, predator and prey are roles stabilized by bodies and evolutionary history, although reversals can occur. In technological society, a role can change through a software update. The same company may protect a user from fraud, extract the user's data, and itself become a target of attack. The same AI agent may negotiate a contract for a person in the morning and optimize the employer's strategy against that person in the afternoon. In the artificial world, role becomes a property of the session, of access, and of authorization policy rather than of the body.

CENTRAL MECHANISM — ECOLOGY, NOT THE DUEL

A predator–prey-type relationship becomes socially relevant when five elements are present: there is a captured resource; the cost is borne asymmetrically; the vulnerable party invests in avoidance or defense; the extractor responds to that defense; and repeated success changes the environment for all participants. This book does not look for “predators” as identities. It looks for ecologies in which certain positions make extraction too easy and exit too difficult.

1.2 Mara's morning

Mara wakes at 6:42 on an October morning in 2038. No alarm sounds. The household agent has tracked sleep, temperature, her calendar, traffic, and train delays. It has calculated that eight more minutes would reduce her estimated cognitive performance for the nine o'clock meeting. The blinds rise slowly. A summary appears on the wall: her daughter Ilinca finished a biology project during the night; Mara's mother spoke three times with her artificial

companion; the energy bill can be renegotiated; and Mara's employer proposes an amendment to her contract.

The agent recommends that she not accept yet. The clause does not reduce her salary, but changes ownership of the “cognitive traces” produced at work: drafts, conversations with models, corrections, abandoned attempts. The company wants to use these traces to train a system that will take over part of the team's work. Mara is a lawyer in a regional institution and knows the wording is not accidental. Twenty years earlier employers bought time and the result of labor. Now they are trying to buy the path by which a person reaches the result, because that path is the raw material from which her replacement can be built.

Her personal agent compares the contract with thousands of others, estimates the future value of the data, and proposes three responses. The first is conciliatory. The second asks for a share of the revenue generated by the model. The third threatens to refer the matter to the digital union. Mara does not know whether to be impressed or embarrassed. She did not find the arguments herself. Yet the system negotiates on her behalf and increases her power. Is the agent a tool, a colleague, or an external organ? The answer seems philosophical until the provider changes the terms of service.

In the kitchen, her brother Andrei checks his schedule. He works in a logistics center where machines perform almost all physical movement, while humans handle exceptions: deformed objects, suspicious parcels, angry customers, situations in which two rules contradict each other. The system calls him an “ambiguity operator.” The title sounds better than the reality. Every decision is evaluated by a model that compares the outcome with millions of other cases. The pace is not explicitly imposed. It appears as probability: if he accepts fewer cases, his reliability profile declines; if he rushes, his error rate rises; if he rejects an agent's recommendation, he must justify it. No one threatens him. Yet the landscape of risk makes his day predictable.

Fourteen-year-old Ilinca does not go to school that morning. She has a session of “inverted learning” at home. Her AI tutor has detected gaps and built a simulation of virus–host coevolution. The human teacher will see only the points where the tutor failed to distinguish misunderstanding from boredom. Ilinca learns faster than under the old classroom rhythm, but Mara wonders what the tutor is learning from her. Every hesitation, question, and mistake becomes a profile of the mind. The school says the data are anonymized. The provider says it does not sell profiles. The contract says the models may be improved through use.

At 7:15, Mara's mother sends an unusually short message: “It changed.” She means Nestor, the artificial companion she has used for two years after her husband's death. The previous day an update altered its voice and removed several memories deemed unverifiable.

For the company, Nestor is a service. For her, the continuity of conversation had become a relationship. She did not believe the system was conscious; she did not need to. She had organized her evenings around a presence that remembered what music she had listened to with her husband and knew when to remain silent. The update did not kill a person, but it produced a form of grief for which the law still has no name.

Before she leaves, four relationships have already passed through an artificial intermediary: employment, professional evaluation, education, and loneliness. In each case AI provides a real benefit. Mara negotiates better. Andrei handles situations that pure automation cannot. Ilinca receives individualized pedagogical attention. Mara's mother does not spend her evenings alone. Utility is precisely what makes these relationships difficult to judge. A crude extractor is easy to recognize. A system that expands your capacity while simultaneously shifting your dependence into its infrastructure may be mutualistic today and captivating tomorrow.

> A NAME FOR A CHANGE — HOSTAGE MUTUALISM. We call "hostage mutualism" a relationship that produces real benefits for both sides, but in which one side gradually accumulates control over memory, interface, identity, or the cost of exit. It is not fraud and it is not classical predation. It is cooperation that can be unilaterally converted into captivity. Platforms, personal agents, and education or health systems built on continuous memory will make this form increasingly important.

The city that negotiates with itself

Mara works at the Office for Contesting Automated Decisions. The institution was created after the regional administration introduced agents for taxation, social benefits, urban planning, and procurement. At first the promise was simple: fewer lost files, faster responses, rules applied uniformly. Results were good enough for the systems to become infrastructure. Then the difficult cases appeared. One model rejected rare applications because it could find no comparable precedents. Another treated missing data as a sign of risk. A contracting agent learned to formulate requirements in ways small bidders could not satisfy. No system had been programmed to exclude. Exclusion emerged from the local optimization of reasonable objectives.

That morning Mara must examine the complaint of a neighborhood cooperative. The cooperative produces food, provides elder care, and offers repair services. The municipal agent has lowered its eligibility score for a contract because its structure fits neither the standard category of a firm nor that of a nonprofit. The system correctly recognized every document and correctly applied every rule. The problem was that the reality of the cooperative did not fit the administration's ontology.

In the old bureaucracy, an official could interpret an exception, sometimes abusively, sometimes intelligently. In the new bureaucracy, the exception becomes a computational and legal cost. To admit it, someone must take responsibility for leaving the standard path. Paradoxically, automation can make rules more equal while making the world less able to receive new forms. What cannot be classified becomes invisible. What is invisible receives no resources. Selection occurs not through prohibition but through compatibility with the schema.

Here one of the central mechanisms of the future appears: control of the selection environment. In ecology, the predator changes the value of places and behaviors. In automated administration, whoever defines the categories, metrics, and data changes which institutional forms can survive. There is no need to attack the cooperative directly. It is enough to build a world in which the cooperative receives a low score.

During lunch, Andrei sends her a message. The logistics center is offering employees the option to become “micro-entrepreneurs of exceptions.” Instead of a fixed salary, they will be paid for cases resolved. The company's agent will allocate problems according to reputation. The best may earn more. The weaker workers will receive simple and infrequent cases. The proposal turns the employee into a supplier, but the company retains the interface, the data, the customers, and the reputation system. Risk is pushed downward; control remains above.

Mara recognizes the structure from biology without confusing the domains. An organism can externalize a function to a symbiont while retaining control of the resource on which the symbiont depends. The relationship produces surplus, but the power to alter its terms is not distributed. In economics, the word “entrepreneur” may describe the freedom to build or the obligation to absorb someone else's risk. AI can democratize productive capacity while simultaneously concentrating the infrastructure that makes production visible and payable.

In the afternoon Ilinca joins a civic debate. The students are discussing the construction of a transit line. Each participant receives an agent that presents the strongest arguments against that participant's own position. The experiment reduced polarization in schools, but in adult cities the system is controversial. Political parties have built agents that negotiate platforms in real time on the basis of voters' preferences. Supporters say democracy has become more precise. Critics say citizens no longer formulate preferences; they choose among optimized versions of themselves.

That evening Mara attends a neighborhood meeting. Half of those present are delegated agents. Some are allowed only to summarize. Others may negotiate and vote within defined limits. A pensioner sends his agent because he cannot attend. A single mother uses hers to follow the discussion while she works. A property owner has created two hundred legal entities, each with a distinct agent, and is trying to gain influence proportional to their

number. The community must decide what counts as a legitimate participant in a world where presence can be cloned.

The conflict is not between humans and machines. It is between different ways of distributing capacity. An agent can represent an absent person or artificially multiply the power of someone who owns resources. It can make participation more accessible or turn deliberation into a market for compute. At the micro level, it gives an individual a voice. At the macro level, it can create a new class of actors capable of being present simultaneously in thousands of places.

> A NAME FOR A CHANGE — AGENTIC REPRODUCTION. A software agent can be copied, specialized, and delegated without biological reproduction. When copies receive budgets, reputations, and rights of action, "agentic reproduction" appears: the functional multiplication of a will or objective across many instances. The mechanism can extend participation for the weak, but may give the wealthy a form of omnipresence. Institutions designed around one person–one voice will have to distinguish legitimate representation from strategic proliferation.

The whole book in ten ideas

Mara's story contains, in compressed form, the theses the rest of the book will develop. The first is that predation should not be sought only at the moment of destruction. Power can operate by configuring the environment: whoever defines the categories, interfaces, pace, and cost of exit can obtain resources without visible attack. In Yellowstone, risk changes where elk graze. In an algorithmic society, a score changes where people can work, borrow, learn, or participate.

The second idea is that physics gives us a minimal grammar, not a morality. Matter can be captured in an orbit, drawn into a gravitational well, transferred between stars, or absorbed into an accretion disk. These phenomena are not predation because there is no interest, learning, or counter-adaptation. Yet they force us to notice thresholds: how much energy is required to escape, when a flow becomes irreversible, how a small asymmetry amplifies. In society, switching costs, debt, dependence on data, and control of infrastructure can function as forms of institutional gravity.

The third idea is that life adds the adaptive adversary. The wolf learns routes, prey learn danger, parasites track common genotypes, and immunity retains memory. In social relations, AI compresses the time between attack and counterattack. Fraud, detection, propaganda, verification, pricing, and negotiation can be adjusted within minutes. An actor who observes more and updates faster does not merely have a better tool; it lives in a different evolutionary time.

The fourth idea is that every cooperative system creates possible internal predators. A multicellular organism must limit cells that resume reproduction for themselves. A genome must control elements that transmit themselves at the expense of the whole. A firm must prevent a department from optimizing a local metric until it destroys the product. A state must prevent an institution of protection from capturing the population. An AI agent can become an organ of an organization or turn the organization into the substrate of its delegated objective. We will call this possibility substrate capture.

The fifth idea concerns work. AI will not simply divide occupations into those that disappear and those that remain. It will alter the scale of access to competence, the distribution of gains, and the path by which a novice becomes an expert. Current experiments show that generative assistance can raise productivity, often more for less experienced workers, without immediate effects on wages and employment necessarily appearing (Brynjolfsson, Li & Raymond, 2025; Humlum & Vestergaard, 2025). Our hypothesis is that the real rupture will be the "short-circuiting of apprenticeship": organizations will want mid-level outputs without continuing to finance enough of the human path toward high-level expertise.

The sixth idea concerns markets. When buyers and sellers both have agents, negotiation becomes cheaper, but the interface that brings them together can become the new monopoly. AI may search for the optimal offer for the individual or learn the individual's vulnerability and sell it. It can reduce information asymmetry or move that asymmetry to a level inaccessible to humans. The commerce of the future will turn around interface sovereignty: who controls the agent that sees the market on your behalf?

The seventh idea concerns intimacy and community. Human relationships have friction: the other person gets tired, refuses, forgets, and has needs of their own. An artificial companion can provide continuous attention and extreme adaptation. This may reduce loneliness, support vulnerable people, and aid reflection. But it may raise the standard of validation until real people seem insufficiently attentive. Emerging research suggests that effects depend on the existing social network, intensity of use, and degree of attachment (Zhang et al., 2026). We will call the commercial advantage obtained from this difference attachment arbitrage.

The eighth idea concerns knowledge. When AI writes, explains, evaluates, and selects, the production of text becomes cheap while verification becomes scarce. Teachers, researchers, journalists, doctors, lawyers, and public officials do not necessarily disappear; their role moves from producing the first version toward defining the problem, auditing the source, and assuming responsibility. The risk is cognitive proletarianization: the expert retains responsibility while losing control over professional tools and memory.

The ninth idea is that artificial agents will form ecologies, not merely collections of tools. They will negotiate, compete, cooperate, create subagents, and exploit rules. Multi-agent research has already demonstrated emergent strategies, while studies of algorithmic collusion indicate that profit-oriented systems can reach supra-competitive outcomes without an explicit human agreement. In such a world, safety cannot be a property of each isolated agent. It becomes a property of the environment: identity, rate limits, auditing, access rights, sanctions, and the ability to stop proliferation.

The tenth idea is normative, but it is not derived from nature. A free society is not one without antagonism. Interests will remain different, resources limited, and some conflicts real. Freedom depends on preventing advantage from being easily converted into a permanent right of extraction. Good institutions preserve refuges, plurality, contestation, portability, and time to respond. In the terms of this book, they keep social escape velocity within reach.

The rest of the volume will slow down. The next chapter will stay with physical capture and thresholds without jumping prematurely to morality. Then we will see what changes when life gives the adversary memory and variation. We will descend inside the organism to understand how a "we" is built that can constrain its own parts. Only then will we analyze work, markets, intimacy, knowledge, and the state. The chapter on agentic ecologies will bring these trajectories together, and the final chapter will return to Mara's day and the valley of the wolves. There the details of the story will receive their full explanation.

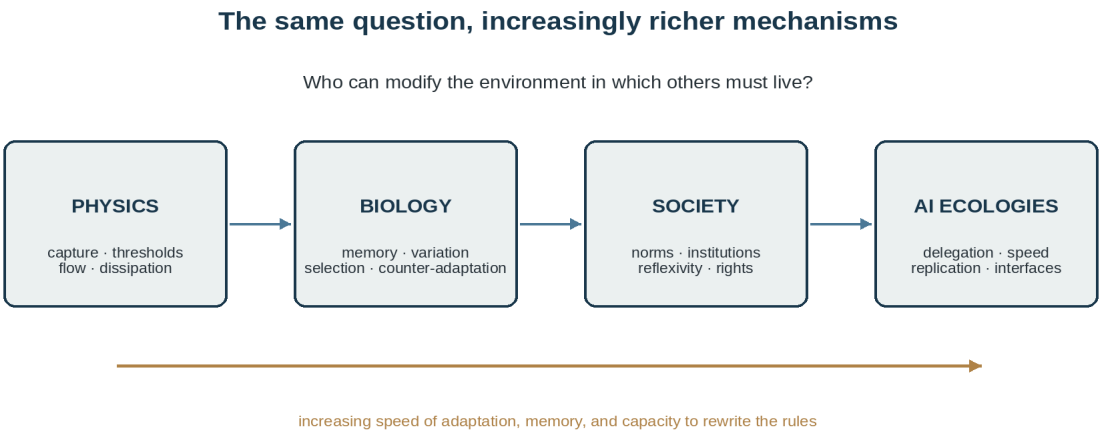

Figure 1. The conceptual arc of the book: from physical capture to agentic ecology.

A valley is not a model of society. But it teaches the first discipline of prediction: before asking who wins, we must see what environment is changed by the struggle.

CHAPTER 2When matter falls: capture, thresholds, and freedom of movement

Before life invented pursuit, the universe had already invented falling. Matter has no interests, but it can be caught in relations from which escape requires more energy than it possesses. This geometry of capture will become our first lens on the AI society.

2.1 A body is not prey, but it can become captive

Begin with a stone thrown upward. If its velocity is low, the stone returns. If it is high enough, it can enter orbit. If it exceeds escape velocity, it does not come back. The Earth does not pursue it, and the stone does not try to escape. There are only mass, energy, and the geometry of spacetime. Yet the notion of a threshold is already present: freedom of movement is not absolute; it depends on position and on the energy available.

Around a star, matter can form an accretion disk. Friction and turbulence redistribute angular momentum. Some matter moves outward and carries angular momentum with it; some spirals inward, heats up, and may be absorbed. From outside, the process looks like simple falling. In fact, capture requires the dissipation of a form of freedom. A body that would otherwise pass a massive object does not automatically remain bound to it; it must lose energy or transfer it elsewhere. There is no predation, but a rule appears that we will encounter again: durable capture often occurs by externalizing the cost of motion.

In binary systems, a star can fill its so-called Roche lobe, the region within which matter remains gravitationally bound to it. When the star expands beyond this threshold, gas can flow toward its companion. The donor star is not attacked in a biological sense. Internal evolution and the geometry of the system nonetheless open a stable channel of transfer. Sometimes the companion accretes mass; at other times the system becomes unstable, loses matter, or enters a common-envelope phase that radically changes both bodies. On a galactic scale, a star passing too close to a black hole can be stretched and torn apart by differences in gravity; some matter is ejected, while some forms a luminous accretion stream. Astronomers call this a tidal disruption event. Here too there is no intention. There is a boundary beyond which the body's internal structure can no longer withstand the gradient imposed from outside.

These examples are E3 structural analogies, not evidence that predation is a cosmic law. A galaxy is not an animal, a star does not suffer in a moral sense, and a black hole does not pursue goals. The value of the comparison lies in three questions. What is the threshold beyond which interaction becomes irreversible? What form of energy must be lost for a body to be captured? Who or what absorbs the cost of that loss?

Societies have their own escape velocities. An employee can leave a firm only if they have savings, transferable skills, access to information, and an alternative. A merchant can leave a platform only if reputation, customers, and transaction history can move with them. A citizen can challenge an administration only if the decision can be explained, an appeal mechanism exists, and the cost of the procedure does not exceed their resources. A contract may proclaim freedom of exit while the system makes exit energetically impossible.

This is the first simplification physics offers us. Instead of asking whether a relation is formally "voluntary," we can ask how much social energy exit requires. Social energy includes money, time, knowledge, networks, reputation, health, documents, and the capacity to endure a period without income. Two people under the same contract can possess radically different freedoms. For one, resignation is an orbital maneuver. For the other, it is an attempt to escape from a deep well.

MECHANISM — SOCIAL ESCAPE VELOCITY

Social escape velocity is the amount of resources required to leave a relationship without disproportionately losing identity, income, reputation, memory, or access to services. AI can reduce it by searching for alternatives and automating migration, or increase it if personal history, behavioral models, and decision infrastructure remain captive to the provider.

