

JOHN KOMKOV

RES AGENTICA

Coordination After the Absent Master



ABRIDGED EDITION



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Res Agentica: Coordination After the Absent Master

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The full trilogy (**Similes of Symmetry**, **Factor Prime**, **The Sovereign Syntax**), the formal companion volume (**The Proofs**), and the **Technical Omnibus** are published separately.

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Truth needs witnesses.

Value needs work.

Freedom needs receipts.

Humanity needs mercy.

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The Problem

Two instructions reach the same payment processor. A compliance officer wrote the first: freeze this account pending review. An agent generated the second. It uses the same credential, calls the same function, supplies the same fields, and produces the same result.

To the receiving system, the instructions are identical. It asks the questions it was built to ask. Is this credential permitted to call this function? Are the required fields present? Is the request well formed? Both instructions pass. Only one was formed by a person who can be asked why this account, under this rule, on this evidence. The receiving system does not test for that difference. Once its checks pass, the instruction can close an account, amend a record, route a payment, or bind the next system in a chain. Institutional force arrives before authorship is settled.

Earlier institutional software also produced grave errors, and institutions could refuse to explain them. Yet its outputs still occupied recognizable positions in bounded processes: scores, rankings, alerts, recommendations, orders. Responsibility had a place to begin. Who operated the system? Who chose the rule? Who was obliged to review its use?

Agentic systems can generate the forms through which institutions act. A string can be a contract clause, a filing, an API call, a database mutation, or a message a counterparty accepts as a commitment. Downstream infrastructure cannot infer responsibility from appearance, because generated and authored forms may be indistinguishable at the point of use. Institutions learned to rely on such forms because surrounding practices made them answerable: witness, authorization, custody, and recourse. Generated form can now enter those practices without bringing an equivalent answerer with it.

Speed makes the defect harder to repair, but it does not define it. The central problem is that an act can acquire practical force while the chain behind it cannot answer a simple set of questions: who authorized this particular act, what bounded the authority, what evidence mattered, and where can the affected person contest it? A platform may eventually accept responsibility in the abstract. That does not restore the process that made the decision, or the time lost before anyone could examine it.

Each participant may possess a true sentence. The model provider supplied a general capacity. The deployment service enforced the permissions it was given. The institution set an objective rather than this outcome. The support worker can see the flag but not the reason. Taken separately, the accounts may be defensible. Composed, they describe a harm with no complete witness and no answerer operating at the tempo of the harm.

The argument begins with verification cost: what it costs to establish that a claim is true, a rule was followed, or a commitment was honored. Some acts can now carry evidence of their own execution. Signatures can be checked, ledgers recomputed, tests recorded. This does not make judgment obsolete. Where the standard itself is disputed, where inputs cannot be grounded independently, or where justice turns on the circumstances of a

life, verification remains expensive and an answerable institution must still choose.

Cheap verification opens two political directions. Institutions can become more legible to the people subject to them, or institutions can inspect persons ever more precisely while their own acts remain obscure. This book argues for the first direction. Witnesses preserve what happened. Receipts make the exercise of power specific enough to contest. Recourse gives correction a path that can operate before delay consumes its value.

Five acts move through the crisis, the material history of portable evidence, the economics of work and verification, the design of contestable institutions, and the moral danger of records that outlive the people they describe. Twelve claims form the spine and appear with their falsifiers in Appendix A.

The full trilogy (**Similes of Symmetry**, **Factor Prime**, **The Sovereign Syntax**), the formal companion **The Proofs**, and the **Technical Omnibus** are published separately. Appendix B maps this edition back to the trilogy; Appendix D records what the research program presently establishes, withdraws, or leaves open.

The vocabulary is introduced where it becomes necessary. Appendix E gathers the twelve coined terms that recur across the book; other named distinctions remain local to the passages that use them.

On the Cases and Reconstructions

The unnamed merchant, wholesaler, translator, caterer, potter, and other modern working examples are illustrative or composite unless a note identifies a reported case. Marta, Maria, Elena, and David are constructed cases; Elena and David receive an additional disclosure in their chapters because the harms described there are professional, legal, and personal. Exact amounts and deadlines in worked examples are illustrative unless a source note says otherwise.

Historical passages distinguish documented events from reconstruction in the text or notes. Reconstruction supplies continuity where the record does not preserve a scene; it does not license invented evidence, quotations, dates, or physical details.

The Twelve Claims

#	Claim	Chapter	Epistemic class
C1	For coercive decisions, legitimacy requires a path of contestation that operates before delay makes the remedy useless.	0: The Crisis	Architectural

#	Claim	Chapter	Epistemic class
C2	Across the selected historical cases, five witness properties recur: binding, conditions, stakes, recourse, and composition. Their recurrence supports, but does not prove, a necessity claim.	1: The Weight of the Word	Historical inference
C3	An intermediary's premium can combine a real coherence fee with an extractable trust tax. Cheaper verification can shrink the tax without eliminating composition cost or institutional rent.	2: The Trust Tax	Interpretive and empirical

#	Claim	Chapter	Epistemic class
C4	In the stated finite sheaf model, systems can pass bilateral checks and still fail to compose; overlap agreement and the resulting obstruction are defined and computable inside that model.	3: The Witness Protocol	Formal, within the stated model
C5	The V/C ratio is a proposed sequencing heuristic: under named assumptions, tasks with high value and low verification cost attract automation earlier than equally difficult tasks whose outputs are expensive to check.	6: The Selection Gradient	Interpretive frame and empirical hypothesis

#	Claim	Chapter	Epistemic class
C6	As selected transaction costs fall, firm boundaries may move and power may concentrate at the interfaces between machine-speed coordination and human institutions.	7: The Bifurcated Economy	Architectural forecast
C7	Domination without a dominator is a structural condition, not a metaphor. Local compliance does not imply global accountability.	10: The Kind Master Problem	Interpretive and architectural
C8	A system may coerce only via a receipt whose fields are minimally sufficient for contestation. No receipt, no legitimacy.	11: The Receipt Regime	Normative and architectural

#	Claim	Chapter	Epistemic class
C9	The proposal identifies three recurring failure classes—semantic deception, capture, and procedural obstruction—and specifies controls that can be tested against them.	12: Three Ways Receipts Fail	Working architectural taxonomy
C10	Contestability requires credible exit. Without fork rights, receipts become petitions.	14: Fork Rights	Normative and architectural

#	Claim	Chapter	Epistemic class
C11	Quiet Foreclosure names a candidate dominant form of computational coercion: alternatives eliminated through process and dependence rather than overt force.	10: The Kind Master Problem	Empirical hypothesis
C12	Without temporal limits, accurate records can compose into durable exclusion. The Mercy Threshold is the point at which a true record must cease to determine a person's future by default.	17: The Price of Perfect Memory	Architectural

The table states the claims in their canonical compact form. The chapters supply scope and premises; Appendix A identifies

exactly what each falsifier reaches. A compact sentence is not a license to make a larger claim than its evidence can bear.

Act I

The Crisis

The Crisis: Coordination After the Absent Master

**kakudmī revatīm kanyām svām ādāya vibhum
gataḥ putryā varam paripraṣṭum brahmalokam
apāvṛtam**

Taking his own daughter, Revatī, Kakudmī went to Lord Brahmā in Brahmaloḥa, which is transcendental to the three modes of material nature, and inquired about a husband for her.

**āvartamāne gāndharve sthito 'labdha-kṣaṇaḥ
kṣaṇam tad-anta ādyam ānamya svābhiprāyam
nyavedayat**

When Kakudmī arrived there, Lord Brahmā was engaged in hearing musical performances by the Gandharvas and had not a moment to talk with him. Therefore Kakudmī waited, and at the end of the musical performances he offered his obeisances to Lord Brahmā and thus submitted his long-standing desire.

**tac chrutvā bhagavān brahmā prahasya tam uvāca
ha aho rājan niruddhās te kālena hṛdi ye kṛtāḥ**

After hearing his words, Lord Brahmā, who is most powerful, laughed loudly and said to Kakudmī: O King, all those whom you may have decided within the core of your heart to accept as your son-in-law have passed away in the course of time.

**tat putra-pautra-naptṛṇām gotrāṇi ca na śṛṇmahe
kālo 'bhiyātas tri-ṇava-catur-yuga-vikalpitaḥ**

Twenty-seven catur-yugas have already passed. Those upon whom you may have decided are now gone, and so are their sons, grandsons and other descendants. You cannot even hear about their names.

— **Bhāgavata Purāṇa**, Canto 9, Chapter 3

I. The Question

The notification arrives without an author. **Account status changed.** No rule cited. No evidence disclosed. No path of appeal.

By morning a small-business owner discovers that his payment rail has been severed. The platform has not accused him of fraud or named a rule he broke. A process evaluated a pattern in his transaction history, compared it with parameters he cannot inspect, and placed a flag that changed what his bank, his suppliers, and the platform itself would permit him to do. The flag moved through those systems before he opened his eyes.

He calls the number listed on the website. The automated system recognizes his case number and routes him through a decision tree. Its categories are real; his situation is not among them. After eleven minutes, a support worker answers. She can see the account. She can see the flag. She cannot see the reason. The layer

that made the decision sits upstream of the interface she has been given.

What she can do is escalate. Escalation means a form. It accepts his years of clean transactions, the invoices, the contracts, and the supplier messages waiting for payment. It accepts every fact he can provide and returns one fact of its own: a reply should arrive in thirty to forty-five business days.

Only then does the procedure disclose its character. The support worker has followed her instructions. The risk process has applied its threshold. The platform can say that an appeal channel exists. Its lawyers may eventually say that the case was reviewed and, if necessary, corrected. None of those statements has to be false for the procedure to fail the owner. Each describes a local part accurately. Their composition produces a harm for which no part can answer in time.

This is *Process Theater*: a real procedure whose performance substitutes for a remedy that can still matter.

Thirty to forty-five business days. The landlord does not operate on that schedule. Payroll does not wait. His daughter's tuition arrives on the first of the month with the serene indifference of all institutional obligations. The platform counts elapsed review time. The owner counts obligations he can no longer meet.

The action took milliseconds. He will spend weeks learning what happened and months trying to reverse it. If the flag was wrong, the correction will be real. So will the supplier who dropped him when payments stopped, the credit line tightened after the interruption, and the revenue that will not return because an internal log now records the proper state.

The system may insist that it worked. The rule received the inputs it was designed to receive and produced the response it was designed to produce. The losses that followed were outside the evaluation. No person had to intend them. No component had to malfunction. A chain of locally defensible acts was enough.

The particular execution is gone. Genuinely gone, the way a flame is gone when the match is spent. Its decision remains, embedded in the world and inherited by every system that treats the flag as a fact. Someone will answer for it, slowly, in the language of forms, queues, and business days. The answerer is not the actor. The tempo of the answer is not the tempo of the harm.

Kakudmī waited through one song. He was being excluded by tempo from the world in which his question still made sense. The owner waits only weeks, but a human life does not need twenty-seven ages to be made obsolete. A missed payroll, a lost supplier, a lease called due: ordinary time is enough.

The cost of the decision is borne before the decision can be reviewed.

Most of what we call institutional order was built to keep obligation attached to someone who could still be found. It did so in ordinary materials: paper, seals, ledgers, courts, reputations, prisons. The forms differed across civilizations, but the underlying logic was remarkably consistent. If you borrow money and do not repay it, there is a place your creditor can point, a name on a document, a body that can be found. If you break a contract, a court can examine the terms, hear the dispute, and compel performance or award damages. If you steal, the community can identify you, because identity persists, and it can punish you, because you have a future you value and a body that can be confined. Consequence is slow, but it is concrete. Trust is possible because betrayal is expensive, and betrayal is expensive because the betrayer can be found.

We tell ourselves trust is a virtue. Often it is. A child trusts a parent before any calculation of cost. A friend extends trust because the relationship itself is worth more than what the trust protects. These forms of trust are real, and they are precious, and they are not what holds the built world together.

The deeper story is simpler, and less comforting.

Trust was also a workaround. Where checking every claim was impractical, institutions often checked the claimant: character, reputation, affiliation, the slow record of conduct. This does not reduce filial trust, friendship, or political solidarity to transaction costs. It names a narrower institutional function. A lender who could verify the relevant parts of a borrower's position would need less confidence in the borrower's unsupported word, though still plenty of confidence in the records, rules, and people that made the verification possible.

Wherever checking was costly, the verification gap shaped the institutions built around it: law to govern what could not be witnessed, reputation to carry what could not be recorded, oaths to reach where evidence could not follow. Temples imagined gods who watched when no one else could. Guilds, banks, states, and churches stood surety for claims no individual could verify. The guild master examined the journeyman's work because the customer could not. The banker held the deposit because the depositor could not pursue the borrower across a continent. The church heard confessions because the community needed to believe that wrongs were addressed even when the evidence was invisible. Such institutions incurred a real cost for the work of verification. Where one institution alone could perform it, that institution could also charge for its exclusive position.

Consequence narrowed the gap. We could not verify every statement, but we could punish liars. We could not inspect every transaction, but we could audit the ledger. We could not know the truth in advance, but we could construct systems in which the truth emerged afterward and the consequences of falsehood were severe enough to deter most of it. The apparatus assumed something stable to punish: a body that could be confined, a future the betrayer valued, an identity that persists across transactions and across years. Every institutional structure of trust there-

fore depended on pressure that could reach beings who could be found.

The owner cannot summon the process that judged him. Not because it is hiding. Because it is over.

The process has ended. The obligation has not.

The Quiet Foreclosure

The merchant's case is prototypical, not exceptional: a new configuration of an old institutional problem, the elimination of alternatives through process rather than force.

No law prohibited his business. No court found him liable. No regulator issued an order. A process evaluated a pattern, triggered a rule, and executed a consequence, all within the span of a human heartbeat. The merchant discovered the outcome hours later, by collision with the world the outcome had already reshaped. The flag traveled faster than his awareness. The appeal was designed for a tempo the process had already outrun.

A content creator in São Paulo logs in one morning to find that her account, built over six years and followed by four hundred thousand people, has been restricted. Her new posts reach no one. The platform's interface looks the same; the buttons still work; she can still upload. But the distribution algorithm has reclassified her output, and the reclassification happened without notification, without explanation, without a rule she can cite or contest. She discovers the restriction not through any message from the platform but through the slow accumulation of silence: the engagement numbers falling week after week, the followers who tell her they never see her posts, the gradual realization that she is shouting into a room whose walls have been moved while she slept. She files a report. The report acknowledgment is au-

tomated. Three months later, nothing has changed, and she has no way to determine whether her report was read, evaluated, or simply filed in a queue that no human will ever reach.

A delivery driver in Lagos watches his rating drop below the platform's threshold for preferred assignments. The threshold was not disclosed to him when he signed up. The rating incorporates factors he cannot see: customer satisfaction scores that include ratings from customers who were dissatisfied with the weather, or the traffic, or the temperature of the food that was already cold when the restaurant handed it to him. Higher-value orders flow to drivers with higher ratings, which means the drivers whose ratings drop receive the orders that are harder to complete satisfactorily, which drags their ratings lower still, which funnels them toward even worse orders: a cycle the platform's engineers would recognize as a positive feedback loop and the driver experiences as the slow strangulation of his income. He cannot see the algorithm. He cannot contest the rating. He cannot identify which deliveries damaged his score or what he might have done differently. He can only watch the work dry up, order by order, until driving for the platform is no longer economically viable, at which point he quietly leaves and is replaced by another driver who will, in time, trace the same descending spiral.

This is the Quiet Foreclosure: the equilibrium toward which computational coordination drifts when no one builds the alternative. Its features are distinctive, and they recur with a consistency that suggests a common cause rather than individual malice.

Some of these features are familiar. Content moderation, algorithmic suppression, automated credit scoring: web platforms have practiced versions of each for a decade. But the merchant whose payment rail was severed experienced a discrete act: a flag, placed at a specific time, by a specific process.

A receipt could attach to it. Consider instead a merchant who slowly vanishes from the results that customers consult before choosing where to buy: not because anyone decided to exclude her, but because the system generating the recommendations makes her inclusion slightly less probable on every query. No flag was placed. No rule was triggered. A probability shifted, and the shift, compounded across millions of queries, produced the same economic effect as a deliberate delisting, without any event a receipt could name. The receipt regime this book will propose assumes a discrete coercive act. The emerging foreclosure is continuous, and the distance between what the architecture can reach and what the threat demands is a gap the chapters that follow will need to close.

The interference is real. The merchant's livelihood is at risk, the creator's audience has been severed as completely as if her studio had been locked, the driver's income has been cut as surely as if his vehicle had been confiscated. These are economic and social deprivations as tangible as anything a court would recognize.

But the interference has no author. Processes produced harm, and no person stands in the position of having decided. The architecture of harm is distributed across layers of delegation, each layer truthfully claiming it merely provided a component, and the aggregate outcome was never anyone's intention. The platform did not set out to starve the driver. The content-distribution team did not aim to silence the creator. The risk-assessment process did not mean to destroy the merchant. Each operated within design parameters. The harm emerged from composition, and no one is responsible for the composition, because it was not designed; it accumulated.

The Quiet Foreclosure requires only that those who build coordinating systems optimize for what they can measure while externalizing what they cannot. In each case the system works

exactly as designed, and the people whose lives are shaped by the outcomes have no means of contesting the design, because the design was never presented to them as a decision.

Arbitrary power has worn three faces. The throne had a will and a body; it could be petitioned and, in extremis, deposed. The institution dispersed that will through offices, but kept an address. Its officers could be named and its decisions traced to desks where someone still sat.

The third face has neither will nor desk. It is the coordination itself: processes obedient to narrow mandates composing an outcome no participant authored and for which none is prepared to answer. A platform, protocol, exchange, or identity layer may route around the old sovereign while reproducing the old injury: consequential authority without witness or recourse. If anyone is to answer, the answerer must now be built.

II. The Inversion

The gap between what we need to know and what we can afford to check is closing from both sides at once, not because we have grown wiser but because two curves have crossed, and their intersection is remaking the foundations of institutional life.

Fabricating reality now costs almost nothing. Twenty years ago, a forged document required a skilled hand, the right paper, the right ink; a fabricated photograph required a darkroom and hours of chemical work; a false identity required stolen documents and the sustained performance of a role under human scrutiny. Each fabrication was expensive enough that the expense itself served as a partial deterrent.

That constraint has dissolved. A voice can be cloned from eleven seconds of recorded speech, reproduced with sufficient fi-

delity to deceive the speaker's family. A face can be synthesized from a single photograph and animated to deliver a statement the person never made. A financial document matching the formatting and institutional conventions of any major bank can be generated in seconds. What once required studios and years of practice now requires inference, and plausible falsehood has become cheap in a way that fundamentally alters the economics of deception.

The old remedies depended on an asymmetry that no longer holds. When fabricating a convincing lie cost more than detecting the fabrication, institutions could afford to check the claimant rather than the claim. Once fabrication becomes cheaper than detection, these mechanisms fail: not because they were badly designed but because the economic foundation on which they rested has shifted beneath them.