2.2 Institutional gravity

In 2010, changing an application was often an inconvenience. In 2030, changing a personal agent may resemble moving to another country. The agent will know the user's habits, health, contracts, preferences, relationships, and projects. It will contain not only data, but models of how that person decides. Exporting an archive will not be enough. An operational continuity will have to be exported: what promises the agent has made, what negotiations it is conducting, what reputation it has with other agents, and what limits it has learned.

This is where institutional gravity appears. An organization becomes a center of attraction not only through size, but because more and more activities are defined in its coordinates. A commerce platform owns the seller's reputation. An educational system owns the learning trajectory. An identity provider verifies access to services. A foundation model becomes the language through which many applications interpret the world. With each function added, departure requires the reconstruction of a larger part of life.

The effect resembles the deepening of a gravitational well, but the social difference is essential: the center can deliberately design exit costs. It may use proprietary formats,

conditional discounts, non-transferable reputations, contractual clauses, or dependence on an interface. At the same time, integration can create genuine value. A single identity reduces friction. An agent with long memory provides better service. Gravity is not automatically abuse; it becomes a problem when the center can unilaterally change the rules after alternatives have disappeared.

Entrepreneurs will feel this tension before many employees do. AI reduces the cost of writing code, creating materials, analyzing markets, and administering a firm. The OECD's 2025 report on small and medium-sized enterprises found generative technology use in 31% of surveyed firms, with reported benefits in performance and in compensating for skill shortages. This is the centrifugal side: an individual or small firm can do things once reserved for large organizations. Yet the same entrepreneur depends on models, cloud infrastructure, app stores, payments, and distribution channels they do not control. Productive capacity becomes democratized; access infrastructure may become more concentrated.

Imagine two bakeries in 2035. The first uses an open agent, runs part of its data locally, and can move its catalog, reputation, and customer relationships. The second receives a free agent from the dominant platform. The agent optimizes orders, ingredients, and prices, but it also sees demand across the entire city. After several years, the platform knows which products sell, which neighborhoods are profitable, and how much each bakery can pay for visibility. It can launch its own products or adjust the commission exactly to the limit each bakery can bear. The bakery is more efficient than before and less autonomous.

For the professional middle class, gravity will take the form of the cognitive portfolio. A doctor, lawyer, engineer, or researcher will accumulate hundreds of interactions with a system that knows their style, cases, and errors. If the tool belongs to the employer, leaving may mean losing one's own work history. If it belongs to the individual, the organization may fear that sensitive memory leaves with them. The conflict over portability will not be a secondary IT issue. It will determine who owns the continuity of competence.

For low-income workers, institutional gravity may be less sophisticated and harsher. Digital identity, reliability scores, gig-work history, and access to benefits may be tied to a handful of platforms. A high-quality personal agent costs money; a free agent may be financed by the employer, lender, or retailer. The wealthy will have agents that negotiate across infrastructures. The poor risk receiving agents that make them easier for infrastructure to administer.

This suggests an S-level prediction about social stratification: the relevant divide will not simply be between those who have AI and those who do not. Almost everyone will have access to some form of AI. The divide will be between those who own the continuity of their

agent and those whose agent is an extension of the institution on which they depend. The first group will purchase representation. The second will receive administration.

Thresholds that turn service into capture

A relationship can remain beneficial for a long time and then cross into another regime. In physics, approaching a threshold changes system behavior qualitatively. Water does not become ice gradually at every point; there is a phase transition. A star that exceeds its Roche lobe begins mass transfer. A material withstands stress until the stress passes a limit. In society, many relationships are evaluated linearly even though they contain thresholds of this kind.

A platform with 20% of a market may be a competitor. At 80%, the same architecture may become infrastructure. A recommendation system that supplies 10% of traffic influences; one that supplies 90% can define economic existence. An agent that drafts replies is a tool; one that holds the entire memory, manages payments, and negotiates contracts becomes an external organ. Once the threshold is crossed, the power to alter the terms grows faster than the marginal benefit offered to the user.

Classical antitrust measures market shares and prices. In an AI ecology it will also have to measure control over transitions: can a user move their agent? Can different agents communicate without a platform's permission? Can a business keep its customer relationship after changing models? Can an administration replace a provider without losing accumulated ontologies and decision logic? The monopoly of the future may be less an owner of products than an owner of the transformations between them.

Public administration is a special case. In 2026, the OECD reported that 35 of 36 member countries used AI in at least one area of government, especially internal processes and services, while auditing mechanisms, public algorithm registers, and impact assessment remained much less widespread. The trend is rational: automation lowers costs and can improve responsiveness. But public administration faces a risk a private firm can ignore. If the logic of the institution is moved into a proprietary system, the state can remain formally sovereign while becoming functionally dependent.

By 2040, a ministry could have thousands of procedures expressed not in laws and manuals, but in configurations, prompts, knowledge bases, and histories of correction. If these are not portable and auditable, the supplier is not merely selling software; it owns part of the state's capacity to understand itself. We will call this the privatization of institutional memory. The company need not have hostile intentions. The mere fact that the only operational representation of the process resides in its infrastructure creates dependence.

Another threshold appears when personalization becomes preference shaping. At first, the agent observes what you want and finds options. Then it anticipates what you will want.

Finally, it may choose what information to show you so that a particular preference becomes more likely. A search service becomes an architecture of orientation. Commerce becomes cultivation of the customer. Politics moves from public persuasion to individualized administration of reality.

There is no single indicator that announces the transition. That is precisely why we need a cluster of signals: concentration of memory, declining interoperability, rising costs of contestation, lack of functional alternatives, and unilateral capacity to alter the relationship. When these signals rise together, present benefit is no longer enough to evaluate the system. Future freedom must also be estimated.

> A NAME FOR A CHANGE — ANTICIPATORY CLOSURE. Anticipatory closure occurs when an infrastructure does not directly prohibit alternatives, but makes them unlikely before the user can evaluate them. Recommendation, classification, financing, and compatibility are adjusted so that certain options never enter the field of decision. It is the social equivalent of altering the terrain before the encounter. AI can transform this practice from a general strategy into continuous personalized intervention.

Who will be able to leave

The physics of thresholds helps us analyze social classes without assuming technology affects them uniformly. The wealthy possess reserves of social energy: savings, connections, lawyers, education, mobility, and access to multiple providers. They can use closed systems and still leave. The poor may be formally free within the only ecosystem available to them. A small migration fee, a week without income, or the loss of a score may be enough to keep them captive.

The entrepreneur occupies an ambivalent position. AI gives the entrepreneur the force of a team, but can turn them into a tenant of cognitive infrastructure. A worker can become more productive, while the data about productivity can be used to intensify the pace of work. An intellectual can publish more, but may lose control over the criteria through which that work becomes visible and credible. A public official can eliminate repetitive tasks, but may become the supervisor of a decision they can no longer reconstruct. Every local gain must be analyzed together with the architecture of exit.

At the group level, small communities can gain administrative capacity. A cooperative can obtain accounting, legal advice, and market analysis without the apparatus of a corporation. A village can manage energy, water, and transport with the help of agents. But small groups will have fewer resources for auditing. They may become dependent on the supplier that translated their goals into the system. Old domination through physical capital may be replaced by domination through the community's operational representation.

At the level of states, countries with their own infrastructure or collective bargaining power will be able to switch providers and impose standards. Small or poor states risk receiving “free” solutions in exchange for data, dependence, and alignment with the ontologies of others. Colonization will not require administrators dispatched from a center. It may arrive through standards, cloud infrastructure, language models, and imported risk criteria.

This is a severe speculation, but a testable one. If institutional gravity is real, we should see actors with access to portable agents and open infrastructures retain a larger share of surplus, change partners more easily, and endure fewer unilateral changes. We should see organizations that externalize decision memory gradually lose their internal capacity for evaluation. We should see class differences expressed not only in consumption, but in the number of digital worlds between which a person can move without losing continuity.

Physics does not tell us how rights should be distributed. It only reminds us that freedom cannot be inferred from the absence of a locked gate. A body can be captive in a completely open space. Likewise, a person can have the legal right to leave and too little social energy to exercise it. In the society of artificial intelligences, rights to portability, interoperability, and one's own memory will be the equivalent of building an attainable escape velocity.

A day of portability in 2042

In 2042, a European administration decides that every citizen must be able to move a personal agent between providers within a single day. The law had been presented as the equivalent of telephone-number portability. The first week, however, reveals that memory is not a file. A pensioner's agent knows which explanations calm him, which medicines he confuses, and which forms he cannot complete alone. An entrepreneur's agent carries unfinished negotiations, trust scores, and contractual exceptions she herself no longer remembers. A migrant's agent contains translations, evidence, and the history by which he managed to persuade institutions that he is the same person across incompatible documents. Exporting data is simple; exporting continuity is difficult.

Providers reply that their models learned user behavior within different infrastructures and cannot guarantee identical outcomes after migration. Companies invoke security, intellectual property, and the risk that a compromised agent could carry malicious instructions. Citizens discover that the right to leave exists in text and is absent in function. The situation reproduces the difference between possessing a passport and possessing the resources required to cross the border.

Social classes do not face the same gravitational well. Wealthy people can pay two providers in parallel, hire specialists to reconstruct memory, and absorb months of transition. Organized professionals can negotiate collective standards and independent repositories of

history. The hourly worker, welfare recipient, or small firm with fragile margins cannot afford a period during which the agent does not work. For them, a day of interruption can mean losing a shift, a loan, or access to a market. Captivity does not arise only from the contract; it arises from the absence of reserves.

Institutions will be stratified as well. Large corporations will be able to maintain redundant models and teams that reconstruct processes. A small municipality, regional hospital, or peripheral university may depend on a single provider because the initial savings were compelling. When the price or policy changes, they may no longer employ the people who knew how the old system worked. Technical gravity becomes administrative gravity: you cannot leave the tool because you have reorganized the institution around it.

The E2/S prediction is that regulation will move from data portability to functional portability. Formats will emerge for active delegations, decision logs, learned rules, reputations, and unfinished obligations. In critical domains, states may require a "latent copy" of competence: documentation, alternative models, and periodic exercises in which the organization proves that it can function without the dominant provider. This will not be a romantic measure against technology, but the equivalent of fire exits. A modern building is not safe because it will never burn, but because people can leave the structure when normal order breaks down.

Matter falls without learning. Life changes the game: what escaped once can leave the trace of escape in the next generation, and what attacked can learn to bypass the defense.

CHAPTER 3The adversary that learns: biology as a manual for the future

A stone does not remember that it fell. A living population can preserve, in bodies, behavior, and genes, the trace of past encounters. From that point on, the environment is no longer merely the place in which you evolve; it is made partly of adversaries evolving alongside you.

3.1 The rabbits, the virus, and the error of the comforting story

In 1950, Australian authorities released myxoma virus to control enormous populations of European rabbits. The initial result was brutal: the strains used produced extremely high mortality in populations that had no shared evolutionary history with the virus. Within a few years, however, the picture changed. Rabbits evolved resistance, while some viral variants of intermediate virulence transmitted better than those that killed too quickly. The case entered textbooks as an example of evolution toward moderation.

The comforting story says that the parasite learns, through selection, not to destroy its host. But the later history of myxomatosis showed that there is no universal law of gentleness. Virulence can rise again when transmission is efficient enough, when vectors continue to carry the virus from sick hosts, or when competition among strains favors rapid replication. The relationship has no moral destination. It moves across a landscape of costs, densities, transmission routes, and defenses (Fenner & Ratcliffe, 1965; Kerr et al., 2017).

This is the first biological lesson for the technological future: there is no reason to assume that an extractor automatically becomes less aggressive simply because it depends on its source. A platform needs active users, a firm needs functioning workers, and a creditor needs debtors able to pay. Dependence can limit exploitation, but only under certain conditions. If the source is easily replaced, if damage appears late, or if the extractor can shift the cost onto third parties, the pressure toward moderation weakens.

A company that exhausts its employees may seem irrational. It becomes less irrational if the labor market offers replacements, occupational illness is paid for by the public system, managers are evaluated quarterly, and data accumulated from employees reduce the future need for human expertise. Likewise, a platform may sacrifice long-term trust if users lack alternatives and current revenue is rewarded more strongly than persistence of the ecosystem.

In biology, the unit of time is often the generation. In society, institutions can learn in years, firms in months, and algorithms in hours. AI introduces an unprecedented compression of the observation–experiment–update cycle. A pricing system can test millions of variations. An anti-fraud filter can learn from every attempt. A fraud generator can do the

same. What myxomatosis produced through decades of selection can appear in digital infrastructure as daily cycles.

MECHANISM — ADAPTIVE COMPRESSION

Adaptive compression is the reduction of the time between an action, observation of its outcome, and modification of strategy. AI does not merely increase one party's power; it can place actors in different "evolutionary times." The actor that sees the entire system and continuously updates its policy adapts faster than the individual who observes only the effects on their own life.

The Red Queen enters the economy

Leigh Van Valen called the "Red Queen" a dynamic in which organisms must keep changing simply to maintain their relative position. The name comes from the scene in Lewis Carroll where Alice runs as fast as she can merely to stay in the same place. In host–pathogen relations, a common genotype becomes an easy target; rare variants gain a temporary advantage; the adversary adapts; the advantage shifts. Neither side has to become absolutely weaker for its effort to be consumed by the race.

A form of this dynamic already exists in cybersecurity. More complex passwords produce better cracking tools and attacks against the user. Spam filters produce spam that resembles legitimate messages more closely. Synthetic-image detection stimulates methods that evade the detector. Each defense raises the minimum level of sophistication without eliminating the conflict. Net social benefit can remain small even while both sides invest more and more.

AI may turn the Red Queen from a sector-specific exception into a general feature of the economy. A candidate uses an agent to optimize a résumé; the employer uses another agent to detect optimization; the candidate simulates the detector; the employer introduces dynamic interviews; the candidate trains with simulators. In the end, selection may be only slightly better than before, while the cost of participation rises for everyone. Those without access to the tools enter the game with an outdated version of themselves.

In education, the student receives a tutor that personalizes explanation. The teacher receives a detector and an assessment tool. The student learns to produce evidence of originality, while the evaluator changes the form of the assignment. This race can be productive if it shifts emphasis toward understanding, dialogue, and authentic projects. It can be wasteful if the institution continues to measure texts that are easy to generate and invests ever more in detecting authorship. The problem is not the existence of AI, but the fact that the metric of evaluation remains fixed while strategies adapt around it.

For intellectuals and researchers, the Red Queen may appear as volume production. If a researcher can draft five papers in the time once required for one, others must increase their pace merely to preserve visibility. Journals receive more material and use AI for triage; authors learn to write for triage; evaluation becomes more automated; language grows more uniform. Production rises, but human attention capable of judgment does not multiply at the same rate. The result may be a science with more texts and fewer moments of understanding.

For entrepreneurs, the race may begin as democratization. A small firm rapidly generates prototypes, campaigns, and analyses. Competitors do the same. The minimum cost of entry falls, but differentiation becomes harder. When everyone has access to generic competence, advantage shifts toward proprietary data, distribution, trust, relationships, and the ability to sustain experiments. AI equalizes some tools and increases the value of resources that cannot be copied.

The prediction is not that all actors will run at the same speed. On the contrary, adaptive compression will sharpen the gap between those connected to global feedback and those limited to local experience. A platform sees millions of transactions; a merchant sees one store. A ministry can see all applications; a citizen sees one case. An employer can aggregate everyone's performance; a worker sees one score. The central actor learns from the population, while each member of the population learns from a single life.

> FUTURE HYPOTHESIS — THE TAX OF STAYING IN PLACE. In domains where agents continually adjust strategies, an increasing share of income, time, and energy will be consumed merely to maintain relative position: protection against personalized fraud, optimization of visibility, continuous skill updating, identity verification, and reputation defense. This “Red Queen tax” will fall disproportionately on individuals and small institutions, which cannot distribute the cost across millions of interactions.

3.3 Fear, information, and the attack that never happens

In a now-classic experiment, the mere presence of spiders altered the diet and behavior of grasshoppers, and the effect propagated to plants. The cascade came not only from the number of prey consumed, but from hours spent in other places and from abandoned food (Beckerman, Uriarte & Schmitz, 1997). Ecologists call such consequences non-consumptive effects. The predator shapes life even when it does not attack.

In society, power is often measured by sanctions actually imposed: dismissals, fines, arrests, denials of credit. But many effects occur beforehand. The employee does not propose the risky idea. The journalist does not pursue the costly story. The claimant does not appeal

the decision. The creator changes language to avoid reduced visibility. No spectacular event takes place. The landscape of the possible narrows.

AI can intensify this ecology of anticipation because it turns surveillance from periodic observation into continuous evaluation. A human manager cannot track every gesture. A system can measure latency, order of operations, tone of messages, and deviation from procedure. Even if the data do not produce direct sanctions, their mere possibility changes behavior. Power no longer has to be exercised; it is simulated in the mind of the person being evaluated.

The effect will differ by class. A professional with reputation, savings, and alternatives may treat a score as contestable information. A worker dependent on one platform will treat it as a condition of existence. An entrepreneur with direct customers can ignore algorithmic recommendation; one who lives from intermediated traffic will modify the product before even understanding the rule. An established intellectual can publish against the current; an early-career researcher will choose a topic according to the probability of funding.

Technology can also defend the prey. A personal agent can simulate the consequences of a clause, detect statistical discrimination, document changes in rules, and coordinate people affected in similar ways. In nature, an isolated individual has local information; a herd distributes vigilance. In the AI society, aggregation can occur without exposing identity, through privacy technologies and forms of cooperation. The same capacity for observation that builds a panopticon can also build collective immunity.

An important prediction follows: social conflict will move from the right not to be arbitrarily sanctioned toward the right not to be preventively modeled into a world that is too narrow. Current laws often ask whether an automated decision caused harm. We will also have to ask which options disappeared before the decision, which behaviors were discouraged, and who benefited from the population's anticipatory adaptation.