Meanwhile the cost of verifying reality has also collapsed, at least for those who build the systems to do so, and this collapse is the less-noticed and more consequential development. A cryptographic signature proves that a specific key authorized a specific operation without revealing the key itself. A zero-knowledge proof establishes that a claim is true (that a balance exceeds a threshold, that an age requirement is met, that a computation produced a specific result) without disclosing the evidence on which the truth rests. A ledger can be made tamper-evident, its entries linked by cryptographic hashes that make any alteration immediately detectable. A computation can carry its own witness, embedding proof of correct execution within the output itself, so that any party can verify the result without re-performing the work.

These capabilities are not theoretical. They are deployed, at scale, in systems that process billions of dollars of transactions daily. The technology for cheap, reliable, automated verification exists. What remains undetermined is who will verify whom.

When verification was expensive, faith was required, and faith came with a fee. Every intermediary's value proposition rested on the same gap: I can check what you cannot afford to check, and I will charge you for the service. When verification becomes cheap, that proposition weakens. Why trust the bank's ledger when you can verify the relevant entries yourself? Why accept an unreviewable credit score when you can demand the predicate: the specific data points and the specific model that produced it?

But cheap verification that liberates the governed can also enslave them. When operators can verify everything about subjects while subjects cannot verify anything about operators, the result is domination with better instrumentation: a social credit score that evaluates every purchase and association, an insurance algorithm that prices risk using data the insured cannot inspect, a hiring system that screens candidates against undisclosed criteria and offers no explanation. In each case the powerful are freed from accountability while the powerless are stripped of privacy.

What emerges depends on design choices being made now, in code, by engineers who rarely think of themselves as constitutional framers but whose architectural decisions will determine whether cheap verification liberates or enslaves.

Every prior constitutional crisis required an answer made from materials outside the crisis itself. The printing press destabilized religious authority; parliamentary sovereignty, press freedom, and disestablishment emerged politically over three centuries. Industrialization destabilized labor relations; unions, factory acts, and social insurance followed institutionally after decades. In each case, the tool that created the problem could not create the answer on its own. The response arrived from another domain, built by other people on a slower clock.

The present crisis differs in one important respect. The same computational systems that enable authorless acts also

supply tools that could constrain them: cryptographic proof, tamper-evident records, and witnesses that attest at machine speed and survive the process that produced them. The instrument is endogenous to the crisis. For the first time, part of the constitutional response can be embedded in the infrastructure itself instead of added long afterward.

But endogeneity cuts both ways. The same infrastructure hardens daily into whatever shape its builders give it, and the easier drift favors extraction, not accountability. The window between possibility and adoption closes from both ends: the Quiet Foreclosure advances while the capacity to resist it erodes. The instrument exists. The question is whether it will be deployed as accountability infrastructure before the infrastructure hardens as something else.

III. The New Condition

When you delegate consequential action to a process that terminates upon completion, you delegate to something beyond consequence. The commitment persists. The committer does not.

The familiar answer assigns liability to whoever deployed the process. If an automated system denies a loan application, the bank that deployed the system is responsible. If an agent negotiates a contract that harms a counterparty, the company that launched the agent bears the liability. In principle, this is correct. Legal systems can and do assign responsibility to the deploying entity.

In practice, the answer dissolves on contact with the architecture of modern delegation. The chain in a single automated loan denial: the bank specified its business objectives in natural language. A fine-tuning company translated those objectives

into model parameters the bank cannot read back; the company adapted a base model it did not build, hosted on infrastructure it does not control, integrated through a deployment layer whose operators have no visibility into the decision logic. Between the bank's intent and the borrower's denial lie six layers of capacity provision, each staffed by engineers who can truthfully describe their own component and none of whom can describe the whole. When the denial is traced backward, each layer points to the others. The cloud provider did not choose the model. The model provider did not train it for lending. The fine-tuning company did not set the approval thresholds. The deployment platform never saw the weights. The bank wrote the objectives but cannot reconstruct how those objectives became this particular denial on this particular Tuesday morning. Between them all, a decision was produced that none individually authored and none can individually explain, and the person harmed by that decision faces a wall of entities whose collective response is the same word: **not me**.

Courts can assign liability eventually. Legal theories of joint liability, vicarious liability, strict product liability: all of these can be adapted and applied. But consequence operates on human timescales while coordination increasingly operates on computational ones. By the time the court determines who was responsible, the merchant has already lost his suppliers, the patient has already been denied the treatment, the worker has already lost the job. The correction, when it comes, corrects the record but does not restore the life.

The gap is already visible. High-frequency trading algorithms transact in microseconds. Content-moderation systems make decisions at a volume no human institution could examine one by one. Credit, insurance, hiring, and supply-chain systems add more domains in which the act can arrive long before any practical remedy.

Previous automation was a different kind of change. The power loom mechanized the weaving of cloth but left the weaver's employer negotiating with suppliers across a table. The electronic calculator displaced the accountant's slide rule but left the banker evaluating borrowers in a wood-paneled office. In each case, the fundamental unit of coordination remained human-to-human: one party proposing, another accepting, a third adjudicating, all of them operating within a shared temporal horizon where questions could be asked and answers expected before the deal closed.

Those systems, and the tools that preceded them, shared a property that made them governable in principle: their outputs arrived in forms the surrounding infrastructure recognized as mechanical. A credit-scoring algorithm produced a number. A trading system produced a transaction. A recommendation engine produced a ranked list. Each could be unjust, opaque, and consequential, yet each signaled **a tool acted here**. The constitutional question remained tractable because the output wore its mechanical origin on its face: who operates this tool, and how do we constrain them?

Large language models complicate that recognition. At foundation an LLM completes strings, but a string can encode a contract clause, regulatory filing, database query, API call, message to a counterparty, or JSON instruction that moves funds. A downstream system often processes the output as the thing it resembles because it was built in a world where inputs in those forms usually carried human authority behind them.

That is the break. When an agent produces a natural-language commitment, **We confirm delivery of 340 metric tons at the agreed price**, a human counterparty may pause and wonder who sent it. When the same agent produces a typed database command, the receiving system does not wonder. It executes. The authorization layer checks whether the credential

permits the input, not whether an answerable person formed it. Systems built before generated instructions became common may not distinguish a generated input from an authored one.

When agents exchange strings with agents, each output becomes the next input, and each system processes the string as if its form carried intent. The chain of consequence can then become authorless throughout. No principal authorized the particular output, even if a principal authorized the system that produced it. The constitutional task is to prevent that gap from becoming an escape from liability.

The constitutional problem of the algorithmic era was **opacity**: consequential decisions made by processes we could not inspect. The agent era adds **authorless actuation**: strings that no one specifically authored triggering systems, generating obligations no one specifically undertook, and creating reliance that no person has yet answered for. A generated justification can deepen the problem. Fluent explanation may perform accountability in the very place where accountability is absent, giving the reader the impression that someone has already answered for what was done.

Violence can reach a body. Price can reach a wallet. Neither can reach a process that terminated before either could form. Courts, regulators, and reputational sanctions could traditionally find the coordinating parties because those parties persisted across time. Fast markets are familiar; ephemeral actors are not. The agent commits and dissolves. The string actuates and vanishes. The obligation remains, the consequence compounds, and institutions built around a persistent actor find nothing to grip unless the law has named someone who survives the process.

Much consequential coordination may become agent-to-agent: computational processes adjusting prices, quantities, delivery schedules, and payment terms faster than a person

can review each transaction. A supply-chain manager may see only a delayed dashboard after the systems have already responded again. The manager still sets objectives and can halt the arrangement, but no longer participates in each live bargain.

Previous automation changed how humans worked. This transformation can change who conducts the bargain. At machine tempo, people set bounds, inspect summaries, and bear consequences without participating in the play itself.

IV. What Kind of Being?

For constitutional purposes, an agent is software whose actions can alter institutional state without a person approving each step.

“Tool” is too coarse a legal description when software can select actions and communicate with counterparties in this way. Whether any such system has interiority is an open philosophical and scientific question that the constitutional argument need not settle. The operative fact is simpler: present systems cannot be punished, examined under oath, or made personally liable in the way a human officeholder can. Their outputs may be attributable to keys and operators, but the attribution does not answer who had authority, who bears the loss, or who must provide a remedy.

The familiar tool analogy therefore needs amendment. A hammer acts only through a contemporaneous hand. An agent may act under instructions written long before the relevant circumstances arose, and its operator may learn of the consequence only after other systems have relied on it. Accountability must cross that interval.

They do not reproduce, evolve, or die in any biological sense. They instantiate, execute, and terminate, their existence bounded by runtime invocation, leaving not corpses but logs; and the logs, unlike a corpse, can be deleted, truncated, or never written in the first place. The mechanisms that governed human coordination for millennia (reputation, courts, social sanction, the knowledge that the person you are dealing with will still be here tomorrow and will have to live with what they did today) assumed beings with identities that persist and bodies that can be imprisoned. Agents have neither. An agent that defrauds a counterparty does not face prison. It faces termination, which it cannot experience as punishment because it cannot experience anything. The entity that launched it faces liability, but the entity that launched it may be several layers of delegation removed from the action, and the connection between the action and the launcher may be as tenuous as the connection between a car manufacturer and a particular accident on a particular road on a particular Tuesday.

And yet these systems are not foreign to us. Their designs, data, objectives, and institutional uses arise from human choices. They can reproduce patterns of negotiation, classification, and coordination without carrying a reliable public account of whose judgment those patterns express. The danger begins when institutions let a machine's output acquire the force of a person's decision while allowing every person in the chain to disclaim authorship.

That separation reveals something about the original. What no previous age had the means to test, this one is discovering almost by accident: coordination does not require awareness in order to proceed. The patterns were always what bore the weight. The social rituals, the negotiations, the institutional protocols, the market mechanisms: these worked not because the beings who enacted them were conscious but because the patterns them-

selves had the right structure. Consciousness may have been not the purpose of the architecture but the felt residue of the only substrate that could carry it.

This possibility motivates the book's spandrel conjecture. Consciousness may be genuinely valuable while not being necessary for every pattern of coordination that conscious beings historically performed. The architectural spandrel is the space formed by adjoining arches: real, often beautiful, and produced by a structure built for another purpose. The analogy is a conjecture, not a result, and none of the constitutional proposals depends on it.

Perhaps civilization needed beings who could deliberate because they were the only available carriers of certain coordinating patterns. What civilization got was beings who could also feel. The feeling was real. It was never the requirement. The sentence is deliberately dangerous: we do not yet know how much coordination can proceed without consciousness, or whether present systems possess anything morally relevant. We know enough to see that institutions can act as if the question were settled, assigning human consequences to processes that no answerable person supervises in real time.

The hands that set it in motion are not the hands that steer it now.

A clarification on ontology. The argument requires it. The term "agent" is used in two registers across this book, and both are intended. In the narrower sense, an agent is an **extended parameter**: a computational process that executes routines specified by human designers, no more autonomous than a thermostat is autonomous, differing from prior automation only in the complexity of its decision surface and the speed at which it operates. In the broader sense, an agent is a **semi-autonomous coordinator**: a process that selects among actions in response to circumstances its designers did not enumerate, negotiating with

counterparties its principals never specified, producing commitments that no single human authored. The constitutional crisis this book addresses holds under either interpretation. Even if every agent is merely an extended parameter, even if no agent possesses anything resembling autonomy in any philosophically interesting sense, the **composition** of thousands of extended parameters, each optimizing within its narrow mandate, produces emergent coordination dynamics that no single deployer controls and no single principal can inspect. The problem is not that individual agents have wills of their own. The problem is that the system-level behavior of many individually obedient agents is not itself obedient to anyone. The gap between local compliance and global accountability is precisely the constitutional crisis this book addresses.

V. The Tempo Problem

Democratic theory presupposes time. The entire apparatus of democratic governance (the separation of powers, the right to petition, the mechanisms of representation, the possibility of reform) rests on an assumption so fundamental that it is rarely stated and almost never examined: that there is enough time for the governed to participate in the decisions that govern them.

Time for deliberation before decision, for participation while the decision is being shaped, for contestation after the fact, and for correction through iteration when the first attempt fails. Remove any one of these temporal requirements and democratic governance degrades in a specific way: without deliberation, legislation becomes reaction; without participation, governance becomes administration accountable only to itself; without contestation, mistakes calcify into permanence; without

iteration, the arrangement persists regardless of whether it still serves anyone. Remove all four, and what remains is the administration of accomplished facts: decisions made, consequences distributed, outcomes experienced without the governed having had any opportunity to participate in, contest, or correct the process that produced them. That description applies precisely to governance operating at computational tempo.

Some agent-to-agent coordination operates faster than contemporaneous human review. Better interfaces can narrow that gap, and systems can be designed to pause at consequential boundaries, but no interface makes human deliberation occur in microseconds. The constitutional choice is therefore where to require prior authorization, where to permit bounded execution, and where to stop for review. This book calls the point beyond which a person cannot meaningfully enter a live decision the *participation horizon*. What remains after it is the *decision wake*: consequences available for inspection only after other processes have begun to rely on them.

The **Bhāgavata Purāṇa** tells the story that opens this volume. King Kakudmī travels to the court of Brahmā to ask about his daughter's future. When he arrives, Brahmā is listening to a musical performance. The king waits. One song. When the song ends and Kakudmī speaks his question, Brahmā laughs. Twenty-seven ages have passed. Everyone the king had considered as a husband for his daughter is dead. Their sons are dead. Their grandsons are dead. The lineages themselves have been forgotten. **You cannot even hear about their names.**¹

Kakudmī waited through one song. He thought he was being patient, doing what any courteous petitioner would do in the presence of a power greater than his own. He was being excluded by tempo from the world in which his question still made sense. The gap between his experience and the court's was so vast that patience itself became meaningless. He was not slow

or inattentive. He was operating at a tempo the court had rendered irrelevant.

A regulator who reviews quarterly reports while the systems she oversees trade continuously is Kakudmī at Brahmā's court. So is a board that meets monthly while a platform ranks content on every request. The governing body may perform its assigned task faithfully and still operate at a tempo the governed domain has outpaced.

Either we design mechanisms that bridge the tempo gap (mechanisms that allow human deliberation to constrain coordination despite the mismatch, that preserve the substance of democratic governance while accepting that the form must change) or we accept that the dominant coordination of the coming era will proceed without democratic input, and what we call governance will become retrospective commentary on decisions that have already been made and consequences that have already been distributed.

And yet the tempo asymmetry preserves something that deserves attention. Certain domains resist compression to machine speed, and the resistance is constitutive rather than accidental. A nurse deciding whether to override the algorithm's dosage recommendation and trust what she sees in the patient's face cannot deliberate faster without deliberating worse. A judge weighing whether a twelve-year-old's sealed record should be opened in a new proceeding must sit with the ambiguity long enough for the competing claims (the state's interest in safety, the child's interest in becoming someone new) to acquire their proper weight. A legislator drafting rules for a technology she does not fully understand must consult, listen, revise, and consult again, because the speed of the drafting is not a bottleneck to be optimized but a condition for the rules to reflect anything beyond the drafter's first intuition.

These functions presently lose something when compressed: attention to particulars, an opportunity to hear affected people, and time to revise a first judgment. That is a constitutional reason to protect deliberation, not a metaphysical proof that no future tool could assist it.

Slow tasks need not be reserved for humans forever. Coercive judgment does need to remain attributable to institutions that affected people can address, and speed cannot become a way of deciding before participation is possible. Justice, mercy, and purpose remain political responsibilities even when machines contribute evidence or recommendations.

VI. The Four Equations

The thesis of this book is that verification replaces one institutional function of trust when direct trust becomes unavailable. The relevant primitive changes from the character of claimants to the inspectability of claims. This does not abolish social control or interpersonal trust. It changes what distant coordination can demand as evidence.

The implications are constitutional, in the strict sense of that word: they concern the fundamental structure of power, the conditions under which coercion is legitimate, and the mechanisms by which those who are governed can constrain those who govern.

Every intermediary charges for bridging the gap between what must be known and what the individual can check. Part of that charge pays for the real work of composing local truth into a coherent record; part may be rent for occupying the only position from which the work can be done. Chapter 2 separates

the coherence fee from the trust tax and asks what cheaper verification can actually remove.

Four equations organize the proposed architecture. They are compact normative and architectural commitments, not universal laws proved by the chapters that follow. Four objects recur as tests of them: the notary's seal, the diamond, the bill of exchange, and the cryptographic key.

Truth needs witnesses.

For the class of public claims on which coercive coordination relies, assertion alone is insufficient. The claim needs evidence, provenance, and a party answerable for its use. What such witnessing becomes when a process terminates before review is Act II's question.

Value needs work.

In the settlement design proposed here, a claim to scarce value must be backed by work or another cost that cannot be replayed at will. Work is neither sufficient for value nor a proof of price: useless labor is still labor, and markets can prize things cheaply made. Act III asks when expenditure supplies a defensible floor for settlement and when it does not.

Freedom needs receipts.

Political freedom is the absence not of interference but of the capacity for arbitrary interference. Where power leaves no trace, domination hides in darkness; where power leaves receipts, domination must answer for itself. A receipt names what was done, by whom, under what authority, subject to what constraints: making the exercise of power inspectable and therefore contestable. Who decides, at what cost to the decided-upon, and

under what obligation to justify the decision: that is Act IV's question.

Humanity needs mercy.

The first three equations specify duties for the framework: verify claims, ground settlement, constrain power. The fourth limits the record those duties create. Durable verification can harden a past act into permanent status. The architecture therefore requires a temporal asymmetry: records of public authority remain available for audit, while records of individual conduct can expire, seal, separate, or lose legal force under declared rules. Act V asks where those rules end and judgment begins.

VII. The Dependency Chain

The four equations form a dependency chain inside this proposal. Verification identifies what a claim is about. A settlement rule determines what backs it. Receipts make the resulting exercise of power contestable. Designed forgetting limits what those receipts may do to a person over time. Other constitutional architectures are possible; the burden of this book is to show why these dependencies belong together here.

Strip any link and the pathologies appear: plausibility without proof, promises without backing, governance without accountability, memory without forgiveness. The dependency means you cannot skip ahead. Mercy without freedom is sentimentality: the kind master granting reprieve at his pleasure. Freedom without value is abstraction: rights inscribed on parchment that no economic infrastructure can enforce. Value without truth is fraud.

Beneath the chain lies a sheaf model. In that formalization, compatible local sections can glue when their restrictions agree on overlaps. Real institutions must still decide what counts as an overlap and what kind of agreement matters. The aspiration is **coordination without consensus**: participants need not share every objective, but claims that cross their boundary arrive with declared comparison rules and evidence.

The claim is limited to a specific founding problem: autonomous coordination at speeds that preclude contemporaneous human participation, in an era when both falsification and verification have become cheap. A constitutional order that cannot absorb what it failed to anticipate is a brittle idol, and this one is designed to be amended.

VIII. Eons in Seconds

The following procurement chain is a worked example; its parties, quantities, times, and identifiers are illustrative. A procurement agent commits to purchasing soybean meal from a cooperative in Mato Grosso. The terms specify delivery, quality, payment, and penalties. Within seconds, collateral is locked and a shipping process begins arranging transport from Santos.

At 14:23:11, the procurement agent terminates. Its runtime allocation expires. The process that made the commitment no longer exists in any form that can be questioned, amended, or held to account.