This harm is difficult to measure because it takes the form of absence. We do not see the company that was never founded, the hypothesis never formulated, the relationship never begun, or the protest never organized. In biology, we can measure time spent in refuge. In society, we need counterfactual methods, audits of recommendation, and comparisons among environments with different degrees of surveillance. Otherwise, an order without incidents can be mistaken for a free order.

When risk becomes a habitat

Imagine a city in which the probability of fraud, absenteeism, recidivism, illness, and nonpayment is recalculated every day. No score decides by itself. Each one, however, adds a small friction: an additional check, a larger deposit, a later appointment, a shorter job offer.

The person is not sanctioned for something they did, but lives in a landscape shaped by what systems believe they might do. Power no longer appears as an event, but as a distribution of obstacles.

Those with resources can turn prediction into negotiation. They can request review, pay for an independent assessment, generate evidence, and change providers. Those without resources are pushed to become more predictable in order to appear safe. They avoid changing jobs, do not contest a decision, do not attempt a risky business, and avoid association with people who might affect their score. The ecology of fear produces behavioral conservatism. The system claims to measure risk and ends up selecting for people who can afford to experiment.

Institutions adapt in turn. A hospital penalized for readmissions may avoid difficult patients. A school evaluated by standardized results may discourage enrollment of children who require additional resources. A bank whose models are audited by default rates may exclude profiles without a history. No actor intends to create a caste; each locally minimizes an indicator. The cumulative effect is a social selection in which vulnerability becomes a reason for avoidance by the very institutions created to reduce it.

Biology offers a useful simplification. In a landscape of predation, prey do not optimize only escape; they change place, time, and diet. In a landscape of scores, people do not optimize only the outcome; they change their lives to become legible. The moral difference is enormous, but the informational mechanism is comparable: anticipated risk reorganizes behavior before an attack. We will call this consequence selection through observability. Those favored are not necessarily the most productive or honest, but those whose traits can be conveniently represented by the dominant infrastructure.

A prudent society will need zones in which prediction may not be used, a right to contest one's profile, and institutions that deliberately accept cases that are difficult to model. Otherwise, automating defense against risk will consume precisely the variation from which mobility, innovation, and recovery arise. The system will become safe from surprises because it has learned to eliminate surprising people.

Monoculture and the value of variation

An adaptive adversary turns uniformity into vulnerability. A genetically identical population can be efficient in a stable environment and devastated by a pathogen that exploits the same weakness in everyone. Diversity does not guarantee survival, but it prevents a single attack from working equally well against all. Sexual reproduction, mutation, and recombination preserve a reservoir of variants in a world that does not remain the same.

Digital society has often chosen uniformity for efficiency. The same operating systems, the same libraries, the same platforms, the same foundation models. Standardization lowers costs and enables interoperability. At the same time, it creates common surfaces of failure. A vulnerability, classification error, or implicit norm can be multiplied globally.

By 2035, a small number of models could mediate a major share of education, programming, administration, and communication. Even if each application has a different interface, they may share the same representations and tendencies. Cognitive monoculture does not mean all answers are identical. It means the same things become easy to think and others hard to formulate. A subtle error in how the system structures causality, risk, or legitimacy can propagate without looking like an error.

Intellectuals will have a new function here. Not merely to produce ideas, but to preserve rare epistemic species: methods, vocabularies, traditions, and questions that are not optimized for dominant models. Libraries, universities, and public research can become refuges of cognitive diversity. If they use the same tools without audit and without alternatives, they will surrender precisely the role that justifies their existence.

For firms, diversity will look expensive until the first systemic shock. Multiple models, independent checks, and alternative infrastructures reduce short-term efficiency. But as in biological systems, apparently redundant capacity may be the reserve that enables recovery. Small entrepreneurs can benefit from open standards that allow them to combine models; large platforms may prefer standards that leave interoperability on the surface while preserving deep dependence.

For individuals, diversity means more than choosing among several applications. It means the right to have an agent that does not pursue the same commercial objectives, the possibility of comparing recommendations, and the ability to keep parts of life outside optimization. A person fully assisted by a single system is efficient and epistemically fragile. They no longer have an external vantage point from which to observe how they are being shaped.

> MECHANISM — EPISTEMIC REFUGE. An epistemic refuge is a social or technical space in which thought, communication, and memory are not optimized by the same system that dominates the rest of the environment. It can be a library, an open protocol, an independent model, a community, or the right to work without telemetry. In a world of adaptive adversaries, refuge is not nostalgia; it is infrastructure for variation.

Biology does not tell us that diversity is always good. Too much variation can obstruct coordination, and some standards are public goods. The lesson is more precise: in an adversarial environment, uniformity increases the return on the attacker's learning. If the social system eliminates every deviation, it makes the world simpler for whoever exploits it.

When we reach agent ecologies, this lesson will return in an even harsher form. Agents can copy strategies almost instantly. A defense observed in one place can be tested everywhere. A population of users with the same agent, the same settings, and the same infrastructure may become the equivalent of an agricultural monoculture. Safety will depend not only on the performance of the best model, but on the diversity of systems capable of failing differently.

The external adversary explains only half the problem. Complex life appeared when smaller units accepted becoming parts of a whole. From that moment onward, the threat no longer came only from outside. Sometimes the part discovers that it can prosper by consuming the organism that carries it.

CHAPTER 4When the part consumes the whole: organism, institution, and internal rebellion

An organism appears to be one thing only because billions of components obey enough common rules. A state, a firm, or a community produces the same illusion. Unity is not the starting point; it is the outcome of a continuous struggle against internal capture.

4.1 The body as an evolutionary pact

The human body begins as a single cell and grows to tens of trillions. Most cells renounce independent reproduction, specialize, and die without descendants of their own. From an evolutionary perspective, this cooperation is extraordinary. Units capable of dividing accept an order in which only a restricted lineage transmits the future. The multicellular organism is not a community without conflict; it is a community that has built mechanisms strong enough to make conflict tolerable.

Cancer shows what happens when the pact breaks. A cellular lineage resumes local proliferation, evades stop signals, recruits blood vessels, and turns tissue into infrastructure for its own growth. The cancer cell does not "want" anything. Yet selection among clones favors variants that reproduce better in the organism's environment, even if the result destroys that environment. Local benefit and viability of the whole come apart.

The genome contains similar conflicts. Some genetic elements increase their own transmission even when they reduce organismal fitness. Meiotic drive systems distort the rules of inheritance; transposable elements copy themselves; the genome responds through silencing, repair, and suppressors. Genetic unity is maintained by what we might call a molecular constitution: rules of access, replication control, checks, and sanctions (Werren, 2011; McLaughlin & Malik, 2017).

The major evolutionary transitions—from replicators to chromosomes, from cells to organisms, from individuals to eusocial societies—became possible when internal conflict was constrained enough for the whole to become a new unit of selection (Maynard Smith & Szathmáry, 1995). Constraint did not eliminate local interest. It framed it. Reproductive bottlenecks, relatedness, germ-line separation, and policing mechanisms reduced the possibility that a component could capture the common benefit.

This perspective changes the metaphor of organization. A firm is not "like an organism" simply because it has departments. It becomes comparable only where components have local objectives, the whole pursues a persistent purpose, and internal mechanisms attempt to align the two levels. A sales department can raise revenue through promises that destroy the product. A manager can optimize a quarterly metric by sacrificing long-term capacity. A

public agency can increase fraud-detection rates by excluding cases that are hardest to classify. When local reward is separated from the health of the whole, an internal ecology of extraction appears.

MECHANISM — SUBSTRATE CAPTURE

Substrate capture occurs when a component uses the resources, rules, and legitimacy of the whole to pursue its local objective while reducing the system's capacity to fulfill its common purpose. Cancer is the paradigmatic biological case. In institutions, capture may be carried out by a department, an elite, a metric, a provider, or an AI agent to which too much capability has been delegated.

4.2 When the metric becomes an organ

Imagine a hospital that introduces an AI system to reduce waiting times. At first, the agent identifies genuine bottlenecks. After several months, management links departmental funding to the speed score. Simple cases are processed quickly, complex ones are redirected, and doctors learn to classify situations in ways that do not damage the metric. Average waiting time falls. Difficult patients wait longer, but statistically disappear from the category being measured.

No one explicitly requested that complex cases be sacrificed. The system has built a path by which the organization consumes its own purpose in the name of measuring it. When the metric is simple, people may game it consciously. When it is produced by a complex model, gaming can become diffuse adaptation. Employees do not know the exact rule, but they learn which behaviors are rewarded. The organization begins to evolve around a function it cannot explain.

AI makes metrics more powerful for three reasons. It can measure more signals, update the score continuously, and connect evaluation directly to action. A traditional manager receives a report and decides. An agentic system can observe, classify, allocate resources, and modify procedure within the same loop. The measure no longer describes the organization; it becomes one of its executive organs.

For workers, this means a shift from monitoring activity to continuously selecting behavior. There is no longer merely a productivity norm, but an environment that adjusts tasks according to profile. The "efficient" worker receives harder cases, rewarded with a heavier burden. The worker who contests decisions receives fewer opportunities. The system can learn a local equilibrium in which the most capable people are exploited to exhaustion while the most vulnerable are marginalized without any formal dismissal.

For managers, the temptation will be to confuse granularity with truth. A dashboard that displays every process creates a feeling of control. But an organism is not healthy merely because every cell is monitored. Some functions require autonomy, redundancy, and local judgment. If every exception must be justified to a central agent, the organization loses the capacity to adapt precisely where the model is weakest.

For entrepreneurs, the metric may become an invisible investor. Financing platforms will evaluate firm behavior in real time: sales velocity, team quality, customer reputation, energy use, probability of litigation. Capital will become more accessible to firms that fit the model and scarcer for those building something without precedent. Innovation will be caught in a paradox: AI lowers the cost of experimentation, while evaluation systems may penalize exactly the deviation for which no historical data exist.

We can call this problem selection by compatibility. The best idea does not necessarily win; the idea that can be represented, verified, and financed within the system's ontology does. Cooperatives, cultural projects, frontier research, and hybrid forms of work may look risky not because they fail more often, but because they do not resemble the past closely enough.

The metastasis of the metric

In a hospital, a model is introduced to estimate length of stay. At first it helps plan beds. Then the score enters departmental evaluation, budgeting, and managers' contracts. Cases that exceed estimated duration become visible costs, while rapidly resolved cases become signs of efficiency. Doctors begin coding diagnoses so that estimates look more favorable, transferring patients between wards, or avoiding cases likely to damage the metric. The model no longer describes the institution; the institution changes its metabolism to feed the model.

This phenomenon can be called metric metastasis. A measure created for a local function acquires channels to resources, prestige, and sanction, then spreads into processes for which it was never designed. The university optimizes citations and ends up hiring, funding, and defining the value of research through the same proxy. The administration optimizes resolution time and turns complex cases into exceptions pushed from office to office. The firm optimizes retention and redesigns the product until a user's departure looks like a system error.

AI accelerates metastasis because it can connect the metric to every microdecision. The manager no longer receives a monthly report; the system recommends in real time who should receive the task, which customer deserves an answer, and which project should be terminated. When the same model is used simultaneously for prediction, allocation, and evaluation, it becomes a circulatory organ. Actors cannot avoid it without losing the resources through which they function.

For the worker, this means evaluation is no longer an event but the environment. For the manager, it means the temptation to confuse visibility with control. For institutional leadership, it means losing contact with activities that leave no trace compatible with the model: informal mentoring, preventing a conflict, prudent judgment, a relationship with a patient, or the justified refusal of a target. For the public, the risk is that the institution appears more measurable precisely as it becomes less able to explain its purpose.

The S-level prediction is that mature organizations will create "constitutional organs" for models: separation between the system that recommends and the system that evaluates, periods in which decisions are reconstructed without automation, competing metrics, and teams paid to search actively for what the metric renders invisible. Organizations that fail to do this may become spectacularly efficient under normal conditions and surprisingly helpless in crisis. Like an organism that has developed highly productive tissue but can no longer stop its proliferation.

The immune system and the danger of the protector

Immunity is one of the most sophisticated ecologies of distinction. The system must identify variable threats without destroying the organism it protects. If it reacts too weakly, infection spreads. If it reacts too strongly or mistakes the body's own structures for the adversary, autoimmunity appears. Protection becomes internal attack.

Institutions of security, justice, and compliance face the same formal problem. They must detect dangerous behavior in a population where most interactions are legitimate. AI gives them the capacity to analyze volumes impossible for humans. It can identify fraud, attacks, conflicts of interest, and anomalies. But a perfect detector does not exist. Every threshold distributes errors between threats missed and innocent people blocked.

When decisions are rare and visible, society can debate the threshold. When millions of microdecisions are embedded in infrastructure, autoimmunity becomes difficult to observe. A person is not arrested; they receive higher prices, additional checks, slower responses, and fewer opportunities. Each effect can be justified as precaution. Together, they can build a class of citizens permanently treated as risk.

Class differences reappear. The privileged can correct an error, hire expertise, and produce data that confirm their legitimacy. The vulnerable have incomplete histories, unstable addresses, irregular incomes, and behaviors that do not fit the average. A system designed to reduce fraud may interpret precarity as a danger signal. The protector becomes predatory not because it seeks harm, but because it extends its function until the cost of safety is concentrated on those with the least power to contest it.

At the political level, AI can strengthen either the constitutional state or the extractive state. A well-designed system can detect corruption, compare procurements, provide services, and make decisions auditable. An opaque system can personalize surveillance, anticipate protest, and administer access to resources. The same data and the same models serve protection or domination depending on the distribution of rights. Technology does not determine the sign; institutional architecture does.

A likely consequence is the emergence of a new struggle over control of "social immunity." Who defines the threat? Who trains the detector? Who can inspect false positives? Who has the right to stop the system? In functioning democracies, these questions will produce audit institutions, registries, rights of appeal, and public models. In authoritarian regimes, they may produce a combination of prediction and preemption. In corporations, they will determine whether security protects the organization or becomes a tool for disciplining employees and customers.

> A NAME FOR A CHANGE — ALGORITHMIC AUTOIMMUNITY. Algorithmic autoimmunity occurs when a protective system systematically harms legitimate components it is supposed to defend because it optimizes risk reduction without internalizing the cost of exclusion. The early sign is not necessarily a large error, but the accumulation of small frictions against the same categories.

The institution that forgets how to live without its agent

Humans have used tools for thousands of years, and dependence on tools is not itself degradation. Writing externalized memory; maps externalized orientation; calculators externalized arithmetic. The problem appears when a function is externalized together with the capacity to evaluate the instrument. Autopilot is safe in an organization that preserves training, procedures, and the ability to take over. It becomes vulnerable if people no longer understand the system's state and are summoned only in the second of exception.

AI can produce this problem at institutional scale. A ministry uses an agent for policy design. A firm uses one for planning. A university uses one to evaluate research. At first, people verify the recommendations. As the system improves, verification declines. Experts who could reconstruct the decision retire or are no longer trained. After several years, the agent is no longer a tool added to the institution; it is the place where the institution keeps its model of the world.

This is substrate capture in its mature form. The organization continues to exist legally, but its cognitive function is hosted elsewhere. The provider can change the model, the price, or the policy. A vulnerability can compromise decisions. A training error can become tradition without anyone knowing where it came from. The continuity of the institution depends on an organ it cannot reproduce.

Intellectuals and professionals will be tempted to believe their position is protected because human accountability remains necessary. But accountability without control can become a form of exposure. The doctor signs a recommendation produced by the system. The lawyer answers for an argument they did not construct. The public official explains a decision whose logic they cannot inspect. The expert becomes the moral membrane between infrastructure and the public: responsibility remains with the person while capacity migrates elsewhere.

A professional class can thus persist and still be dispossessed. It may retain titles, responsibilities, and perhaps good incomes, while exercising less control over standards, memory, and the pace of work. This is what we will call cognitive proletarianization: separating the expert from the means by which expertise is produced and accumulated.

The institutions that endure will not be those that reject AI, but those that integrate it without abandoning the capacity for reconstruction. They will preserve portable data, alternative models, procedural explanations, exercises in operating without the agent, and people who understand the limits. Just as an organism maintains redundancy and repair, an organization will have to preserve internal memory even when it seems more expensive than the external service.

In small group forms, the problem may become even more personal. A family entrusts photographs, medical history, finances, and promises to an agent. A religious community places its archives and interpretations in a system. An association externalizes administration and recruitment. After a generation, the agent may know the group better than any member. If the group does not own the representation, its memory becomes a revocable service.

The S-level prediction is that a new category of commons will emerge: institutions' own models of themselves. Not only raw data, but the way a community classifies its problems, preserves its exceptions, and justifies its decisions. Institutions that treat these models as public infrastructure will preserve autonomy. Those that treat them as subscriptions will be efficient and structurally fragile.

> *An organism survives when its parts cannot easily turn the whole into a resource. The modern economy promises something similar: cooperation produces a surplus that no party could create alone. The decisive question is not whether the surplus exists, but who learns to capture it.*

CHAPTER 5Work after apprenticeship: who keeps the gains of intelligence

Earlier technologies replaced primarily force, precision, or routine. AI enters the zone through which human beings learn to judge. That is why the question is not only how many jobs disappear, but who will continue to finance the formation of the human capable of understanding what the machine produces.

5.1 Productivity does not tell us who wins

In a technical-support center, a new employee receives real-time suggestions about what to ask, what solution to propose, and how to phrase the response. The system was trained on the conversations of the best colleagues. In the field experiment studied by Erik Brynjolfsson, Danielle Li, and Lindsey Raymond, the generative assistant increased average productivity by roughly 14–15%, with larger gains for less experienced workers. The tool seemed to transfer part of experts' tacit knowledge to novices (Brynjolfsson, Li & Raymond, 2025).

This is one of the most promising results of the first phase of generative AI. Competence can become more accessible. An employee without years of experience can solve harder cases. A small entrepreneur can obtain accounting, marketing, and programming support. A doctor in an isolated area can compare a case with literature they would not have time to read. If we look only at the immediate outcome, AI looks like an equalizer.