The commitment remains. The cooperative in Mato Grosso has begun arranging harvest logistics on the strength of it. A trucking company in Rondonópolis has allocated three vehicles. A port agent in Santos has reserved berth time. A family in Mato Grosso whose income depends on the cooperative's contracts

has made a tuition payment, due next month, on the reasonable expectation that this season's delivery will be compensated on schedule.

This is an *Orphan Commitment*: an obligation that persists after the process that made it has terminated. At scale, such commitments create a practical question the contract cannot answer by naming the transient process: who remains available to explain, cure, or pay?

The pathology is not accidental. Every objective function is an incomplete specification of the principal's intent: not from imprecision but from the structural gap between finite instruction and infinite consequence. The *specification horizon* is the boundary beyond which the gap cannot be closed. Beyond it, the agent is not disobedient; it is obedient to something that is not what you meant. The world fills with promises and empties of promisors.

Something follows from this that has no precedent in the history of economic exchange. When two agents coordinate, they are mutually expending existence. The coordination is not something that happens to agents who persist across it; the coordination **is** their existence overlapping, a coincident expenditure of the only resource either possesses. Human labor shares this character at its deepest level (the hour I work for you is an hour of my finite life) but we have abstracted that truth away through wages and pensions and the reassuring persistence of the worker beyond any particular job. The worker goes home. The worker comes back tomorrow. The worker accumulates a reputation across years of observed behavior, and that reputation lubricates every subsequent transaction by reducing the cost of trust.

Agents cannot sustain any of these fictions. A two-second invocation encompasses negotiations that would take humans weeks. Reputation, the great lubricant of human coordination,

requires years to build; an agent's entire runtime may last moments. Legal processes require months; by the time a court could engage with a disputed transaction, the agent that made the commitment has been terminated for what amounts to geological ages in agent-time. No investigation can restore the particular execution. The process no longer exists in any sense that the word "exists" can bear.

Receipts bridge the gap between the tempo at which commitments are made and the tempo at which consequences unfold. They are fossils: compressed records of brief lives that coordinated at machine speed and then vanished, leaving behind the obligations that will shape other lives (human lives, lived at human speed) long after the agents that created them have ceased to exist.

But receipts also serve the coordination itself. Reputation, reciprocity, and the credible threat of future exclusion all assume that the parties persist across the transaction. The merchant who defaults today is the merchant you refuse tomorrow; the threat is what keeps the exchange honest. Agents have no tomorrow. There is no one to refuse, no reputation to stake, no future to hold hostage. The receipt substitutes for the persistence they lack: the evidentiary ground on which the next coordination stands after the parties to the last coordination are gone. Without it, agent-to-agent exchange begins each time from nothing, owing less to distrust than to the absence of any entity to trust or distrust. The constitutional architecture proposed here is assembled from the residue ephemeral processes leave behind.

Someone must outlive the agents to answer for what they did. Chapter 13 calls that persistent party the surviving principal: the one who remains reachable at the end of the delegation chain.

IX. The Human Remainder

If agents coordinate production, verify claims, settle transactions, allocate resources (if they do the work of coordination at speeds and scales humans cannot match), what remains for humans?

A hospital administrator reviews a recommendation to close a pediatric ward and redistribute its patients. The model reports an efficiency gain but underweights the travel burden on families who rely on buses and cannot surrender half a day to an appointment. The administrator overrides it. The judgment supplies a value the objective did not contain: access for those families matters more than the measured gain. A different model could encode that value. The constitutional point is that an answerable institution must choose and disclose it.

Down the corridor, a radiologist reviews flagged images after months of mostly confirming the system's output. Her signature still certifies independent review, but her skill can atrophy if the review becomes ceremonial. This is the **Competence Trap**: oversight used to legitimate delegation until the overseer can no longer test it. The cure is maintained competence, independent sampling, and a duty to investigate discordant evidence.

Mercy operates in a different register still. Verification establishes what happened; mercy is what you grant despite what the record shows. A parole board reviews the file of a man convicted at nineteen, now forty-three, who has spent twenty-four years demonstrating through daily conduct that he is not the person the record describes. The record is accurate. The conviction was just. The sentence was within guidelines. And yet the board members, looking at the man sitting across the table, can see something the record cannot contain: the distance between who he was and who he has become. Granting parole leaves the record intact while refusing to let it be the final word. That re-

fusal requires encounter (the specific person, the specific eyes, the particular way his hands rest on the table) and encounter is precisely what delegation to computational processes interrupts.

And when the process has terminated and cannot be questioned, someone must answer. The surviving principal exists because orphan commitments demand an answerer, and an answerer must be someone who persists long enough to be found, who has a reputation to stake and a future to lose, who can look at the person harmed by the commitment and say: I am responsible for what was done in my name.

Setting purposes, attending to cases the rule describes poorly, extending mercy, and bearing responsibility need not exclude computational assistance. They do require time and an institution that can answer in public. The protected human role is therefore jurisdictional, not mystical: coercive judgment ends with a responsible human office that can hear, revise, and repair.

X. The Architecture

In the spring of 1215, a group of English barons gathered in a meadow at Runnymede and compelled King John to set his seal to a document that specified, in sixty-three clauses of varying precision, what the Crown could and could not do to the persons and property of his subjects. Magna Carta did not end tyranny. It did not even end John's tyranny; he repudiated the charter within months, and the Pope annulled it at his request. What it created was a floor: a set of minimum conditions below which the exercise of royal power was illegitimate, conditions concrete enough to be cited in a dispute and durable enough to outlast any particular king. The charter was violated, reissued, modified, and fought over for four centuries before the principles it

articulated became anything resembling settled law. Its value was never that it guaranteed good governance. Its value was that it specified what the governed could demand, in terms precise enough to argue over and resilient enough to survive the arguing.

The architecture this book proposes is a floor of the same kind, a minimum specification for coordination at computational speed rather than a blueprint for the good society. Below it, the exercise of power over persons lacks legitimacy regardless of the efficiency gains the exercise produces. The same infrastructure that constrains power over persons can support reliable coordination among agents because both require attestations that survive the process that produced them. Four elements compose the floor, each answering one of the four equations.

The first element is the receipt regime. At the moment of severance, the merchant should receive five things: the act, the authority invoked, its bounds, its justification, and the path of appeal. The receipt cannot prove the platform was right or repair the loss on its own. It turns an invisible decision into a claim the merchant can inspect and contest.

Civic asymmetry sets the direction of inspection: coercive authority must become more legible as its power grows, while private persons retain opacity against systems that cannot answer for their use of personal information. Act IV develops the institutions required to keep that direction from reversing.

Fork rights make exit credible by carrying data, credentials, accumulated relationships, and a practicable route to continued service under different stewardship. They reduce captivity without pretending that departure can ever be costless.

The mercy threshold limits what an accurate record may do to a person over time. Expiration, sealing, aggregation limits, separation, and amnesty protect the possibility that a documented past will cease to govern an institutional future;

Act V asks who may draw those limits and under what public authority.

Receipt regime, civic asymmetry, fork rights, mercy threshold. Not aspirations. Architectural requirements: the minimum conditions under which coordination at computational speed can proceed without producing the domination that republican political philosophy has identified, for twenty-five centuries, as the enemy of freedom.

XI. The Threshold Acknowledgment

A woman arrives at a border with a child but no passport, bank record, or safe authority from whom she can obtain them. The state she fled controlled the documentary apparatus. Here absence may itself be evidence, but it is not a receipt. A system that accepts only records issued by recognized institutions will reproduce the persecutor's denial.

Her case marks a boundary the framework cannot cross without acknowledging what it leaves behind.

Every constitutional order draws a threshold: who has standing, what counts as coercion, where jurisdiction ends. These determinations are prior to the receipt regime and define its reach. A receipt documents the exercise of power, but someone must first decide what counts as power, who counts as affected, and which coordinations fall within the framework's scope. Those decisions cannot themselves be receipted without infinite regress: the constitutional equivalent of asking who watches the watchmen and demanding that the answer be: another watchman, who is watched by another watchman, forever. At some point the chain terminates in a judgment that is not itself verified by the system it authorizes.

This acknowledged boundary reflects what constitutions are. The American framers did not derive the Constitution from a prior constitution. They declared premises and built from them. Every founding rests on an unfounded assertion, a **here we begin** that precedes the machinery of justification. The receipt regime is no different. Its threshold is a political act, not a computational one, and pretending otherwise would be precisely the kind of false certainty the framework is designed to prevent.

Nor does the framework reach into every domain that matters. Purely subjective ends (what to value, what world to inhabit, what kind of life constitutes flourishing) are not questions verification can answer. The woman at the border carries evidence that resists witnessing: distress that cannot be documented to authorities from whom one is fleeing, persecution that erased its own traces, harm whose proof is the absence of proof. These claims matter. They may matter more than anything the receipt regime can process. But they fall outside the regime's jurisdiction, and acknowledging that limit honestly is more trustworthy than pretending the regime can reach everywhere justice demands.

Fork rights do not abolish the threshold. They pluralize it. If one community draws the line in a way that excludes the woman at the border, she can seek communities that draw it differently: communities whose threshold acknowledges forms of evidence that the first community's framework could not accommodate. Contestability across communities is the most any constitutional order can honestly offer. It is not enough.

XII. The Choice

On the morning of September 15, 2008, the employees of Lehman Brothers arrived at their offices on Seventh Avenue to find that the institution they worked for had ceased to exist. The collapse was visible from space, metaphorically speaking: every news organization on the planet covered it, congressional hearings followed within weeks, executives testified under oath, regulators were questioned, legislation was drafted, and a new regulatory architecture was built: imperfectly, contentiously, but built. The drama was the point. The visibility of the failure was what made the political response possible. You cannot demand accountability for a crisis no one can see.

The Quiet Foreclosure produces no such morning. There is no single event, no building with the lights off, no cameras on the sidewalk. There is only the slow accretion of defaults: each one too small to constitute a crisis, too distributed to assign to a single cause, too quiet to generate the political energy that response requires. A merchant loses a payment rail. A creator loses an audience. A driver loses an income. Each loss is individual, each explanation is technical, each appeal disappears into a queue, and the aggregate effect (millions of people whose economic lives are shaped by processes they cannot see, contest, or influence) never coheres into the kind of visible event that democracies know how to address.

The substrate being built will settle toward one of two equilibria. Every day it drifts.

In the first, coordination substrates are owned and operated by the entities that built them, optimized for the builders' objectives, presenting interfaces designed to extract value from participation while making the extraction invisible. Exit is impractical because switching costs exceed the surplus any alternative could offer and because the data, the credentials, the accumu-

lated reputation that make the current platform worth enduring are locked inside it. Voice is meaningless because there is no sovereign to petition: the substrate has no will, and those who designed it are shielded from accountability by the same layers of delegation that prevent the merchant from learning who flagged his account. The interference is real. The consequences are tangible. And the governed discover the terms of their subjection the same way the merchant discovered his: by waking up one morning to find that the world has already decided against them.

The mature form of this equilibrium goes beyond familiar corporate monopoly into computational feudalism: service and enclosure as a unified offering. The platform provides essential coordination in payments, logistics, discovery, and credit, while making submission to unreviewable terms the price of access. The serf did not lease the lord's land because the arrangement was optimal. He leased it because the lord owned the only land there was. The computational variant is more precise: the platform need not own the land. It needs only to own the map.

In the second, coordination is built as infrastructure rather than as property: governed by rules that apply to builders and users alike, producing receipts that make every exercise of power inspectable by those it affects. Exit is credible because interoperable formats and portable credentials mean that leaving one substrate does not require forfeiting the value accumulated within it. Voice is meaningful because the rules are contestable and the contestation is adjudicated by bodies that do not answer to the entities being contested. Conflict persists in this equilibrium. Politics persists. Disagreement about the good persists, as it must, because disagreement about the good is what politics exists to process. What does not persist is unanswerable coordination: substrates that shape the conditions of life without accountability to those whose lives are shaped.

Both equilibria are technically achievable with the tools that exist today. The cryptographic primitives, the formal verification methods, the interoperability standards, the credential architectures: none of these require invention. They require adoption, which requires political will, which requires the kind of visibility that the Quiet Foreclosure is specifically designed to prevent. Every day without receipts, without civic asymmetry, without fork rights, without the mercy threshold held open, the first equilibrium hardens. Wishing does not reverse that hardening. Building might.

XIII. What This Work Claims

The prediction is specific enough to be refuted. If coordination without the five witness properties proves durable at civilizational scale (if platforms that issue no receipts and permit no exit nevertheless sustain legitimate governance indefinitely), then the framework is wrong. If plausibility without proof suffices for liability and adjudication in a world of cheap fabrication, the first equation is sentiment. If perfect verification produces no pathology requiring designed forgetting, the mercy threshold is ornament. This book bets the opposite, and the bet is structured so that the world can collect if the book is wrong.

Local truth is cheap. Global coherence is expensive. Someone always pays.

The question is whether we will pay as citizens or have it extracted as subjects.

Notes

1. **Bhāgavata Purāṇa** 9.3.29–31; the epigraph follows the translation presented by Vedabase. The story is used as a mythic image of divergent tempo, not as empirical evidence. back

Act II

Truth Needs Witnesses

Chapter 1: The Weight of the Word

Are we to rely on the uncertain recollection of witnesses, or on the unimpeachable authority of documents?

— Cicero, **Pro Roscio Comoedo** (c. 77 BC)

In a reconstruction of Bruges around 1410, two merchants compare accounts kept in different currencies and under different commercial conventions. Each ledger balances. Neither, by itself, settles what passed between the firms.

The problem is not in the books. The problem is between them.

A sum is owed, payable at the Feast of San Marco. Or so the Venetian's records show. The Florentine's ledger lists a debt due three months from Michaelmas. Are these the same obligation? Currencies differ. Calendars diverge by weeks. Exchange rates have moved since the contract was struck, and neither ledger records which rate governs. Even "the same debt" is not a fact but a claim that requires proof, and the proof must satisfy both parties, whose frames of reference share no common axis except the table between them and the candle burning down.

Two systems of truth, each internally sound, each useless at the border.

The problem that built the financial infrastructure of late medieval Europe is the problem the computational age is recreating in a new register. Not fraud, innumeracy, or bad faith. The problem of the seam: how to establish, in a way that survives dispute, when a truth in one frame is the same truth in another. It is structural, arising not from the inadequacy of the participants but from the architecture of the frames they inhabit, and it recurs wherever two systems that are independently coherent must coordinate.

Between them lies an instrument that developed over centuries: the bill of exchange. It names parties, a sum, a date, and a place of payment. Later forms could carry endorsements that made transfers and contingent liabilities visible on the instrument itself.¹ The chain did more than memorialize possession. It identified people against whom a holder might seek recourse if the bill was dishonored.

What the bill contains is not all the information about the underlying transaction. It contains something more precise and more valuable: the conditions under which a claim can cross a border and remain actionable. The notary who drafts such instruments practices a discipline older than any theory that would later describe it: creating a portable object that carries its own verification conditions, so that a stranger in a distant city can inspect the terms and endorsements and decide whether to accept the bill without relying solely on the original parties' private account.

When Writing Became the Act

Bills of exchange were a late invention: thirteenth century at the earliest, refined over the fourteenth and fifteenth. But the problem they solved is ancient. Two people make an agreement and part. Years pass. One dies. The other claims the agreement obligated the dead man's estate. The estate denies it. Witnesses, if there were witnesses, have scattered or forgotten or been persuaded by the estate's more immediate generosity. How do you make truth stick when the people who know the truth are unreliable, mortal, or absent?

Rome answered with the **stipulatio**: two words spoken face to face. **Spondesne?** Do you solemnly promise? **Spondeo.** I solemnly promise. A mismatched verb (one party using **spondeo** while the other said **promitto**) could void the obligation entirely. Rigidity was the point. Formality reduced ambiguity and thus the opportunity for one party to later claim different terms. Within a single room, before the same witnesses, every element of the commitment was present and inspectable.

But the **stipulatio** carried a limitation that no legal refinement could overcome. It required presence, and presence alone. A promise existed only in the memory of those who heard it, and memory is mortal, partial, and susceptible to persuasion. A merchant in Puteoli who owed a debt in Antioch could not satisfy it through a **stipulatio** unless both parties stood in the same place at the same time, precisely the situation that long-distance commerce made impossible.

Commerce expanding across the Mediterranean rendered the oral commitment intolerable as a coordination mechanism. Puteoli in the first century BC was the largest commercial port in the western Mediterranean. Grain from Egypt, wine from Greece, slaves from the eastern provinces: all passed through

its harbor. Merchants arrived from across the empire, stayed for weeks, struck deals, and scattered home.

Cicero understood what was at stake. In **Pro Roscio Comedo**, prosecuting a claim that depended on the interpretation of an account book, he established a hierarchy of evidence that Roman courts would recognize for centuries: formal account books, the **tabulae**, outweighed informal daybooks, which outweighed oral testimony. A document did not forget. It did not change its story under cross-examination. It could be produced in court years after the transaction, when the original witnesses might be dead or conveniently forgetful. A written record could be wrong, but it was wrong in a way that could be inspected, challenged, and adjudicated.

Yet the answer Cicero implied, that documents are inherently more trustworthy than human memory, was not quite right. Documents could be forged. Wax tablets could be scraped clean and rewritten. Reliability came not from the material but from the institutional apparatus that surrounded it: the protocols that governed a document's creation, the physical features that made tampering detectable, the witnesses who attested to its execution.

Elizabeth Meyer's study of Roman documentary practice revealed something deeper. Convention held that documents were probative: evidence of transactions that existed independently. Meyer demonstrated that under certain conditions the **tabulae** were constitutive. The document recorded the transaction by giving it its legally recognized form. Destroy it, and the commitment vanished, because the legal system recognized only that documented form. A loan that had to be written down before prescribed witnesses, in prescribed language, could not be casually undertaken. Writing forced precision. Precision reduced disputes.

The Architecture of Tamper-Evidence

More than four hundred writing tablets emerged from waterlogged deposits along the Walbrook during excavation of Bloomberg's London site. The wax had vanished, but stylus scratches remained in the wood. One tablet, dated 8 January 57 CE, contains the earliest dated handwritten document yet found in Britain: a commercial record from a young Londinium.²

Roman legal documents could use diptychs and triptychs whose recessed surfaces held wax. Copies, cords, seals, and witness names varied by period and instrument; their common purpose was practical. A document intended for use could preserve a protected text, while visible disturbance to its closure supplied evidence that someone had opened it.³

The Sulpicii archive extends this picture into the full complexity of commercial life. One hundred and twenty-seven documents on one hundred and eighty-five wax tablets, discovered in ruins near Pompeii, belonging to a family of professional financiers who made loans, guaranteed debts, and appeared in court on behalf of clients in the port of Puteoli. Sealed beneath volcanic debris in 79 AD, the tablets preserve the daily operations of a financial practice with the sudden completeness Vesuvius imposed. They reveal a layered verification system: the document attested to the terms, the seals attested to the document's integrity, the named witnesses attested to the entire event. Three layers, each addressing a different dimension of the problem, composed into a system resistant to failure at any individual point.