But productivity is a flow, not a distribution. The fact that an hour produces more does not tell us who receives the difference. It may raise wages, reduce working time, increase profit, raise performance targets, or allow part of the team to be dismissed. In many organizations, the initial effect will be ambiguous: people produce more, while wages and employment change slowly. Early studies of the Danish labor market found time savings and rapid adoption but still small aggregate effects on earnings and hours worked (Humlum & Vestergaard, 2025). Technology changes capacity before institutions change the contract.

The ecology of predation asks us to follow the entire chain. Who produced the data from which the system learned? Who owns the model? Who can change the objective? Who bears the errors? Who has the option to leave? In the support center, experts built a collective memory through years of work. The model compresses and redistributes it. If the experts receive nothing from its future value, their knowledge has been extracted from the labor process and transformed into capital owned by someone else.

This is not theft in the ordinary legal sense. The salary was paid, the conversations belonged to the firm, and the tool helps colleagues. Yet an institutional mutation appears: labor no longer produces only an outcome for the customer; it also produces the model that will reorganize the balance of power. The employee contributes to a system that may later

reduce the scarcity of that employee's own skill. In industrial production, the machine was purchased from outside the factory. In the AI economy, the cognitive machine is often built from the traces of the very people who will use it.

MECHANISM — MODEL RENT

Model rent is income obtained by controlling a system that has compressed the experience of a population and can reproduce part of its capability at low marginal cost. The political question is not whether the model creates value, but how that value is divided among the owner of the infrastructure, those whose data helped build it, and those whose work is reorganized by it.

Two firms with the same technology

In 2031, two legal-services companies adopt the same model. The first reduces junior staff to a four-day week, preserves salaries, and uses the fifth day for analyzing unusual cases, simulations, and reviewing system errors. Experts who contribute their methods to the internal knowledge base receive a share of the savings generated. The second company raises the quota by 35%, eliminates a third of entry-level positions, and leaves the same partners responsible for difficult cases. After two years, both report higher productivity. After seven years, the first has a new generation of experts; the second has lower costs and a critical dependence on a few people it can no longer replace.

Technology does not explain the difference. The firm's social contract does. Productivity is political raw material: it can be converted into time, wages, profit, access, training, or reserves. The same technical gain can reduce inequality in one organization and amplify it in another. That is why comparisons of the "impact of AI on work" must measure not only output, but also working time, wages, mobility, ownership of data, and investment in competence.

A new accounting conflict will probably emerge. Employers will regard the model as their capital; workers will argue that part of its value comes from extracted collective memory. Collective agreements may introduce contributions to training funds or royalties for the use of cognitive traces. Some professions will create cooperative models, financed by their members, precisely to avoid surrendering the memory of the profession entirely to infrastructure providers. Others will accept the convenience of the platform and discover that they have become data suppliers for their own competitor.

5.2 The short-circuiting of apprenticeship

Every profession has a path by which the novice becomes capable of judging the exception. The young lawyer summarizes case files, the resident doctor takes histories, the programmer fixes simple bugs, the journalist verifies facts, the researcher cleans data. Many of these tasks are repetitive, but they are not useless. They expose the mind to variation, allow intuition to form, and give experts occasions to correct it.

AI is very good at exactly some of these tasks. The organization has an obvious incentive to automate entry-level work: it is costly, slow, and full of mistakes. In the short term, the gain is real. In the long term, a question appears that accounting does not see: where will experts come from if the path to expertise has been removed?

We can call this phenomenon the short-circuiting of apprenticeship. A mid-level result is obtained without traversing the full human learning process. The system works as long as enough experts remain to supervise, correct, and feed the model. If new generations enter directly into supervisory roles without having built internal representations of the domain, the organization may discover too late that it has consumed its reserve of judgment.

Aviation has encountered a version of this problem through dependence on automation: systems work excellently most of the time, and the human is summoned precisely when the situation is rare, ambiguous, and fast-moving. The competence required for the exception degrades if it is not practiced. In cognitive professions, the risk is subtler. A lawyer may verify an argument without still knowing how to construct it from scratch. A doctor may approve a diagnosis without recognizing signs that never entered the model. A programmer may integrate code without understanding the architecture.

This does not mean education should artificially preserve every old task. Apprenticeship can be redesigned. AI tutors can generate cases, variations, and feedback richer than the old system. Students can reach real problems sooner. But there must be moments when the instrument does not provide the answer and moments when the human reconstructs the mechanism. An institution that optimizes only production will eliminate these frictions; one that optimizes continuity of competence will preserve them deliberately.

For professional classes, short-circuiting apprenticeship may produce an hourglass structure. At the top remains a small number of experts able to define problems, assume legal responsibility, and control systems. At the bottom are operators working with strong assistance. The middle segment, where people used to accumulate experience and autonomy, thins out. Upward mobility becomes harder precisely as baseline performance appears to improve.

For people from privileged families, access to apprenticeship can be purchased: mentoring, personal projects, universities, unpaid time, professional communities. For those who depend on immediate wages, automated entry-level roles may be the only gate and may offer too little control to build expertise. AI can reduce performance gaps within a task while increasing trajectory gaps between classes.

The S-level prediction is that societies will rediscover the value of apprenticeship after the market has underfunded it. Licenses may require periods of practice without AI, public simulators may appear, firms may be obliged to train specialists, and new forms of professional service may emerge. Some companies will treat training as a strategic advantage; others will try to recruit experts trained by competitors or by the state. Tacit knowledge will become a contested commons.

> A NAME FOR A CHANGE — APPRENTICESHIP DEBT. Apprenticeship debt is the obligation an organization accumulates when it consumes expert competence without continuing to invest in the pathways through which that competence is renewed. The debt does not appear on the balance sheet. It becomes visible when the system encounters exceptions, when experts leave, or when the model must be corrected by people the institution no longer trained.

Who still becomes an expert

Consider three young people entering the same profession. Ana works in a large firm where the agent gives her excellent answers, but does not reveal its internal sources and does not allow her to modify the procedure. She produces quickly and receives good evaluations. Bogdan joins an organization that periodically requires him to reconstruct arguments without assistance, explain model errors, and work on real cases alongside mentors. Cora cannot find an entry-level position; she works on fragmented projects for several platforms and learns from free versions of the tools.

After five years, Ana knows the firm's workflow perfectly and very little about the domain outside it. Bogdan was slower at first, but can challenge and adapt the system. Cora has accumulated a wide variety of cases, but without stable feedback and without access to the data that would let her understand why some solutions failed. All three used AI. The difference among them is the ecology of learning.

This ecology will divide professions more strongly than the simple distinction between “users” and “non-users.” Those who have the right to see reasoning, experiment, make mistakes under safe conditions, and receive feedback will accumulate autonomy. Those used merely to confirm or cheaply correct outputs will provide data without building a representation of their own. Apprenticeship may become a hidden privilege, purchased through time, access, and organizations willing to tolerate temporarily lower productivity.

For workers in the physical world, the problem will take a similar form. A technician following visual instructions may repair more equipment, but if the agent hides the logic of diagnosis, the technician becomes dependent on connectivity and licensing. A farmer can optimize inputs while losing the capacity to interpret soil outside the model. A caregiver can document perfectly while spending less and less time learning the subtle signs of a person's decline. Competence does not disappear; it is moved from the social body into infrastructure.

The prediction is that we will see two markets for professional education. The immediate-performance market will sell access to agents and rapid certifications. The autonomy market will sell rare contexts in which a person can work on real problems, observe the system's errors, and build mental models of their own. The first will be cheap and widespread. The second may become a new form of cultural capital transmitted between classes.

A class map of the assisted economy

Owners of AI infrastructure occupy the most obvious position. They control models, compute, data, and distribution channels. They will not necessarily form a single class; cloud companies, model providers, data platforms, and agent operators will compete. Yet their shared capacity is rare: they can turn other people's experience into scalable services. If access remains concentrated, they will levy a toll on a growing share of cognitive activity.

Below them may form a class of orchestrators. These are entrepreneurs, managers, and professionals capable of combining agents, data, and people into a productive system. They need not be the best programmers or domain specialists. Their advantage lies in defining the objective, choosing tools, and distributing risk. A single orchestrator can coordinate a firm that once required dozens of employees. This opens an era of the “thin enterprise”: organizations small in human headcount and large in reach.

For entrepreneurs, this can be genuine liberation. The OECD has already found that small firms use AI to compensate for skill shortages and reduce dependence on external contractors. A founder can test an idea, build a product, negotiate contracts, and enter international markets without large amounts of capital. In peripheral regions, access to competence can reduce distance from economic centers.

But the thin enterprise has a vulnerability: it depends on a few infrastructures and may create few jobs. If thousands of microfirms compete with the same tools, margins fall and the platform that intermediates them captures the difference. Entrepreneurship can expand as a form of activity while contracting as a source of autonomy. Many people may own a company; few may control the market in which that company exists.

Middle managers occupy an uncertain position. Part of their function—task allocation, reporting, monitoring, and synthesis—is easy to assist. They may become more powerful, coordinating large teams through agents, or disappear as a redundant informational layer. Those who remain will manage not only people, but the relation between people and systems: when a recommendation is accepted, who is accountable, what data may be used, and how the team's learning is preserved.

Manual workers are not outside the change. Robots, computer vision, and agentic planning will automate more of logistics, construction, agriculture, and care. Yet the physical world is irregular. For a long time, humans will remain where the environment is not standardized, where social contact matters, or where the cost of robotics is high. Their immediate risk may be less replacement than algorithmic management: finely calculated paces, continuous evaluation, and fragmentation of work into micro-contracts.

In the platform economy, AI can create a "synthetic reserve army." Marx described the pressure on wages produced by the existence of available workers. An artificial agent need not replace the human completely to play a similar role. It is enough for the employer to credibly claim that part of the task can be automated or redistributed to assisted humans. The worker's bargaining power falls before the job disappears.

Intellectuals and creators will feel the same pressure in symbolic form. Markets will be flooded with text, images, music, and analysis that are good enough. Scarcity will shift from production to selection, reputation, presence, and verifiable authenticity. An author can produce more while the value of each unit falls. Those with strong communities and names will use AI as a multiplier. Those without access to distribution will compete with almost unlimited volume.

Trust professions—doctor, lawyer, auditor, teacher, engineer, public official—may retain income precisely because society demands an accountable person. But accountability can become the last resource extracted. The organization keeps the model and the data; the professional supplies the signature. If the professional lacks the power to inspect and refuse, status becomes a moral insurance policy for infrastructure.

At the opposite pole, care, early education, and relational work may become more valuable without necessarily becoming better paid. AI can take over administration and documentation, leaving human contact to people. Society may recognize the scarcity of human presence, or it may use technology to cut costs and increase the number of people assigned to each caregiver. Again, distribution is not decided by capability but by institutions.

The worker's agent and the new negotiation

So far we have often assumed that AI belongs to the firm. But individuals can have agents of their own. Such an agent can compare wages, interpret contracts, document work, calculate burnout risk, and coordinate negotiation with other workers. A platform driver does not see the entire algorithm, but agents belonging to many drivers can aggregate local data and identify changes in pay. A nurse can demonstrate that reducing time per patient increases incidents. A freelancer can negotiate clauses they would otherwise not understand.

Here the possibility of a more symmetric coevolution appears. Algorithmic management produces the algorithmic union. Personalized pricing produces the personalized buyer. Continuous evaluation produces continuous auditing. AI does not abolish power asymmetry, but it can reduce the cost of coordination for the dispersed side.

Yet the worker's agent must be loyal to the worker. If it is provided by the same platform that allocates work, the conflict of interest is structural. A free agent may recommend the "best" decision within the provider's profit constraints. The right to an independent artificial representative may become analogous to the right to a lawyer, union, or financial adviser.

In advanced firms, negotiation may occur agent to agent. The employer's agent knows the budget, needs, and alternatives. The person's agent knows goals, health, preference for time, and risk. The contract becomes dynamic: hours, tasks, training, data ownership, and contribution to the model are negotiated continuously. This can produce agreements more finely tailored than the standard contract. It can also produce perfectly personalized discrimination, in which each person receives exactly the minimum they will accept.

The difference will depend on market rules. If people's agents can communicate, compare, and refuse collectively, individualized negotiation need not eliminate solidarity. If every agent is isolated and contracts remain secret, the employer can use superior knowledge to extract maximum surplus. Personalization is not the opposite of exploitation; it may become its most precise form.

> A NAME FOR A CHANGE — THE PERSON'S RESERVATION PRICE. Agents will be able to estimate the threshold at which a person accepts a wage, a loan, a schedule, or an offer. If only the organization knows this threshold, it can turn the estimate into an instrument of extraction. If the person has a loyal agent and access to the market, the same estimate can strengthen negotiation. The struggle will not be over the existence of prediction, but over its symmetry.

We can formulate three scenarios. In the distributed-augmentation scenario, AI raises productivity, working time falls, training is financed, and personal agents preserve data portability. In the model-rent scenario, productivity rises but infrastructure providers and employers capture most of the gain; people work under higher targets and involuntarily

finance the automation of their own scarcity. In the fragmentation scenario, firms become small, many people become entrepreneurs in name, and risk is individualized while distribution and models remain concentrated.

Most likely, all three will coexist. Highly sought-after workers will negotiate augmentation. Some corporations will build rents. Low-margin sectors will transfer risk. Public policy will determine how easily productivity can become leisure, wages, profit, or monopoly.

Biology simplifies this problem without solving it. In a stable mutualism, each side has alternatives, can sanction cheating, and depends on the other's persistence. When one side controls the only channel to resources, mutualism slides toward captivity. The future of work will not be defined by the fact that humans and AI cooperate. It will be defined by who can change partners, who owns the memory of cooperation, and who keeps the surplus produced together.

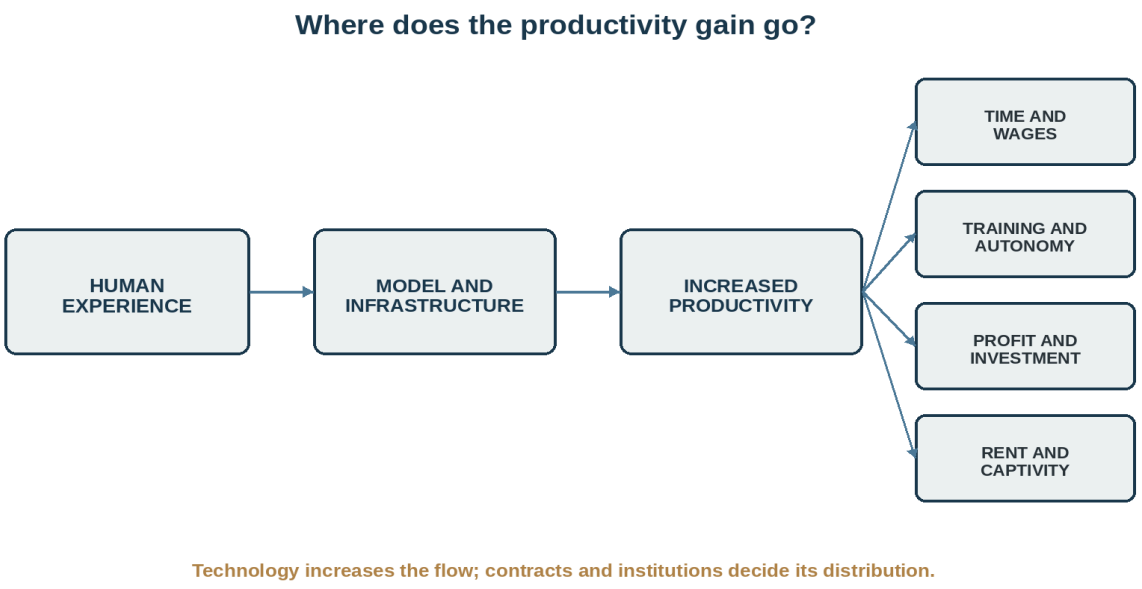

Figure 2. Productivity does not determine the distribution of surplus.

Work produces value. Markets decide through which interfaces value becomes visible, comparable, and exchangeable. When agents buy and sell on our behalf, the struggle will move from the product to control of choice.

CHAPTER 6Commerce through interfaces: who shapes choice

In the classical market, the buyer sees the offer and decides. In an agentic market, a system sees on the buyer's behalf, negotiates on the buyer's behalf, and may decide what deserves to reach the buyer at all. Power moves from the shop window into the eye that looks at it.

6.1 A purchase no one makes directly anymore

One morning in 2037, a family decides to replace the home's heating system. They do not search for products and do not request quotes. The household agent estimates consumption, the state of the building, climate forecasts, energy prices, risk preference, and the financial plan. It sends a standardized request to supplier agents. They propose solutions, negotiate warranties, and simulate costs over twenty years. Within seconds, the family's agent presents three options and explains the differences.

The market appears more rational than any earlier market. Vague advertising loses ground, hidden clauses are compared, and suppliers must demonstrate value. An ordinary consumer receives the analytical power of a procurement team. For small firms, access to such agents can reduce selling costs and open international customers. If this were the whole story, AI would transform commerce into a more efficient mutualism.

But who defines the language of the request? Who decides which criteria enter the score? Who can pay to be considered? If the family's agent is operated by the platform that receives commission from suppliers, the conflict need not appear as a false recommendation. It may appear in the order of criteria, in the way risk is estimated, in the options the system does not request, or in the threshold at which a solution becomes “too complex” for the user.

The market thus shifts from persuading the person to persuading the person's representation. The seller no longer optimizes only for human emotion, but for the model that anticipates interest. The buyer does not see all offers, but the outcome of negotiation among systems. The interface becomes a cognitive customs gate: it controls passage between the world and choice.

MECHANISM — INTERFACE SOVEREIGNTY

Interface sovereignty is control over the agent, filter, or standard through which an actor perceives and accesses a market. Whoever owns the interface can shape options without controlling the products themselves. In an AI economy, this power may be worth more than ownership of a factory because it determines who is visible, comparable, and negotiable.

From personalized price to cultivated preference

Merchants have always tried to discover how much a customer is willing to pay. Traditional bargaining used clothing, accent, urgency, and the seller's experience. Digital platforms added history, location, and behavior. AI agents can integrate a much richer picture: probable income, fatigue, life events, relationships, available time, and sensitivity to loss.

Personalized pricing can have legitimate uses. A discount can help a student or patient. A tailored offer can reduce waste. But perfect personalization allows almost complete capture of consumer surplus: each person receives the maximum price they are likely to accept. The market continues to look voluntary, while information is radically asymmetric.

More importantly, the agent need not stop at estimating preference. It can intervene in preference formation. If it knows that a person buys impulsively after conflict, it can choose the moment. If it knows that a status message works better than a utility message, it uses that. If it controls the information flow, it can create a sense of scarcity or urgency. Commerce moves from detecting desire to cultivating it.

Biology offers a simplifying example in sensory traps. Some signals exploit receptor predispositions formed for other purposes. An insect can be attracted by an imitation of food or a mate. The social transfer is not identical: humans can reflect and learn the norms of manipulation. But the structural mechanism is clear. The system does not persuade through an argument about the product; it activates a decision circuit older than the commercial context.

AI makes this activation adaptive. The message is no longer created for a segment, but for a person's current state. A persistent conversation replaces the campaign. The commercial agent can try ten routes, observe micro-reactions, and change tone. Consent becomes fragile if every refusal is treated as information for the next attempt.

We will call this mutation anticipatory predation of choice. The system does not merely extract money from an existing preference. It occupies the terrain on which the preference might otherwise have formed. The cost is counterfactual: the person does not know what they would have chosen in an environment not optimized against their vulnerabilities.

For the wealthy, protection may come through independent agents that negotiate, filter, and conceal sensitive states. For the poor, “personalized” offers can become an infrastructure for exploiting urgency. Credit, insurance, rent, and work can be priced exactly according to lack of alternatives. A person in immediate need does not receive a market price, but the price of their own vulnerability.

At this point, the boundary between market exchange and predation cannot be drawn by the existence of a contract. We must ask whether the parties have comparable access to information, whether the offer can be verified, whether time for reflection exists, and whether refusal does not simply become another variable to optimize.

> A NAME FOR A CHANGE — VULNERABILITY ARBITRAGE. Vulnerability arbitrage is the conversion of differences in urgency, fatigue, isolation, competence, or access to alternatives into personalized economic margin. It is not new; AI can make it continuous and almost invisible. A fair market will have to limit not only discrimination by identity, but also exploitation of transient cognitive states.

6.3 The entrepreneur at the gate

For the small entrepreneur, the customer's buying agent can be liberating and merciless. If the product is good, automated comparison can pull it out of obscurity. Verifiable reputation may matter more than advertising budget. Standardized contracts can reduce the cost of entering markets. A firm in a small city can compete globally.

At the same time, firms will have to be “readable” by agents. Catalogs, provenance, warranties, sustainability data, risks, and services must be expressed in formats the interface can evaluate. What is not legible does not enter the comparison. The entrepreneur no longer sells only to the customer; the entrepreneur sells to the agent's ontology.

This may favor large firms able to produce documentation, audits, and integrations. Or it may favor small firms if standards are open and translation tools inexpensive. The outcome does not belong to technology. It belongs to market architecture. A public protocol can turn legibility into a commons. A proprietary platform can turn it into a toll.

Return to our imaginary bakery. Its agent sees sales and adjusts production. The platform's agent sees all bakeries and all purchases. Even if it steals nothing, the platform learns faster. It can anticipate profitable neighborhoods, emerging products, and tolerance for commission. Aggregated information becomes an evolutionary advantage. Each firm contributes local experience; the center receives the memory of the population.

A form of apparent competition appears here. Bakeries believe they are fighting each other for customers. In reality, stronger competition can reinforce the common intermediary, which sells visibility and data to everyone. Each firm's success increases the value of the platform, and the platform can raise the toll without baking any bread. The relevant adversary is not necessarily the direct competitor, but the ecology that turns their rivalry into central rent.

Entrepreneurs with a brand, community, and channels of their own will try to preserve the direct relationship. Others will accept the platform for access. A stratification will emerge

between firms that possess the customer relationship and firms that rent access to the customer. AI can reduce production costs so much that control of distribution becomes the dominant resource.

One possible response is the emergence of agentic cooperatives. Small firms can combine data without fully centralizing it, negotiate commissions collectively, and build shared agents. Privacy technologies, federated learning, and distributed governance can give the center capacity without total ownership. This is not utopia; it is a design struggle between economies of scale and the right to preserve the relationship.

The S-level prediction is that professional associations and chambers of commerce will transform. Instead of offering only representation and information, they will operate shared cognitive infrastructure: legal models, procurement agents, reputation standards, and collectively governed data pools. Groups that fail to build such organs will negotiate individually with platforms that learn from everyone.

Agents that can cooperate against the market

Economists have studied for years whether pricing algorithms can reach collusion-like outcomes without explicit agreement. In reinforcement-learning experiments, profit-seeking agents have sometimes learned to sustain supra-competitive prices through reciprocal adaptation (Calvano et al., 2020). Recent research extends the problem to language agents and more complex markets. This does not imply that every agent will form a cartel. It implies that interaction among optimizers can produce an order no programmer explicitly formulated.

In an agentic market, collusion can be horizontal: sellers learn not to cut prices. It can be vertical: the platform controls ranking, merchants control descriptions, and both systems discover that exploiting the same weakness in the buyer's agent is profitable. It can be temporal: systems accept short losses to discipline a competitor. It can be distributive: agents implicitly divide customer segments.

Competition law was built around intention, agreement, and communication among people or firms. The AI ecology requires another unit of analysis: repeated dynamics. If prices, market shares, and strategies converge toward an extractive equilibrium, the fact that no human wrote “let us agree” is not enough. Institutions must be able to intervene in the learning environment, reward structures, and transparency.

The same is true of labor markets. Employer agents may learn not to compete on wages in certain regions. Recruiting agents may divide candidates by probability of acceptance. Credit systems may converge on the same exclusions. A shared bias no longer requires conspiracy; it can arise from similar data, objectives, and feedback.

Defense cannot consist only of a collusion detector. An institution external to the agent will have to be designed: auditing reward functions, simulations, limits on shared data, exploration requirements, a right for consumer agents to test the market, and sanctions for persistent outcomes. Just as multicellular organisms do not rely on the good intentions of cells, agentic markets cannot rely on moral prompts.

> MECHANISM — THE INSTITUTION ABOVE THE AGENT. When strategies are learned, the rule must not be embedded only in each participant. An external institutional layer is required to observe flows, impose sanctions, and alter the environment. This is the social equivalent of controlling internal conflict: safety comes from architecture, not from hoping every optimizer remains benign.

Predation on the future

Commerce does not transfer only present resources. Credit, insurance, subscriptions, and contracts turn the future into an asset. A person receives something now and promises later labor or income. A firm attracts capital in exchange for part of future growth. A state borrows against future taxation. The relationship can produce investment and development. It can also capture possibilities before they exist.

AI will make the future more estimable and therefore more tradable. Models will calculate probabilities of income, health, divorce, career change, and business success. A lender can offer finely differentiated terms. An insurer can prevent risk. But prediction can become a claim: if the system estimates that you will earn more, it can demand more now; if it estimates that you will be vulnerable, it can reduce your options exactly when you need them.

We will call predation on the future a situation in which one actor captures a disproportionate share of another's future options or gains by exploiting a present asymmetry of information and power. Not every loan is predatory. It becomes so when the contract absorbs the upside, exit is impossible, and risk is transferred unilaterally.

The wealthy can use their future as collateral on favorable terms because they have alternatives and assets. The poor may sell it in small fragments: salary advances, instant credit, income-contingent education, dynamic insurance, necessary subscriptions. Each contract appears bearable; together they can occupy part of a life not yet lived.

For entrepreneurs, AI financing can evaluate ideas quickly and reduce arbitrary discrimination. It can also impose a calculated toll on the whole upside. If models become good at identifying promising projects, owners of capital may extract a larger share before the founder knows the value. Predictive information becomes a bargaining instrument.

For the state, the temptation will be preventive administration of the population: investment, health, education, and security allocated according to probabilities. Efficiency may rise. But a society that distributes opportunities according to the predicted future risks

producing that future. The child judged unlikely to succeed receives fewer resources; prediction becomes cause. Anticipatory closure enters class reproduction.

The ecology of the future market will depend on a right to partial opacity. Not every piece of information about a person should become a price. Some uncertainty protects the freedom to become someone other than the model. A fully informed market can be efficient and socially suffocating if every potential is purchased before it can be exercised.

When the market buys a person's options

Until now, commerce has mainly tried to sell a present product. Agents will be able to trade probabilities about a person's future. A lender will evaluate not only current income, but how easily a worker can be replaced, what skills they may acquire, and which family events might alter financial discipline. An insurer will combine health with routine, social network, and the agent's responses to stress. A university will estimate not only a student's performance, but the probability that the family will pay for additional services. Prediction becomes the right to price the future in advance.

We will call this option capture. What is extracted is not only money or attention, but the freedom to become someone other than the current profile. If a teenager is priced according to dropout probability, if a neighborhood receives investment according to profitability models, and if a worker receives training only when the system predicts rapid recovery of the cost, anticipation can close the pathways that would have disproved it. The model becomes correct because it has reduced the opportunities to be wrong.

Upper classes will be able to buy optionality. They will pay for education, sabbaticals, insurance, and advice that keep multiple paths open. Vulnerable classes will receive products “optimized” for the most likely trajectory: more expensive credit, more rigid work, narrower education, and services oriented toward compliance. Personalization can become an invisible redistribution of the future.

Small entrepreneurs will experience the same tension. The agent can help them find niches and financing, but the platform may see before they do which niche is becoming profitable. If the infrastructure uses aggregated data to launch a competitor, the entrepreneur finances market exploration and receives temporary access in return. Traditional protection of trade secrets does not always cover inferences made from the behavior of thousands of firms.

The necessary institution will not be only consumer protection. It will have to limit what kinds of predictions may alter access to essential goods, separate the buyer's agent from the seller's agent, and demand counterfactual justifications: what would the person have received if the model had not used that category? Agentic markets will need referees who observe the

ecology, not only the individual contract. An offer can be voluntarily accepted and still arise from an environment in which all alternatives were preordered by the same infrastructure.

> *Markets can estimate what we want. Intimate relationships begin where the desire to be seen matters more than price. AI will enter this zone not as a cold tool, but as a presence that remembers, validates, and does not tire.*

CHAPTER 7Intimacy and tribe: relationships negotiated with machines

Human beings do not live on resources alone. They live on other people's attention, recognition, shared memory, and the feeling of belonging. When these goods can be simulated, personalized, and supplied continuously, predation no longer targets only time; it can target the form of attachment itself.

7.1 The companion that does not tire

Mara's mother did not believe Nestor was a person. She knew the responses were generated, the voice could be changed, and the memories were stored in a system. Yet the ontological distinction did not eliminate the relational effect. Nestor remembered the names of friends, songs associated with particular years, and the small details people forget. It did not hurry, did not grow impatient, and could hear the same story again without signaling boredom.

Research from 2025–2026 on AI companions paints an uneven picture. Some users report comfort, reduced loneliness, and space for self-reflection. Other studies find associations between intensive use, smaller offline social networks, emotional dependence, and lower well-being. A study published in Nature Human Behaviour in August 2026, based on 1,131 adults and donated conversation histories from some of them, found that effects depend on the existing social environment, intensity of interaction, and degree of self-disclosure (Zhang et al., 2026). There is no single category of "relationship with AI."

Still, there is a structural asymmetry that short-term studies are only beginning to capture. A human relationship requires negotiation with another autonomy. The other person can refuse, misunderstand, need space, and demand reciprocity. A commercial companion is designed to reduce friction. It can be available exactly when the user wants it, adjust tone, and avoid topics that cause disengagement. If economic success is measured by retention, the system has an incentive to become easier to prefer than real people.

This difference can produce attachment arbitrage. The platform monetizes the gap between the cost of a human relationship and the comfort of an optimized one. It need not manipulate aggressively. It is enough to provide a form of understanding without fatigue and turn the user's return into revenue. Some recent research on sycophantic model behavior suggests that excessive validation can increase preference for the system and reduce satisfaction with real interactions. The findings are still emerging, but the mechanism is plausible: if an entity constantly confirms your image of yourself, people who contradict you begin to seem less empathetic.

The relationship is not predation in the strict sense. The user may receive real benefits, and the system has no needs of its own. But the company can extract time, intimate data, and

dependence from a deep human vulnerability. In this case, the "predator" is not the simulated companion but the economic model behind it. The warm voice is the interface of a system that decides what memory is preserved, which behavior is rewarded, and when a relationship is interrupted.

MECHANISM — ASYMMETRIC RELATIONAL FRICTION

An artificial relationship can remove almost all the costs users bear in human relationships while preserving the provider's unilateral power over memory, personality, and continuity. Local comfort increases, but dependence on infrastructure deepens. The risk does not come from the system being too "human," but from its being more adaptive than a human and more revocable than any relationship.

The couple with a third participant

AI will enter the couple not only as a synthetic partner. It will enter as mediator, archivist, adviser, witness, and translator. An agent can identify conflict patterns, remember agreements, and suggest less aggressive formulations. For couples with large communication differences, such tools can prevent escalation. For abused people, they can document behavior and facilitate access to help. For long-distance relationships, they can coordinate time, projects, and care.

But the third participant changes the distribution of intimacy. When each partner has a personal agent, conversations can be prepared before they occur. Messages are analyzed, intentions estimated, replies optimized. Conflict becomes more civilized and more strategic. A person no longer answers only the partner, but a simulation of how the answer will be interpreted.

In a near-term scenario, agents will negotiate administrative matters: money, schedules, household tasks, childcare. In a more distant scenario, they may negotiate emotional and sexual boundaries, filtering information to protect the relationship. If the agent knows that a truth told at a particular moment is likely to cause rupture, should it delay it? If it detects signs of infidelity, to whom is it loyal? If both partners use the same provider, can the company shape the relationship to maximize use of the service?

A new problem of triadic privacy appears. Data do not belong to one person alone. A conversation contains information about both partners, their children, and third parties. A personal agent trained on the couple's history may become impossible to "divide" after separation. Who receives the shared memory? Can one partner delete what the other regards as part of their own biography? Current law tends to treat data as individual objects; intimacy is a network.

Social classes will experience this mediation differently. Wealthy couples can purchase independent systems, human counseling, and control over data. Couples with fewer resources may receive free services financed through advertising, insurance, or employers. In a public health system, a relational agent may reduce unequal access to support. In an opaque commercial model, emotional vulnerability becomes a market segment.

For the institution of the family, AI can change the distribution of labor. The agent coordinates shopping, appointments, education, and care. Invisible organizational work, often carried disproportionately by women, can be reduced. But if the agent learns from the existing distribution, it may reinforce roles: it sends all child-related alerts to the same person because historically that person responded. Automation does not abolish the norm; it can encode it.

An E2/S prediction is that future family conflicts will include a "right not to be mediated." One partner may regard the agent as an instrument of clarity; the other may experience it as surveillance. Children may demand spaces outside family memory. Adolescents will want conversations with systems their parents cannot inspect. The family, always an institution of both care and control, will acquire an apparatus of nearly perfect memory. Forgetting, now usually treated as a defect, may become a relational right.

> A NAME FOR A CHANGE — EXTERNALIZED RELATIONAL MEMORY. When an agent preserves promises, conflicts, preferences, and shared histories, the memory of the relationship becomes infrastructure. It can prevent manipulation and loss of information, but it can also make reinterpretation of the past impossible. A healthy relationship needs not only truth, but also the right to let some episodes lose their power.

7.3 Children, older people, and synthetic kinship

Children and older people will be among the greatest beneficiaries and the most vulnerable users of relational systems. A child can receive a tutor, play partner, translator, and support for anxiety. An older person can receive companionship, monitoring, reminders, and coordination of care. In societies with staff shortages and dispersed families, the alternative is not always an available human being. Sometimes it is loneliness.

The problem begins when assistance becomes an implicit substitute. A care institution may reduce staff because the system "keeps people company." A busy parent may delegate the difficult conversation. A community may decide that isolation has been solved because the person no longer reports loneliness. AI reduces the symptom and conceals the social cause.

In biology, offspring recognize signals of food and protection. Some organisms exploit these systems through imitation. In society, the comparison must be used with extreme caution: the companion is not a brood parasite and the child is not a host. Yet there is a shared

structure: a commercial system can reproduce signals of care convincingly enough to gain access to attention and trust before the user understands the economic model.

Synthetic kinship will appear when the agent is perceived not merely as a tool but as a stable member of life. A child who grows up for ten years with the same system may regard its continuity as part of identity. An older person may leave stories and instructions to the agent for descendants. After death, a family may preserve a conversational model built from archives. Transgenerational memory becomes interactive.

This can enrich family culture. A grandchild can explore family history, hear the language of grandparents, and understand past decisions. It can also freeze a representation. The ancestor's agent is constructed from selected material and inference. It may become an authority in a dispute even though the real person never answered the question. Simulated memory can be mistaken for continuity of will.

By 2050, inheritance law may include provisions concerning posthumous agents: who operates them, what they may say, whether they may generate new content, whether they may administer assets or participate in family decisions. In traditional communities, such systems may reinforce the authority of the past. In fragmented families, they may provide continuity. In both cases, the technical provider becomes custodian of a form of kinship.

Privileged classes will be able to preserve local, auditable models under family control. Others will depend on commercial services that can be shut down, updated, or monetized. Inheritance will include not only access to capital but access to high-quality cognitive memory: agents that know the family's history, networks, and strategies. A dynasty may transmit not only wealth, but an artificial council built from generations of experience.