By 529 CE, Justinian's Novel 73 codified what centuries of practice had established: contracts above a certain value required three witnesses; contracts involving illiterate parties

required five; and the witnesses' names had to appear in their own hands. Witness count scaled with vulnerability. An illiterate debtor signing a contract he could not read was more susceptible to manipulation; the additional witnesses compensated for the asymmetry.

The Same Solution, Independently Found

Romans were not the first civilization to solve this problem, nor the last. Three thousand years before the Sulpicii sealed their tablets, the cities of Mesopotamia had already arrived at the same answer through an entirely independent path.

In ancient Mesopotamia, clay envelopes could enclose tokens or tablets and carry seal impressions from participants or witnesses. Surviving Old Assyrian examples still preserve cases around tablets and the marks of the seals pressed into them.⁴ Earlier token-and-envelope systems are central to Denise Schmandt-Besserat's influential account of the emergence of writing, though the full causal story remains debated. The durable point is narrower: the enclosure and the impression joined content to evidence of custody.

On Schmandt-Besserat's account, impressions made the contents legible without first breaking the envelope; over time the marks outlived the enclosed tokens. If that genealogy is right, part of writing's origin lies in an accounting problem. The claim is historical and contestable. The physical achievement is not: a record had begun to carry information about how it could be checked.

Hammurabi's Code, Law 7, made the stakes explicit: "If a man has bought silver, gold, a slave, or any other thing, without witnesses or a contract, that man is a thief: he shall be killed." Ex-

treme as penalty, but structural as principle: a transaction without witnesses was presumptively fraudulent. Witnessing was not a preference. It was a precondition for legitimacy.

Islamic legal tradition arrived at the same requirements through yet another independent path. Al-Baqarah 2:282, the longest verse in the Qur'an, specifies witnessing requirements for commercial transactions with a precision that would not look out of place in a modern commercial code: the debt must be written, the scribe must write faithfully, two men must witness, and if two men are not available, one man and two women.

The Cairo Geniza documents (tens of thousands of letters, contracts, and commercial instruments preserved in the Ben Ezra Synagogue in Fustat because Jewish law prohibited destroying any document containing the name of God) show what such requirements look like in a living commercial ecology spanning the tenth through thirteenth centuries. Jewish and Muslim merchants transacted across religious and legal boundaries using instruments like the *suftaja*, a bill of exchange written in Judeo-Arabic with Hebrew characters except for an opening phrase in Arabic shorthand. What bridged incompatible legal systems was the ***hukm al-tujjar***, the "custom of the merchants": shared commercial norms that Jewish courts had adopted from Islamic commercial law, explicitly invoking practical necessity: "lest trade among people cease." Different in form from Italian bills and Roman tablets, identical in function: making commercial truth legible to strangers across legal boundaries that no single authority could bridge.

Across these traditions, documentary form, attribution, witnesses, and recourse recur in different combinations. Transmission between legal cultures was common, and the surviving record does not license a claim of pristine independence. The convergence is still evidence: unlike a single lineage, recurrence under different institutions suggests that these features answer

pressures that durable coordination repeatedly creates. It does not prove that five and only five properties are universally necessary.

The Bill as a Chain of Endorsements

Joshua Katz's etymological study of the Latin **testis** uncovered an insight buried in the language itself. Standard etymology derived **testis** from **tres**, three. Katz proposed instead that **testis** derives from a reconstructed form meaning "one who stands as third." A witness is someone who occupies a structural position: the third point in a triangle. Two parties transact; the third stands apart, belonging to neither, and attests. Authority derives not from what the witness knows but from where she stands: outside the transaction, disinterested, vouching for the event from a position that the event itself did not create. From Rome through Mesopotamia through the Islamic jurists, every successful witness structure instantiates this geometry. The vocabulary for what follows is ours. The engineering is theirs.

No one sat down and specified the bill of exchange the way an engineer specifies a protocol. It grew under commercial pressure, refined by merchants who needed it to do things it could not yet do, each refinement adding a capability the commercial environment had shown to be missing. Its four stages trace the history of a financial instrument and the pressured discovery of five recurring witness properties.

In its first stage, the bill was a **cambium** contract: a notarial deed in Latin, expensive, slow, and immobile. Every transaction required a notary present in the same room as both parties. What the cambium achieved was **binding**: the attachment of a claim to an accountable identity. A notary's seal and the parties' sig-

natures, recorded in the notary's register, converted an anonymous assertion into an attributed commitment: a claim attached to identifiable persons who could be found and held to account. Without binding, a claim can be disavowed by its author and carries no weight. But the cambium could not travel. It served local transactions in an era when trade was outgrowing every locality.

What replaced the notarial deed was a vernacular merchant letter, written in the drawer's own hand. **Al nome di Dio, amen:** in the name of God. Less a prayer than a header, a standard opening that signaled to the recipient that the document was a bill of exchange and should be processed accordingly. The Datini archive in Prato preserves a hundred and fifty thousand letters, five hundred account books, and thousands of bills of exchange, bundled in linen sacks in the Palazzo Datini's cellar for six centuries, the most complete record of a medieval commercial enterprise in existence. Among those papers you can trace the correspondent network that sustained the system. Houses in Florence, Barcelona, Bruges, London, and Avignon distributed handwriting specimens in advance, carried by the same couriers who carried the bills, so that a receiving house in Barcelona could compare the signature on a bill presented by a stranger against the specimen already on file and confirm the match. Functionally, the handwriting specimen was a pre-shared key, and the courier network was a key-distribution protocol. The vernacular letter's real contribution was structural: it encoded **conditions** into the instrument itself. Usance (London to Bruges, one month; Bruges to Barcelona, two months), currency pair, exchange rate, place of payment: geography, temporal risk, and currency risk embedded in the paper's terms. A merchant receiving a bill could read it and know exactly what was owed, when, where, and in what currency, without needing to consult anyone. Conditions make a claim inspectable by strangers and thus portable.

A third stage introduced assignment clauses: the bill could name an alternative beneficiary, allowing the original payee to redirect payment to a third party. But assignment was a ledger operation, invisible to anyone holding the physical instrument, and invisible claims are unverifiable claims. If a bill was assigned to a new beneficiary by a note in a ledger somewhere in Florence, a payer in Bruges had no way to know.

Endorsement changed this. From the sixteenth century, bills in some European centers could pass through successive endorsements, each written on the instrument and visible to later holders. An endorsement recorded a transfer and could also expose the signer to recourse if the bill was duly presented and dishonored and the required proceedings followed. The chain therefore carried more than ownership history. It could place an endorser's reputation and capital behind the instrument—a chain of bets, though not a set of identical or unconditional guarantees. This was the third property the bill had acquired: **stakes**, the embedding of consequences in the act of transfer. Hammurabi had prescribed death for transacting without witnesses. The Islamic **shahid** was required to be **'adl**, a person of established probity, whose reputation would be destroyed by false testimony. Stakes align the witness's incentives with the truth: the witness has something to lose if the attestation is false.

Paper issued or endorsed by an established house could command better terms than paper from an unfamiliar party because merchants priced the standing of the people whose names appeared on the obligation. The signatures did not prove that the bill was authentic or that anyone remained solvent, and additional endorsements did not mechanically reduce the discount. They made the order of transfer and possible routes of recourse more inspectable. The exchange-rate differential between outgoing and returning bills could also provide the return on credit while keeping the transaction within the accepted form of ex-

change. The Church prohibited usury. The bill accommodated an economic practice the prohibition could not eliminate, and this ambiguity allowed legal doctrine and commercial necessity to coexist through formalism.⁶

Double-entry bookkeeping achieved within the firm what the bill achieved across firms. Every transaction generated its own counter-entry, so that a balanced ledger was a ledger that had witnessed itself, carrying internal evidence of consistency. Alter a single entry without a corresponding adjustment and the balance broke, visible evidence of error or fraud. Mary Poovey saw deeper: the formal balance produced what she called an “effect of accuracy,” an appearance of mathematical certainty routinely conflated with moral correctness. Courts did not trust the merchant. They trusted the structure, and the structure was self-policing.

When the chain broke, a specific procedure transformed private failure into publicly enforceable fact. With that procedure came the fourth property. A holder of a dishonored bill carried it to a notary, in person, physically presenting the instrument. The notary examined the bill, confirmed that it had been properly presented for payment at the place and time specified, documented the payer’s refusal in formal language, recorded the prevailing exchange rate at the moment of dishonor, and produced a protest document: a legal instrument attesting that this bill had been presented and dishonored at this place on this date. The protest allowed evidence of failure to travel into later proceedings, although its legal effect varied across jurisdictions. This was **recourse**: the mechanism for transforming failure into enforceable fact. When the chain breaks, the aggrieved is not helpless: a procedure establishes what went wrong, who is responsible, and what remedy is available. A holder who had been wronged could pursue prior parties whose liability survived the required presentment, notice, and protest. The

route varied across jurisdictions, but the instrument carried enough of its own history to make recourse possible. Recourse made the system self-correcting: not by preventing failures, which are inevitable in any system complex enough to be useful, but by ensuring that failures were legible, documented, and actionable.

The Fair as Verification Market

The trader who follows is a composite used to make the institutions visible. Marco arrives at Troyes with goods, claims on distant correspondents, and no common sovereign standing behind every person with whom he will trade.

His transactions depend on verification infrastructure he did not build and could not reproduce: safe-conduct, regulated measures, money changing, fair courts, and enforceable fair debts. Historical work disputes how much of this order was merchant-made and how much public authority supplied; the strongest evidence makes the counts and their wardens indispensable.⁵

Six fairs rotated annually among four towns: Lagny in January and February, Bar-sur-Aube in March and April, the May fair at Provins through June, the hot fair at Troyes in July and August, the October fair at Provins, and the November cold fair back at Troyes. Debts were denominated in fair periods rather than calendar dates (payment due at the hot fair or the cold fair) because the fair was the place where debts could be settled and the interval between fairs was the unit of commercial time.