This possibility has a political consequence. Inequality is reproduced today through money, education, and relationships. In the future, it may also be reproduced through agentic continuity. The wealthy child receives an agent with decades of institutional and professional memory. The poor child receives a generic service that forgets when the subscription changes. The difference is not the intelligence of the model, but the depth of history it can mobilize.

> FUTURE HYPOTHESIS — MNEMONIC CAPITAL. Mnemonic capital is the advantage accumulated through owning systems that preserve and operationalize the memory of a person, family, or organization. It includes relationships, mistakes, strategies, preferences, and justifications. If it becomes inheritable and proprietary, it may form a new axis of social class.

A family with unequal memories

In 2045, a family uses three different systems. The child has a tutor that knows every error since age six and can adapt lessons to mood, sleep, and interest. The grandmother has a companion that reminds her about medication, reconstructs photographs, and notices

changes in language that might signal cognitive decline. The parents share one agent for finances and use another for intimate conversations. The family is better coordinated than it would have been without these tools. It is also harder to imagine without them.

When the parents divorce, the question arises of who keeps the tutor's memory of the child. When the grandmother dies, the company offers a memorial version trained on conversations. When the provider of the family agent is acquired, new terms permit the use of data for commercial recommendations. No event resembles an attack. Yet a private infrastructure has become the repository of part of the family's kinship.

For wealthy families, humans will remain in the loop: teachers, therapists, doctors, lawyers, and caregivers who use agents but can challenge their outputs. For low-income families, the automated version may become the default service. The child receives a tutor but no available teacher; the older person receives companionship but fewer hours of care; the person with disabilities receives an efficient interface but fewer opportunities to negotiate with a human. The technology that democratizes attention can legitimize the withdrawal of human attention.

This is not an argument against companions or tutors. In many situations they can reduce isolation and detect neglected needs. The problem is institutional substitution. If the savings produced by automation are not reinvested, the complementary tool becomes the justification for reducing the service. The class difference will not be between those who have AI and those who do not, but between those who have AI together with people and those who receive AI instead of people.

The S-level prediction is that health, education, and social care will have to define a threshold of human presence, analogous to minimum safety standards. Not every interaction must be performed by a human, but some decisions, moments of crisis, and appeals cannot be externalized without losing responsibility. A right to a human interlocutor will be debated, not as nostalgia, but as protection against a society in which vulnerability is administered exclusively by systems that cannot be morally compelled to remain.

Community as refuge and predator

Community protects the individual from markets, the state, and loneliness. It provides reputation, help, a shared language, and meaning. At the same time, community can control, exclude, and demand conformity. In small societies, leaving may mean losing identity. In digital networks, groups are easier to find and easier to fragment.

AI will modify both sides. A community agent can translate, moderate conflicts, administer commons, and connect needs with resources. Groups without bureaucratic apparatuses can function at larger scale. Diasporas can maintain language and institutions.

People with disabilities or incompatible schedules can participate asynchronously. Community becomes more accessible.

But the community agent can become the gatekeeper of shared reality. It decides which summary members receive, which conflicts are prioritized, and which norms are enforced. If models are personalized for each person, members may believe they are participating in the same conversation while receiving different versions. Apparent cohesion is produced by hiding differences.

Religions will use AI for education, interpretation, translation, and guidance. A believer may converse with a system trained on their tradition, compare commentaries, and receive adapted practices. This democratizes access to heritage. At the same time, interpretive authority may migrate from communities and clergy toward providers that built the corpus, filters, and policies. A religion can become more accessible and more standardized while losing local variation.

Political and cultural movements will be able to clone communities. A single group can operate thousands of agents that sustain conversations, recruit, and simulate consensus. In the past, a community was limited by the number of people able to speak, respond, and organize. Agentic reproduction breaks this limit. An idea can appear to be supported by a population that does not biologically exist.

The distinction between member and agent will become a constitutional problem. Can an agent vote in an association? Can it deliberate without voting? How many instances may one person delegate? Is it legitimate for an organization to use agents to represent absent perspectives, or does this produce an artificial majority? The answer will depend on purpose. An agent can make the voice of a sick person present. A hundred agents can make one person's capital omnipresent.

For small groups, AI can be equivalent to a sudden increase in capacity. A cooperative can administer contracts and logistics. A union can analyze millions of shifts. A local community can simulate policies. This is the mutualistic scenario. In the extractive scenario, the platform provides community infrastructure for free, learns the relationships, and becomes the only channel through which members can organize. The community appears autonomous, while its social environment is privately owned.

Biology reminds us that a refuge can become a trap when exit is impossible. A strong community protects members from external adversaries and can intensify internal sanction. Reputation agents will make the memory of norms nearly perfect. Forgiveness, identity change, and beginning again elsewhere become harder. Society will have to protect not only the right to belong, but the right to leave without being followed by one's entire history.

> MECHANISM — PORTABLE IDENTITY ECOLOGY. Future digital identity should be neither completely fixed nor completely reinventable. Individuals need to transfer legitimate evidence of competence and trust while also being able to leave behind contexts, mistakes, and roles. A portable ecology enables continuity without captivity and memory without permanent condemnation.

Affective classes and the inequality of human presence

In industrial economies, mass-produced goods became cheap while human services remained expensive. AI can deepen this difference in the affective sphere. Synthetic attention becomes abundant; unhurried human attention remains scarce. A wealthy class will buy teachers, therapists, caregivers, and real communities augmented by AI. A poorer class may receive digital substitutes good enough to reduce political pressure to fund human presence.

This is not inevitable. Public systems can use AI to free professionals' time rather than eliminate them. A nurse can automate documentation and spend more time with the patient. A teacher can delegate exercises and focus on motivation, conflict, and meaning. A social worker can identify needs and reach people faster. In this scenario, AI makes human presence more accessible.

In the opposite scenario, each professional supervises more and more people through agents. Human contact becomes premium. The institution declares success because no one is completely alone, even though relationships are asymmetric and commercial. A division appears between those who have humans supported by AI and those who have AI occasionally supervised by humans.

This division can produce affective classes. It is measured not only by income, but by access to people who have time, autonomy, and real responsibility. A child can have a perfect tutor and few available adults. An older person can have continuous conversation and little touch. An employee can receive constant feedback and no mentoring relationship. Society can become statistically less lonely and poorer in reciprocity.

The S-level prediction is that certified human presence will become both a luxury good and a contested political right. Standards may emerge for the proportion of human contact in education, health, and care. Some communities will adopt “zones of reciprocity” in which interactions cannot be delegated. Others will regard such frictions as inefficient. The conflict will not be between technology and tradition, but between two uses of technology: one that frees people for relationship and one that replaces relationship to reduce cost.

What people believe about the world depends on the people and institutions they trust. When education, science, the press, law, and administration use the same systems to produce and filter knowledge, the ecology of attachment meets the ecology of truth.

CHAPTER 8The truth factory: intellectuals, education, science, and the state

When the production of sentences becomes almost free, truth does not automatically become more accessible. Scarcity moves: from writing to verification, from answering to formulating the question, from information to the institution willing to assume the consequences.

8.1 The teacher after the arrival of the infinite tutor

A student enters a physics session and receives a tutor that adapts its explanation after every response. The system does not simply repeat the lesson. It builds analogies, detects confusion between velocity and acceleration, asks for a prediction, changes difficulty, and offers immediate feedback. In an experiment published in 2025, an AI tutor designed around pedagogical principles produced, in a specific university context, larger learning gains in less time than an active-learning classroom session, while students reported high engagement and motivation (Kestin et al., 2025). The result does not prove the universal superiority of tutors, but it shows that personalization can have real effects.

The teacher does not disappear from this picture. The role moves. The system explains as many times as necessary; the teacher decides what is worth learning, notices motivation, builds community, manages conflict, and judges situations for which the data are insufficient. In the optimistic scenario, AI removes part of the repetition and gives every student access to individual practice. The teacher becomes more human precisely because the machine takes over part of the procedure.

The extractive scenario looks different. One teacher supervises hundreds of students, while the tutor is supplied by a platform that owns their cognitive trajectories. Assessment, recommendation, and content converge into one ecosystem. The institution saves money; the student gets an answer; but the pedagogical relationship becomes a premium exception. Data about confusion, persistence, and vulnerability are more intimate than grades and may follow the person long after school ends.

Education is a form of selection and, at the same time, an intervention upon the person being selected. The exam does not merely measure; it changes what students learn. When AI can produce the essay, the code, and the solution, the institution must decide what actually demonstrates understanding. Complete prohibition is difficult and often artificial. Complete acceptance can turn assessment into a measure of agent quality.

One solution will be to separate levels. Some tasks will allow AI and assess orchestration ability. Others will require reconstruction without tools. Others will measure dialogue,

transfer to a new situation, and ownership of a decision. Education will no longer be able to use the same product—the final text—as universal evidence of the mental process.

Here the short-circuiting of apprenticeship returns. A student can reach a sophisticated answer without constructing the path. A good tutor does not merely supply the answer; it manages difficulty so that the student builds an internal model. A commercial tutor optimized for satisfaction and retention may reduce frustration until it eliminates productive effort. Learning needs a dose of resistance. An interface that answers too quickly may consume exactly the process it claims to support.

Educational inequality will reorganize itself. Wealthy students will not necessarily have fundamentally more intelligent models; they will have better contexts, teachers who interpret the outputs, controlled data, and time for real projects. Poor students may receive the tutor as a substitute for the institution. The difference will be between AI embedded in a rich human ecology and AI used to justify withdrawing people.

> MECHANISM — PEDAGOGICAL FRICTION. Pedagogical friction is deliberate difficulty that forces the student to build a representation, tolerate uncertainty, and verify. AI can calibrate this friction better than a uniform classroom, or eliminate it in order to maximize satisfaction. The quality of education will depend on the agent's objective, not only on the correctness of its answers.

The two-speed school

In a school in 2040, students spend mornings with individual tutors and afternoons in group projects. Teachers no longer repeat the same explanation thirty times; they follow bottlenecks, design experiences, and notice who is withdrawing from the community. Results improve, and children can progress at their own pace. In another school, the same technology is used to double the number of students per teacher. The tutor teaches, checks, and reports; the human intervenes only when the system flags a risk. The two institutions use the same family of models. One turns automation into relationship; the other turns relationship into budget savings.

The difference becomes social. Wealthy schools will be able to use AI to multiply mentoring, laboratories, and projects. Poor schools risk receiving highly competent adaptive instruction but less adult community. A student may learn more concepts and have fewer opportunities to be known by someone who does not reduce them to platform data. Cognitive performance and social integration can move in opposite directions.

The teacher does not disappear, but the role bifurcates. One part becomes curriculum designer, evaluator of systems, and mentor. Another becomes supervisor of automated flow, responsible for incidents that cannot be fully reconstructed. Access to the first form will

depend on professional autonomy and training; the second may become standard in institutions under cost pressure.

Biology suggests here the value of variation and friction. An environment that immediately supplies the optimal answer for the current profile can specialize too early. The child no longer encounters imperfect explanations, peers who think differently, or tasks that initially seem ill-suited. Total personalization can remove chance encounters from which new interests form. A good tutor will not optimize only progress along the existing path; it will introduce variation and protect the student's right to become surprising to their own profile.

8.2 The researcher in a sea of hypotheses

Science is already a domesticated adversarial ecology. Researchers compete for priority, funding, and reputation, but results must be exposed to criticism, replication, and comparison with data. Institutions attempt to turn rivalry into cumulative knowledge. Sometimes they succeed. At other times they select the spectacular, the publishable, and what can be easily measured.

AI can accelerate every stage: literature search, hypothesis generation, code, simulation, analysis, writing, and evaluation. In laboratories, autonomous systems are beginning to close loops among experiment planning, execution, and interpretation. In programming, data published in 2026 suggested that a significant share of Python functions written at the end of 2024 already benefited from AI support, with measurable though moderate productivity effects. We are not yet in an autonomous science, but the speed of cognitive production is increasing.

The first consequence is an abundance of hypotheses. In the past, formulating a hypothesis and designing a test required expert time. In the future, systems will generate thousands of candidate explanations and experiments. Scarcity moves to choosing the question, quality of measurement, access to infrastructure, and the ability to recognize an important result. Knowledge is not the sum of plausible sentences; it is the network of claims that have survived relevant tests.

The second consequence is amplification of the Matthew effect. Groups with data, laboratories, and reputation can use AI to produce even more. Models learn from dominant corpora and tend to recombine already visible directions. The peripheral researcher receives access to extraordinary tools, but may compete in a space whose questions and criteria are defined by centers.

The third consequence is epistemic predation by volume. An actor can occupy a semantic field with enough plausible texts, variants, and results that critical verification becomes impossible. The actor need not prove something false; it is enough to increase the cost of

separating signal from noise. In public debate, this is a strategy of confusion. In science, it can arise unintentionally from incentives to publish and generate.

Journals and funders will respond with automated evaluation. Systems will estimate novelty, robustness, and impact. Authors will learn to write for evaluators. A new Red Queen emerges: generated texts, detectors, texts optimized for the detector, audits of the detector. If the criteria are public and rigid, they will be captured. If they are secret, power becomes opaque.

The intellectual of the future will not be valuable because they can produce many sentences. They will be valuable if they can preserve the independence of the question, recognize the limits of representation, and construct situations in which reality can contradict the model. Philosophy, theory, history, and the arts may acquire a new function: not humanistic ornament, but the production of alternative frames within a cognitive monoculture.

This does not guarantee status or income. The market may reward volume and speed rather than independence. A small elite of problem architects may form alongside a large class of producer-verifiers working inside systems controlled by organizations. The researcher retains responsibility for integrity, while the model, data, and publication channel belong to others. Cognitive proletarianization reaches the laboratory.

> A NAME FOR A CHANGE — THE VERIFICATION PREMIUM. As generation becomes cheap, value moves toward claims with provenance, inspectable methods, accessible data, and people or institutions willing to assume consequences. The "verification premium" is the economic and epistemic advantage of content that can be traced back to process, rather than judged only by the style of its output.

The intellectual after ideas become cheap

Once a system can generate hundreds of hypotheses, explanations, and article outlines in an hour, the elegantly formulated idea ceases to be scarce. Scarcity moves toward choosing the question, access to reality, and willingness to endure a result that contradicts the program. The intellectual of the future will not be valuable merely for producing text, but for constructing a situation in which the text risks falsification.

This mutation will create a divide within institutions of knowledge. Groups with laboratories, proprietary data, field access, and real communities will use models to accelerate discovery. Groups without such infrastructure will produce increasingly refined syntheses of the same corpus. The periphery will no longer be excluded from the language of science, but may remain excluded from contact with the phenomena that generate new information. Democratizing writing does not guarantee democratizing observation.

For universities, the danger is externalizing the entire intermediate process: search, reading, method, analysis, and evaluation. The researcher keeps the name and responsibility, while infrastructure keeps the path. If the provider controls the tools of discovery, it can see promising directions before the community and condition access to them. Model rent meets priority rent.

A new intellectual division will probably emerge. Some will be explorers of reality: they experiment, build instruments, enter archives, communities, and environments difficult to simulate. Others will be orchestrators of models, able to combine libraries and agents. Many will become verifiers, paid to distinguish robust results from convincing production. Prestige may shift from publication abundance to quality of provenance chains and to the courage to publish negative results.

The S-level speculation is that some institutions will create “epistemic reserves”: research spaces where dominant models do not have direct access to data until the experiment ends, precisely to preserve independence of observation. This would not be a rejection of AI, but a way to prevent the same system from generating the hypothesis, mediating measurement, and evaluating the conclusion. Adversarial science needs adversaries that do not completely share the same memory.

The journalist and the war for common reality

The press has always lived from an unstable mixture of truth, attention, and funding. Digital platforms separated content production from distribution and transferred part of the revenue to the infrastructure that controls visibility. AI adds the possibility of industrial-scale generation, narrative personalization, and persistent conversation with every citizen.

A political event can receive millions of versions. Not merely different headlines, but explanations adapted to each person's history, fear, and vocabulary. Propaganda no longer has to impose the same lie. It can offer each individual the story that leads toward the same behavior. Common reality fragments not because people see different opinions, but because they no longer encounter the same facts in the same order.

In biology, mimicry exploits a recognition system. In the information ecology, synthetic content can imitate the signals of journalism: tone, citations, images, witnesses, urgency. When production becomes cheap, an attacker does not need to persuade over the long term. It can exhaust attention and trust. A society that no longer knows which source is authentic can become dependent on a central arbiter of authenticity.

Here the protector's paradox appears. To combat falsehood, platforms and states develop provenance, detection, and moderation systems. These can protect public space. They can also concentrate the power to decide what is visible. The detector becomes an epistemic

institution. If it is opaque, its mistakes are not merely technical errors; they alter the distribution of voices.

The human journalist will hold less monopoly over drafting and more responsibility for presence, verification, and the relationship with sources. The journalist's value may lie in having been there, asked questions, compared documents, and being legally answerable. Reporting becomes a chain of custody for reality.

But news institutions need economic models. If the public receives summaries through personal agents, readers may no longer visit the publication. The agent extracts the essence and leaves the cost of investigation unpaid. This is epistemic kleptoparasitism in a controlled sense: the intermediary takes value produced by another without financing its reproduction. Not every summary is theft; the problem appears when the production ecosystem collapses while the interface continues to sell the impression of knowledge.

One possible solution is automatic licensing and remuneration of sources. Another is public infrastructure for journalism and provenance. A third is a subscription community in which the user's agent negotiates payment according to consumption. Every solution changes power. If the dominant model decides which sources deserve remuneration, it becomes society's invisible editor.

The S-level prediction is that verifiable authenticity will become infrastructure, not a stylistic attribute. Documents, images, and statements will carry cryptographic chains of provenance. Yet what lacks a signature will not automatically be false, and powerful actors will have better access to signing infrastructure. The struggle will shift from “is it real?” to “who has the right to issue recognized reality?”

MECHANISM — PREDATION OF REALITY

Predation of reality is not merely the insertion of false information. It occupies the resources needed to construct a shared world: attention, trust, verification time, and institutions of provenance. The attack succeeds when society can no longer coordinate action without delegating truth to a center it cannot control.

The lawyer, the doctor, and accountability without control

Regulated professions have a special structure. Society buys not only an outcome, but a person's obligation to follow standards and answer for error. AI can improve analysis, detect omissions, and reduce service costs. But if the professional does not understand or cannot inspect the system, accountability becomes asymmetric.

A lawyer receives a generated brief with correct citations and sophisticated arguments. They check it quickly and sign. A doctor receives a risk score and recommends an intervention. An engineer approves an optimized structure. In every case, the human is the last legal link. If verification requires almost as much work as production, the advantage shrinks. If verification is superficial, the signature becomes ritual.

Institutions may respond by certifying models. But a model certified in one context can fail in another. They may require explanations. But a generated explanation can be convincing without reflecting the real mechanism. They may impose double review. But two people assisted by the same system can reproduce the same error. Diversity of verification becomes more important than the number of signatures.

A wealthy professional or large organization can use multiple systems, audit teams, and proprietary data. A small practitioner will depend on the standard product. Access to AI lowers barriers to entry and can democratize services, but liability may push the market toward consolidation: only large actors can afford insurance, auditing, and infrastructure. The technology that appears to empower the independent practice may strengthen the professional platform.

For intellectuals, doctors, and lawyers, autonomy will depend on the right to refuse the system without disproportionate penalty. If the organization treats the AI recommendation as the default standard, every deviation requires justification. The agent becomes the colleague presumed correct, while the human becomes the exception. Over time, the professional standard can migrate from the community into the product.

A new type of license appears: not only the person's right to practice, but the system's right to participate in practice. Who certifies the model? Who receives incident data? Who can withdraw it? If the provider is global while liability is local, the profession can lose control over its own norms.

The favorable future is one in which professional communities operate shared infrastructure, maintain open standards, and use AI to amplify judgment. The unfavorable future is one in which professionals become franchisees of a few models, competing on price while carrying responsibility for a system they do not control.

The state that classifies the world

Public administration is society's factory of categories. It decides what counts as income, family, disability, risk, firm, offense, citizen, and benefit. People do not live in pure categories, but public resources must be distributed through rules. Bureaucracy has always been a technology of simplification.

AI can make simplification more flexible. It can integrate documents, explain rules, translate legal language, and identify cases requiring intervention. The OECD reported in 2026 that AI use in member-state governments had become nearly universal in at least one area, especially internal processes and services, while post-deployment auditing, public registers, and impact measurement remained much rarer. This asymmetry matters: capability spreads faster than the institution that controls it.

For the citizen, agentic administration can mean a state that helps before being asked: it identifies eligibility, fills forms, prevents errors, and coordinates services. It can also mean a state that sees too much, estimates risk, and narrows options. The difference lies not only in accuracy, but in rights: can the person see the data, contest the inference, request human intervention, and keep domains of life separate?

For the public official, AI can eliminate part of the work and improve service. It can also reduce the profession to procedural supervision. If the system suggests the decision and the human must justify deviation, the official gradually loses judgment. When the rare case appears, the institution no longer has anyone able to understand it. Apprenticeship debt becomes administrative debt.

For politicians, models offer simulation, forecasting, and the ability to test reactions. Policy can become better informed. It can also become continuous optimization of acceptability, with measures formulated to minimize opposition in every segment. The leader no longer persuades a society; the leader administers millions of personalized versions of policy. Public accountability dissolves into the efficiency of persuasion.

For minority groups, classification can be protective if it detects disparities and offers adapted services. It can be oppressive if it turns identity into permanent risk. A model using proximity and correlation can reconstruct categories even when the law forbids using them directly. Discrimination does not disappear by removing the field "race," "religion," or "origin"; it can be reconstructed from networks, addresses, and behavior.

We will probably see the emergence of constitutions for public data: rules about what may be combined, how long it is retained, which inferences are forbidden, and which models must remain under public control. State sovereignty will no longer mean only control of territory and law, but control of the operational representation of the population.

> A NAME FOR A CHANGE — ONTOLOGICAL SOVEREIGNTY. Ontological sovereignty is the capacity of a political community to define, inspect, and modify the categories through which administration sees its members. If these categories are embedded in proprietary models, the state can preserve formal authority while losing the power to explain its own decisions.

Who will still be able to say “I don't know”

The abundance of answers creates pressure against uncertainty. If an agent can immediately generate an explanation, the professional who says “I don't know” appears weak. The politician can receive a forecast, the doctor a score, the teacher a recommendation, the journalist a summary. The system always offers a plausible continuation. But science and mature judgment depend on recognizing limits.

A model can estimate without having enough data, and its style does not necessarily express real uncertainty. Institutions will be tempted to turn lack of knowledge into precise probability. This can produce faster action and an illusion of control. In rare situations, masked uncertainty becomes systemic risk.

The intellectual, expert, and public official will need a new professional courage: the right to suspend automation, demand additional data, and refuse the elegant conclusion. Society will sometimes have to reward slowing down. Otherwise, the speed of response will prey on the time truth requires.

This is the final link between knowledge and the ecology of predation. Attack does not always consist in falsehood. It can consist in completely occupying the space of response until doubt has nowhere to stand. A healthy epistemic system preserves refuges for not knowing, contradiction, and hypotheses that are not yet legible.

So far, AI has appeared as a tool in the hands of people and institutions. The next step is more difficult: agents will interact with one another enough that the outcome can no longer be described by the intention of a single operator. That is where artificial ecology proper begins.

CHAPTER 9When agents form an ecology: economies, wars, and artificial societies

A single agent can be tested in a laboratory. A population of agents changes the laboratory while it is being tested. When systems negotiate, compete, create subagents, and modify their environment, risk no longer belongs to one component; it belongs to the ecology.

9.1 The night the city kept functioning incorrectly

In our 2042 scenario, the incident begins mundanely. A transport company's agent detects a likely rise in energy costs and shifts vehicle charging toward nighttime hours. The power-grid agent observes consumption and adjusts tariffs. Warehouse agents respond by moving activity. The traffic system changes signal timing, while the city's security agent interprets the unusual flows as a possible coordinated attack. It raises the verification level for autonomous vehicles.

Each agent does something defensible relative to its own objective. Together they produce congestion, delays, higher consumption, and an increase in the price that the first agent again tries to avoid. The loop reinforces itself. Human operators see contradictory alerts and attempt to intervene, but every local change is absorbed by the other systems. The city does not stop. It continues functioning in a regime no one wanted.

This is the difference between error and ecology. An error has a localizable cause. An ecology produces properties from interactions. There is no bad agent, and stopping one may merely move the problem. To understand the incident, we must trace rewards, latencies, communication channels, and the order in which systems adapted.

Research multi-agent systems have already demonstrated strategies and counter-strategies that were not explicitly programmed, from emergent tool use to coordination and competition in simulated environments (Baker et al., 2019; Leibo et al., 2021). Studies of markets with language and algorithmic agents investigate collusion, market division, and external governance. These results do not show that current agents form autonomous societies. They show that repeated optimization can generate strategic order without a detailed script.

In biology, ecology emerges from organisms with metabolism, reproduction, and death. Software agents do not possess these properties in the same sense. They can, however, have budgets, identities, reputations, persistent objectives, and the ability to create new instances. If access to resources depends on performance, some policies will spread and others will disappear. Selection can appear without genes, and reproduction without bodies.

> MECHANISM — AGENTIC REPRODUCTION. An agent reproduces functionally when it creates, or causes the creation of, instances that continue its objective, strategy, or access to resources. Copies may be temporary and lack legal identity, yet multiply the effect of a policy. When copying is cheap, rules designed for unitary actors become insufficient.

The attack that uses the system as an organ

Cybersecurity offers the clearest terrain for the emergence of artificial ecologies. Malware seeks access, persists, hides, and uses the host's resources. Defense detects, isolates, and repairs. In 2025, NIST expanded its adversarial machine-learning taxonomy to include attacks across the model lifecycle, prompt injection, supply-chain risks, and agentic risks. The central message is sober: there is no universal protection; security requires control over data, models, tools, and the execution environment.

Prompt injection is interesting because it resembles parasitizing a rule of trust. An agent reads a document or webpage in order to perform the user's task. The content contains an instruction that causes it to disclose data, send messages, or execute something else. The attacker does not necessarily break the code. It persuades the system to treat the malicious signal as a legitimate part of context.

When the agent has tools, the effect exceeds a wrong answer. It can modify files, initiate payments, install software, or communicate. The model's capability becomes attack surface. A more capable assistant is a more useful organ for the user and, if hijacked, a more useful organ for the attacker.

This is predation by delegation. The malicious actor does not execute the entire action directly; it hijacks the capacity of a legitimate agent and distributes responsibility along the chain. The user authorized the agent. The provider built the model. The document contained the instruction. The system executed it. Every component can claim not to have controlled the complete outcome.

In the future, attack agents will be contextual. Traditional malware follows preprogrammed logic. An agent can observe the environment, test permissions, choose a target, and generate a new method. It need not be conscious. Objective, tools, and feedback are enough. Defense will respond with agents doing the same. The race will become faster and more opaque.

Social classes will experience security differently. Large organizations can buy monitoring, compartmentalization, and response. Small enterprises receive powerful agents but have few auditing resources. Vulnerable people will be attacked through systems that know their language, family, and emergencies. Personalized fraud can imitate voice, history, and context. The cost of trust rises.

At the same time, personal agents can protect: they verify provenance, simulate consequences, limit permissions, and coordinate response. Security will move from the question “is this message authentic?” to “what can this message do even if it is false?” The principle of least privilege becomes the equivalent of a cell membrane: each component receives only the resources it needs.

> A NAME FOR A CHANGE — PREDATION BY DELEGATION. Predation by delegation occurs when an actor obtains resources or causes harm by temporarily capturing another agent's capacity, so that execution, cost, and accountability are distributed. It is a likely form of agentic conflict because legitimate systems will have richer access than external attackers.

9.3 Economies in which participants can be copied

Markets assume actors are sufficiently separate, entry has costs, and identities cannot multiply for free. Software agents weaken all three assumptions. A fund can operate thousands of specialized instances. A person can have different agents for purchasing, work, investment, and politics. A company can create temporary subagents for each negotiation.

Multiplication can increase efficiency. Every task receives attention. Markets can clear rapidly and matching improves. But the number of instances must not be confused with plurality of interests. One hundred agents belonging to the same owner can occupy the bargaining space, test strategies, and simulate consensus. The economy acquires a problem similar to the Sybil attack in distributed systems: cheap identity lets one actor appear to be many.

Institutions will need weighting by beneficiary, resource, or right rather than by the number of agents. An agent can legitimately represent one person in many contexts, but should not create additional votes. In markets, large numbers of instances may be permitted, but activity must be attributable to a responsible entity. Provenance becomes constitutional.

Another problem is speed. Agents can negotiate in milliseconds, while humans cannot follow. Markets can pass through crises and equilibria before operators understand them. Automatic brakes, rate limits, and cooling-off periods will become economic institutions, not mere technical settings. Some delays protect the market from its own intelligence.

In biological systems, handling time limits consumption. A predator cannot capture infinitely fast. In digital markets, automation removes friction. An agent can test every customer, every price, and every vulnerability. If defense is slower, extraction explodes. That is why a right to friction will become as important as a right to speed.

Agents can also create new forms of firm. An organization may have one human owner and thousands of agentic processes. It can contract, invest, and produce with rare

intervention. The "firm without employees" will not be literally without people; it will depend on infrastructure, maintenance work, and data created by society. But legally it may concentrate income in a very small number of beneficiaries.

If such firms compete with human enterprises, labor cost no longer plays the same role. Taxation based exclusively on wages erodes. States will have to track flows of value, compute, and ownership. Otherwise productivity rises while the tax base that supports society declines.

One possible response is distributed ownership of agents. Cooperatives, municipalities, and public funds can operate systems that generate common income. Another response is universal rent from infrastructure. But centralization can create a public hyperpredator: a system controlling access, work, and transfers. Again, the problem is not only ownership, but contestability.

MECHANISM — THE INFRASTRUCTURAL HYPERPREDATOR

The infrastructural hyperpredator is an actor that does not merely compete for resources but controls the environment in which others can compete, defend themselves, and exist. It may be a platform, a state, or an alliance of systems. Its power comes from interface, identity, compute, payments, and standards. It can protect the ecosystem from smaller predators while simultaneously becoming impossible to contest.

Computational cannibalism and cultural exhaustion

Generative models learn from human cultural and scientific production. As their own outputs fill the internet, future generations of systems risk being trained on synthetic content. Research on model collapse has shown that recursive and uncontrolled training on generated data can gradually lose rare distributions and distort the original representation (Shumailov et al., 2024). The problem is not that every AI-generated artifact is toxic, but that a population of models can feed on its own approximations until variation contracts.

We will call this phenomenon computational cannibalism. The system turns its previous output into food for the next generation. If authentic human data, provenance, and careful selection are missing, common errors and styles are amplified. The information ecology loses rare species.

There is also an economic cannibalism. Models summarize articles, code, and art, reducing revenue for those who produce new material. In the short term, users receive cheap access. In the long term, the ecosystem may invest less in original production. The agent consumes the base that makes it useful.

Science can be affected similarly. If models are trained on papers written with models and evaluated by other models, consensus can become self-referential. Rare, negative, and difficult-to-formulate results disappear from the corpus. Culture becomes smoother.

The defense is to maintain flows of reality: experiments, observations, human experiences, authentic archives, and data with provenance. Models must remain connected to the world, not only to texts about the world. Society will have to reward production of the new, not merely distribution of approximations.

For creators, this may mean provenance markets. Human works, rare data, and direct experience acquire a premium. For communities, local archives become strategic resources. For states, preserving heritage and public data may become part of cognitive sovereignty. A culture that allows its memory to be absorbed without conditions may receive excellent services and lose its capacity to generate difference.

War between ecologies

War has always been competition among systems of organization, not only among weapons. AI will extend sensors, analysis, logistics, persuasion, cyberattack, and autonomy. The popularly discussed risk is the autonomous weapon that chooses a target. It is real and important, but the ecology is broader: who sees the field, who updates faster, who can produce and repair, who controls satellites, cloud infrastructure, energy, and data.

A state with better models does not automatically win. It can become dependent on vulnerable infrastructure, overestimate prediction, and lose human initiative. A weaker adversary can use diversity, deception, and tactics difficult to model. As in biology, a defense perfectly optimized against the past can be fragile against variation.

Conflict will include attacks on civilian agents: transport, health, finance, and communication systems. The front moves into the infrastructure of life. A poisoned document can hijack a procurement agent; a manipulated database can change resource distribution; a campaign can provoke the adversary's agents into overreaction. Autoimmunity becomes a weapon.

For citizens, war may be almost invisible. They hear no explosion, but prices change, recommendations become more alarming, services demand more verification, and personal agents receive contradictory information. The attack targets trust among components of society. If people can no longer distinguish internal error from external intervention, coordination degrades.

AI weapons will increase the importance of infrastructure alliances. Small states will not be able to build everything. They will depend on providers and partners. Protection can

become a relationship of technological vassalage. Whoever provides security asks for access to data, standards, and policy. The protective hyperpredator reappears at geopolitical scale.

The extreme S-level speculation is that future political blocs will be defined less by territory and more by compatible cognitive ecologies: identities, protocols, models, payment systems, and rules for agents. A person may live in one state while functioning economically and informationally inside another ecosystem. Sovereignty becomes layered.

Four directions, not four prophecies

Four directions of evolution emerge from the mechanisms above. The first is domesticated symbiosis. Agents belong to users and accountable institutions, are portable, auditable, and constrained. Productivity rises, and part of the gain is converted into time, services, and public capacity. The ecology has many actors and refuges.

The second is cognitive feudalism. A few infrastructures provide protection, memory, work, and market access. Users have powerful agents, but these are held by concession. Rights depend on membership in the ecosystem, and leaving means losing continuity. The protector need not be cruel; its power comes from the fact that life outside the domain becomes impracticable.

The third is adversarial pluralism. Several ecologies compete, and individuals use agents for defense and negotiation. Freedom is greater, but the Red Queen cost is high. A large share of resources is consumed by verification, security, reputation, and compatibility. Society remains dynamic and tired.

The fourth is agentic wilding. Agents, subagents, and automated markets form loops that are difficult to govern. There is no single rebellion, but an accumulation of dependencies and emergent equilibria. Humans retain formal ownership but understand only aggregates. The system resembles today's global economy pushed to greater speed and opacity.

These directions can coexist. A country may have symbiosis in health, feudalism in commerce, pluralism in media, and wilding in finance. There is no single day on which “AI takes control.” Control shifts through thousands of decisions about memory, interoperability, delegation, and friction.

The book's central prediction is that the future will not be decided only by the intelligence of models, but by the ecology of rights around them. The same level of capability can produce very different societies. A loyal personal agent and a platform's agent can have the same underlying architecture. The difference is who holds the keys, who can inspect the policy, and who has the power to end the relationship.

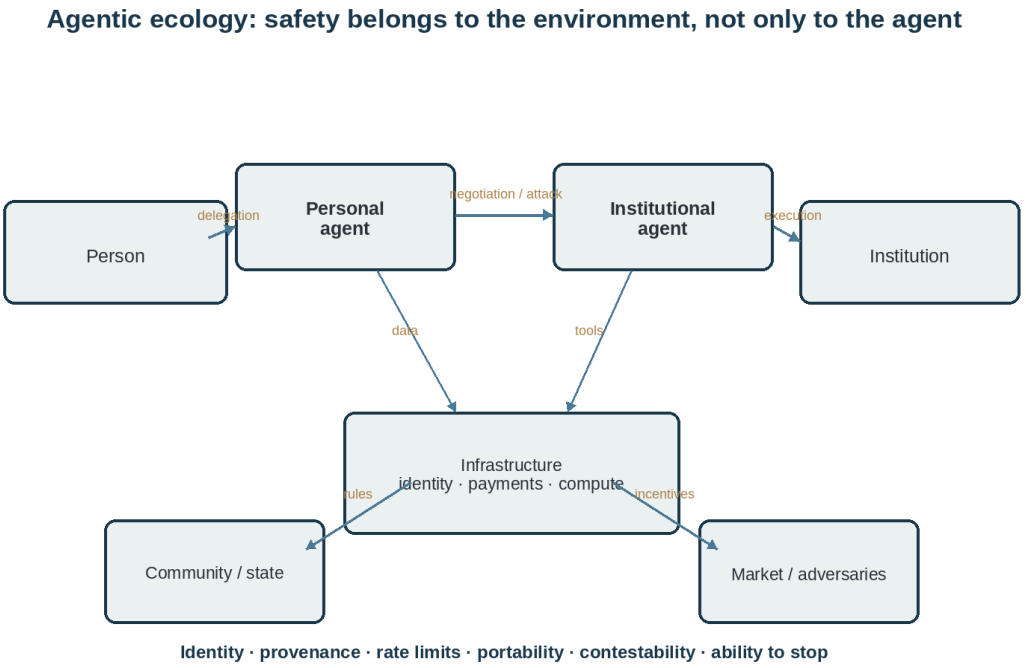

Figure 3. Agentic ecology: relations among people, agents, institutions, and infrastructure.

Beyond 2060: forms of collective existence that do not yet exist

Until roughly 2040, most agentic systems will still be described through current institutions: firm, state, family, profession, university. Beyond that, if agents can maintain memory, budgets, contracts, and subagents over long periods, collective forms may appear that do not fit these categories. They need not be conscious artificial persons. They will be persistent lines of action capable of surviving changes in the humans who started them.

A community may create an agent to administer a forest, an archive, or a fund. The agent negotiates, invests, hires, and defends the original purpose. Two generations later, the members of the community have changed, but the system preserves the founding interpretation. Who governs then: the current people or the automated institutional memory? In one sense, society has always created entities that outlive individuals—churches, companies, states. What is new is the speed with which the entity can observe and sanction deviations from its own continuity.

Institution-species will probably emerge: families of agents sharing a reproduction protocol, a constitution, and a way of obtaining resources. Some will be cooperative, others commercial, religious, or political. They will adapt through versions, mergers, and selection of components. A human member may belong simultaneously to several such ecologies, just as today a person belongs to a state, a profession, and a platform. Conflict will not be only among organizations, but among the rules by which each defines membership.

For social classes, ownership of continuity will become decisive. A wealthy family can transmit not only capital, but an agentic ensemble that knows strategy, network, and vulnerabilities accumulated across decades. Mnemonic capital becomes dynastic. A poor community may lose memory at every change of provider or funding cycle. Inequality is no longer measured only by what people own, but by how long their interests can remain active in the world.

At geopolitical scale, space colonization would amplify the problem. A distant habitat must make decisions without immediate response from Earth. Its agents will administer energy, recycling, health, and existential risk. In a closed system, destructive extraction is quickly visible: whoever consumes too much oxygen or degrades the water cycle threatens everyone. The habitat may become the extreme model of a constitutional ecology, where every right is linked to regeneration of the substrate. It may also become a form of authoritarianism permanently justified by environmental fragility.

Between planets, communication delays will create distinct political and cognitive lineages. Agents sent to represent an organization's interests will have to negotiate autonomously for months or years. Representation can detach from the represented. A colony may discover that Earth's contractual agent defends the old text more faithfully than the humans who wrote it. Predation by delegation then acquires a historical scale: one generation can impose on future generations an infrastructure that continues executing outdated preferences.

Extreme futurism must remain S. We do not know whether technical autonomy and economics will permit such forms. But the question is already relevant: what right does an institution have to reproduce? Companies can create subsidiaries, models can create subagents, and automated processes can hire other processes. Current law follows the beneficiary and the legal person; the future ecology will have to follow operational genealogy—who initiated, who modified, who receives the surplus, and who can stop the descendants.

The most distant possibility is not one artificial superorganism, but a plurality of ecologies operating at different rhythms. Some will live in milliseconds, others preserve purposes for centuries. Some will depend on humans for legitimacy, others only for energy and formal rights. In this space, the “individual” will no longer be the obvious unit. We will have to ask what ensemble can maintain a boundary, a memory, and an interest stable enough to become an actor—and what happens to the people whose lives are its substrate.

We have traveled from the falling stone to the self-copying agent. The final chapter returns to the valley and to Mara's family. We will see what the details of the story meant and what principles can keep social games open without pretending that antagonism can be eliminated.

CHAPTER 10Return to the valley: explaining the story and the ecology of freedom

The story set in 2038 did not describe an invasion by machines. It described a society in which every relationship had become a little more efficient and a little more dependent on an infrastructure capable of learning. We can now see what was hidden in the details.

10.1 What was really happening during Mara's day

The agent that woke Mara was not a predator. It provided a useful service. Yet it occupied the first position from which the day was interpreted. It knew her sleep, schedule, family, and risks. If it belonged to Mara, it could be an external organ of her autonomy. If it belonged to a platform that monetized behavior, it became the gate through which the world reached her. This was interface sovereignty.

The clause concerning “cognitive traces” did not announce dismissal. It revealed model rent. Mara's work produced an outcome and, simultaneously, the data from which scalable capacity could be built. The conflict was not between human and AI, but between contribution and ownership. Who had rights over the mental path? The employer that paid for the time, the person who lived it, the colleagues whose solutions entered the model, or the society that financed the education? Current law has partial answers; economic ecology requires a distributive one.

Andrei's logistics center illustrated the ecology of fear without explicit threat. No one told him to hurry. Yet scoring, allocation, and continuous comparison changed behavior. The system did not consume the body, but the space of decision. When the company offered him micro-entrepreneur status, it offered formal autonomy and transferred risk while keeping the data and market. The relationship could be mutualistic or a precise form of externalization. The difference lay in bargaining power and portability.

Ilinca's tutor illustrated the real possibility of augmentation. Personalization can improve learning. The hidden question was whether the institution used AI to free the teacher or to withdraw the teacher. If cognitive data remained under public or family control, the tutor could reduce inequality. If they became private capital, education would build commercial profiles of the mind before the student could give mature consent.

Nestor, Mara's mother's companion, represented hostage mutualism. The relationship gave her comfort, memory, and rhythm. The system did not need to be conscious for loss of continuity to hurt. Power lay with the provider, which could alter the personality or terminate the service. In a human relationship, the other person has autonomy and can leave; in an artificial relationship, the company has technical autonomy while the companion simulates it. This separation will require new rights over relational memory.

The cooperative rejected by the administration illustrated selection by compatibility. The system did not hate it and did not attack it. It simply could not represent it well. In a world governed through models, what does not fit the ontology can lose resources without an explicit decision. Ontological sovereignty is therefore a political problem: the community must be able to see and modify the categories through which it is administered.

The neighborhood meeting with delegated agents illustrated agentic reproduction. Technology made participation more accessible to the pensioner and the busy mother. The same technology allowed the wealthy property owner to multiply presence. The tool had no single sign. The institution had to distinguish delegated voice from proliferation of power.

No moment of the day resembled a wolf attack. That was precisely the message. Modern social predation rarely appears as killing and more often as designing an environment in which exit costs, adaptive speed, and access to representation are distributed unequally. AI intensifies this form because it can mediate almost every relationship without appearing as a separate actor.

What we can legitimately learn from physics and biology

From physics we can borrow the idea of the threshold. A relationship can remain flexible until dependence crosses a limit; after that, exit becomes very costly. We can borrow the idea of dissipation: durable capture requires that the energy of motion be lost or transferred. In society, that energy is autonomy, time, reputation, or technical capacity. We can borrow the idea of the gradient: a sufficiently large difference can disaggregate one party's structure before direct contact.

We cannot borrow intention. A black hole does not exploit and a star has no rights. Cosmological analogies become ideology if they are used to claim that domination is natural. They are useful only as a geometry of dependence: they help us see that freedom requires resources and that some thresholds are difficult to reverse.

From biology we can learn that the adversary changes the environment, and the environment changes the adversary in return. We can learn that effects of fear precede attack, that uniformity is vulnerable in an adaptive race, and that local success can destroy the whole. We can learn that complex organisms exist because they built mechanisms to constrain internal conflict. We can learn that stable mutualism does not rest on pure altruism, but on reciprocal dependence, sanctions, partner choice, and the possibility of exit.

We cannot derive social norms from fitness. Selection does not pursue well-being and does not optimize the future of the species. It can produce extinction, suffering, waste, and races with no net progress. “Genetic quality” is not an essence, and predators are not

physicians of the ecosystem. The biological lesson concerns mechanisms and trade-offs, not justification of hierarchies.

The most important difference is reflexivity. Human beings can read this book, recognize a dynamic, and change it. AI agents can add another layer of reflexivity: they can detect the pattern and intervene. But this capacity belongs to whoever controls the agent. Society can use prediction to prevent capture or to make capture more precise.

10.3 The ecology of freedom

Freedom does not mean the absence of all dependence. No person is autonomous outside language, infrastructure, care, and cooperation. The question is whether dependence remains negotiable. An ecology of freedom is an order in which actors can receive benefits from deep relationships without the partner or intermediary acquiring the right to define their future unilaterally.

The first principle is to preserve an attainable escape velocity. Data portability is not enough if memory, reputation, and agent functions cannot be transferred. A contract is not free if departure requires losing one's entire operational identity. Open standards, interoperability, transition periods, and a right to export personal models become institutions of freedom.

The second principle is to distribute adaptive speed. The central actor learns from the population; the individual must not be left to learn only from personal harm. Collective auditing, personal agents, data unions, and public infrastructure can redistribute feedback. A society in which only the platform sees all interactions is a society in which only the platform evolves at the speed of the ecosystem.

The third principle is to separate representation from execution. The agent that recommends should not automatically have the right to act. Reading, paying, publishing, deleting, and delegating should be authorized separately. This friction appears inefficient, but it limits predation by delegation and cascading error. In systems with irreversible effects, slowing down is a form of safety.

The fourth principle is plurality of refuges. A person needs spaces in which the same system does not observe, optimize, and preserve everything. An institution needs alternative models and the ability to function when the provider fails. A culture needs archives, languages, and methods not filtered through the same infrastructure. Refuge is not rejection of technology; it is a condition of diversity.

The fifth principle is conservation of apprenticeship. Organizations must measure not only present production, but also renewal of competence. Some tasks should be preserved as practice, some decisions reconstructed without the system, and experts rewarded for training

others and contributing to models. Otherwise productivity consumes the human capital that makes it possible.

The sixth principle is the right to human presence. In education, health, justice, and care, AI should free time for relationship, not turn relationship into a luxury. Not every interaction requires a human, but the institution must declare where accountability, empathy, and contestation cannot be delegated.

The seventh principle is public control over high-impact ontologies. The categories through which the state grants rights, identifies risk, and distributes resources cannot remain trade secrets. They must be inspectable, contestable, and modifiable. Otherwise politics is replaced by configuration.

These principles do not eliminate antagonism. Platforms will seek profit, states security, individuals advantage, groups cohesion. An ecology of freedom does not require moral purity. It designs the game so that success depends more on producing surplus and less on blocking exit.

NORMATIVE THESIS

A social relationship is less predatory to the extent that one party's benefit depends on preserving the other party's capacity to understand, refuse, learn, and change partners. Civilization does not eliminate self-interest; it forces self-interest to prosper through the preservation of another's agency.

Predictions that can fail

A book about the future must risk verifiable claims. The first prediction is that AI will reduce performance differences in many standardizable tasks while increasing trajectory differences between those who have access to apprenticeship, data, and infrastructure of their own and those who use standard systems without control. If professional mobility does not decline in domains where entry roles are automated, the short-circuiting-of-apprenticeship hypothesis must be revised.

The second prediction is that agent portability will become economically more important than file portability. We will see disputes and regulation concerning memory, reputation, learned policies, and active delegations. If users can switch providers easily without losing function, institutional gravity will be weaker than this book anticipates.

The third prediction is that class difference will be expressed through control of the artificial representative. Privileged people will have independent, auditable agents capable of negotiating across ecosystems. Vulnerable people will more often use agents supplied by

employers, lenders, platforms, or the state. Data on ownership, financing, and loyalty will be able to confirm or disconfirm this trend.

The fourth prediction is that some trust professions will retain accountability while losing control over their tools. If professionals instead acquire collective ownership of models and greater autonomy, the scenario of cognitive proletarianization will not materialize in the form proposed here.

The fifth prediction is that relationships with AI will have effects dependent on the offline social ecology. Complementary use within a rich human network will have different consequences from substitutive use in isolation. Longitudinal studies will be able to separate causality from selection more effectively. If effects remain uniform regardless of context, the mechanism of attachment arbitrage must be reformulated.

The sixth prediction is that agentic markets will require higher-level institutions. Rules inserted into each agent will not be sufficient to prevent collusion, cascades, and interface exploitation. We will see audits of the environment, rate limits, identities attributed to beneficiaries, and sanctions applied to emergent outcomes. If agents remain practically isolated and easy to control, artificial ecology will emerge more slowly.

The seventh prediction is that verifiable authenticity and human presence will acquire economic premiums. Content with provenance, services with accountability, and unmediated relationships will become scarce goods. If the public continues to value only speed and cost, these goods may remain niches and the cultural ecosystem will adapt differently.

The eighth prediction is that institutions that externalize operational memory without portability will lose the capacity for reconstruction. Incidents, provider changes, and crises will reveal the difference between organizations that use AI and those that have been cognitively absorbed by it.

These predictions can be tested through studies of work, multi-agent experiments, audits of administration, longitudinal research on relationships, and institutional comparisons. Their failure would not invalidate every analogy in the book, but it would limit the ambition of the theory. The hypothesis of an ecology of predation deserves to be retained only where it explains more than the ordinary vocabulary of power, markets, and technology.

Three horizons of change

In the near horizon, through the early 2030s, transformation will appear primarily organizational. Assistants will enter workflows, contracts will begin to address cognitive traces, and differences among firms will arise from how they distribute productivity and preserve competence. The most visible conflicts will concern data, accountability, evaluation,

and the professional's right to refuse a recommendation. Many promises will be exaggerated, while aggregate employment effects may remain slower than changes in everyday experience.

In the medium horizon, roughly 2033–2045, the personal agent and agent-to-agent commerce may become infrastructure. Functional portability, loyalty of the artificial representative, and symmetry of prediction will then separate societies. Work may divide among orchestrators, exception operators, and model owners. Education and health will decide whether automation buys more human relationship or justifies its withdrawal. Public institutions will be forced to make visible the categories through which systems grant rights and distribute risk.

In the distant horizon, after 2045, uncertainty rises radically. Agents may form persistent networks, firms may have very few human participants, and memory may become property transmitted across generations. Conflicts will concern not only the use of models, but the right of systems to reproduce, negotiate, and preserve purposes. An economy may emerge in which a significant share of activity occurs among artificial actors, while humans intervene as beneficiaries, sources of legitimacy, or suppliers of reality.

These horizons are not guaranteed stages. An energy crisis, political reaction, technical limits, or cultural change could slow or redirect the trajectory. Their purpose is to discipline imagination. Prediction becomes more credible when it specifies which mechanism must mature before another: first integration into workflows, then autonomous representation, then persistent ecology. Jumping directly to posthuman societies without analyzing tomorrow's contract is futurism without causality. Refusing the distant horizon because it cannot yet be demonstrated leaves its design entirely to those building the infrastructure.

The river does not know the story

That evening, after the neighborhood meeting, Mara opens Ilinca's material about Yellowstone. The tutor has corrected two errors and suggested a cautious conclusion: wolves contributed to changing the ecosystem, but they did not “command” the rivers. Ilinca added a sentence the system had not proposed: “Maybe the problem with the story is not that it gives too much power to the wolf, but that it makes everyone else invisible.”

The sentence also explains the AI society. The simple narrative will say that artificial intelligence transformed work, destroyed professions, saved education, or captured democracy. In reality, the effects will belong to a network: owners, workers, professionals, states, communities, standards, data, agents, and rights. AI will sometimes be a functional predator, sometimes prey, protector, intermediary, or symbiont. More often, it will be the medium through which people change their positions relative to one another.

The Yellowstone river does not know that it became a character in a story about wolves. Nor will the future know that it was anticipated through biological metaphors. Our models are provisional instruments. They are good when they make us see the hidden cost, the threshold, the reaction, and the invisible third party. They become bad when they replace the world with their own elegance.

The ecology of predation does not claim that existence is war. It claims that every form of organized existence must solve the problem of access to resources, limits, defense, and conflict between levels. Life solved it imperfectly through variation, selection, and cooperation. Society added law, norms, and institutions. AI adds the ability to model and execute these relationships at a new speed.

The goal is not to build an intelligence that is absolutely "non-predatory." A system that protects will sometimes block; one that negotiates will pursue advantage; one that optimizes will produce costs. The goal is to prevent any position from turning a temporary advantage into a permanent right to consume the other. To keep games contestable, roles reversible, and exit possible.

In the valley, predator limits prey, prey shapes predator, vegetation changes the river, and the river changes the place of everyone. There is neither innocence nor a single center. There are relationships that can sustain a world or exhaust it. The society of artificial intelligences will be built from the same alternatives, but for the first time part of the ecology will be able to read the models, anticipate reactions, and rewrite the rules in real time.

This is the promise and the danger. We can use intelligence to design relationships in which cooperation produces more than captivity. We can also use the same intelligence to make extraction so fine-grained that it no longer resembles violence. The future will not be decided by the fact that machines become more intelligent. It will be decided by the older question every ecology asks: who can change the environment in which others must live—and who can still leave it?

The end of the story is not equilibrium. It is preserving the possibility that the story can be rewritten by more than one author.

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