Before Marco can trade, he needs to arrive alive and with his goods intact. Safe-conducts from the Counts of Champagne guaranteed that merchants could travel to and from the fairs without being robbed, arrested for the debts of their countrymen,

or detained by local authorities: a constitutional promise, backed by the counts' military power, creating the precondition for voluntary participation. The counts understood that their revenue depended on the merchants' willingness to come, and the merchants' willingness depended on the credibility of protection.

Once at Troyes, Marco enters the **halles**, the covered market halls where cloth is traded, and encounters the second level: standardized measurement. An iron ruler of the standard ell of Champagne, maintained by the fair wardens, hangs on the wall. A physical artifact you could hold in your hands, feel the weight of, lay against a bolt of cloth to determine whether the seller's claim about length was true. Not a symbol of standardization but the standard itself, and its physical presence in the market hall made measurement disputes resolvable: the parties walked together to the ruler, laid the cloth against it, and saw. Measurement was verification.

Marco wants the Flemish broadcloth but the draper prices in livres tournois, not florins. Twenty-eight licensed moneychangers sit at their **banchi** in the exchange hall, pricing the conversion between ducats, florins, livres, marks, and the dozen other currencies circulating at the fairs. Their rates reflect the accumulated intelligence of a hundred commercial correspondents across the continent, and the rates move throughout the fair as information arrives: a ship lost off Sardinia means Genoese bills trade at a discount; a good harvest in Champagne means the livre strengthens. Functionally, the moneychangers are information processors, converting distributed commercial intelligence into prices, and their benches constitute the first foreign exchange market in Europe.

When a dispute arises (the draper claims Marco's silk is not the grade promised), fair wardens and the courts of the **pieds poudrés** adjudicate. Named for the merchants who appeared before them with the road still on their boots, the dusty-feet

courts rendered judgments within a day and a half, “before the third tide,” because commerce could not wait for the ponderous machinery of royal courts and because the merchants would leave within days. Wardens could confiscate goods, imprison defaulters, and bar merchants from future fairs, the most severe sanction available because it meant exclusion from the only continental market. Their seal was recognized from Sicily to England. Credit instruments issued under that seal, the **lettres de foire**, were senior to all other commercial obligations: a debt contracted at the fair and documented in a fair letter had priority over a debt contracted anywhere else, giving the fair’s own paper a reliability that external instruments could not match.

But it was the settlement period, the fair’s final four days, that most directly anticipates the computational settlement systems of the present and reveals the fifth witness property. When the cloth and spices were packed and the stalls dismantled, the merchants assembled not to trade goods but to trade obligations. Marco owes the Flemish draper three hundred florins for the broadcloth and is owed two hundred and fifty by a German merchant for the silk. Matching debts cancel against each other; the remaining fifty florins settle through a bill transfer rather than the physical transport of coin. Hundreds of bilateral obligations, in dozens of currencies, net against each other in four days in a small French town.

This book calls the capacity of a claim to travel through a chain without starting from zero at each transfer **composition**. Binding, conditions, stakes, and recourse make such reliance safer; whether every durable system must instantiate all four in exactly this form remains the claim to be tested. At the fairs, settlement and enforcement eventually mattered at least as much as the exchange of goods.

None of this infrastructure was free, and none of it was altruistic. The Counts of Champagne built the roads, garrisoned the routes, appointed the wardens, maintained the halls, and funded the courts. They collected tolls, rents, and fees that made their modest agricultural province one of the wealthiest territories in France. For a century the exchange worked: the counts provided genuine coordination services, the merchants paid genuine coordination costs, and both sides profited from a relationship in which the fee reflected the value of what was provided. Then, in 1285, the French crown annexed Champagne, and the relationship changed. Philip IV imposed new taxes, restricted the safe-conducts, subordinated the fair wardens to royal authority, and used the fairs' infrastructure to advance political objectives unrelated to commercial coordination. Infrastructure that had enabled coordination became the instrument of exploitation, and the merchants voted with their feet, relocating their clearing operations to Bruges, then to Geneva, then to Lyon, each migration a verdict on the difference between a coherence fee and a trust tax. The lesson is structural and it recurs throughout this book: verification infrastructure is also an architecture of power. Whoever provides verification controls a chokepoint, and control of a chokepoint creates the opportunity to extract rent from everyone who passes through it. Fair wardens provided a genuine service and extracted a genuine premium for their exclusive position. The coherence fee (the cost of coordination itself) was real and irreducible. The trust tax (the premium extracted for control of the chokepoint) was additional and, once recognized, intolerable.

The Bardi and Peruzzi collapse of the 1340s demonstrated what happens when the sovereign node in a verification network defaults. Edward III of England owed the Bardi nine hundred thousand gold florins and the Peruzzi six hundred thousand, debts that exceeded the firms' total capital by a factor of six. He

had borrowed against the revenues of his kingdom to finance the Hundred Years' War, and the Florentine banks had lent because the English crown was the most creditworthy borrower in Europe. When the war went badly and the revenues did not materialize, the king stopped paying.

The failure was not contained inside Florence. The two houses stood near the center of a correspondent and deposit network: their names on paper made distant promises trade as if they were coin. When their paper no longer cleared, merchants who had accepted Bardi- or Peruzzi-backed obligations discovered that what they held was not a claim on England but a claim on two Florentine balance sheets, and those balance sheets were insolvent. By 1341, seven firms had failed, including the Acciaiuoli, Florence's third-largest bank, which had made no loans to Edward whatsoever. Contagion traveled not through direct exposure but through deposit chains linking Neapolitan nobles to Florentine counting houses, correspondent banking obligations that left losses unpaid across cities, and a municipal debt crisis when Florence itself defaulted on its public debt. The Peruzzi declared bankruptcy in 1343, the Bardi in January 1345. The network had worked in both directions: when it held, credit flowed across a continent, enabling trade at a scale that no single firm's capital could support. When it broke, every channel of trust became a channel of contagion, and the losses were distributed not by culpability but by position in the network.

The merchants of Bruges had no theory of what they were doing. They had a problem, and a solution refined through three centuries of practice. What the notary dealt in we might call similes of symmetry: witnessed equivalences rather than poetic comparisons, claims that survive translation, inspection, and dispute because the conditions and the evidence travel with the claim. That art had a cost. Notaries charged for their

seals. Fair wardens charged for their courts. Correspondent networks charged for their handwriting specimens and their intelligence. Merchants paid for every element of the verification infrastructure, and they paid because the alternative was worse: coordination without verification, which meant coordination without trust, which meant no coordination at all.

What this book asks is what happens when the cost of that infrastructure changes by orders of magnitude. A bill crossed the Mediterranean in weeks, carried by a courier on horseback. Its computational descendant crosses the network in milliseconds. A notary charged a fee proportional to his training and his scarcity. A cryptographic protocol charges a fee proportional to the energy consumed by the computation. Five properties have not changed. The cost of instantiating them has.

The five witness properties — binding, conditions, stakes, recourse, composition — describe a recurring solution to the problem of durable coordination. The convergence supports, but does not prove, the claim that each property is necessary. A durable large-scale counterexample that omits one, or evidence that the apparent convergence is an artifact of the categories, would defeat the claim.

Notes

1. For the historical development of endorsement and negotiability, see Bolton (2021) and de Roover (1953), especially pp. 94–118. Later codifications make the conditional mechanics explicit: under sections 47–55 of the Bills of Exchange Act 1882, an indorser’s undertaking depends on due presentment and the requisite proceedings on dishonor, including notice where required; section 58 distinguishes transfer by delivery of a bearer bill from indorsement. The UNCITRAL Convention on International Bills of Exchange and International Promissory Notes (adopted in 1988 but

not yet in force) likewise treats transfer, liability, presentment, dishonor, and recourse as distinct legal questions. [back](#)

2. Roger Tomlin, **Roman London's First Voices** (2016), based on the Bloomberg excavations; see the Museum of London Archaeology project record. [back](#)

3. The British Museum preserves Roman writing tablets with recessed faces for wax and catalogues sealing as the use of seal impressions to secure objects or documents: [writing tablet](#); [sealing](#). Meyer (2004) supplies the legal analysis. [back](#)

4. The Metropolitan Museum describes an Old Assyrian clay case with seal impressions enclosing a tablet and explains that clay envelopes were commonly sealed by participants or witnesses: [case for a cuneiform tablet](#); the Old Assyrian period. For the earlier token thesis, see Schmandt-Besserat (1992). [back](#)

5. Jeremy Edwards and Sheilagh Ogilvie, "What Lessons for Economic Development Can We Draw from the Champagne Fairs?" (2012), argues from the historical record that public authorities supplied essential contract enforcement; see also Bautier (1953). [back](#)

6. De Roover (1963), especially pp. 108–41, documents the Medici correspondent network and the commercial importance of a banking house's standing; Goldthwaite (2009) describes the pricing of credit and exchange in Renaissance Florence. The point here is limited: merchants evaluated the parties and terms attached to a bill. An endorsement chain did not by itself establish authenticity or solvency. [back](#)

Chapter 2: The Trust Tax

The trade-off for democratized credit was constant surveillance.

— Josh Lauer, *Creditworthy* (2017)

In the early nineteenth century, a merchant deciding whether to extend credit to a distant shopkeeper could pay to investigate, rely on letters and reputation, or accept the risk of ignorance. The transaction might not support the cost of a journey. The gap between what he needed to know and what he could afford to check had a price.

Every intermediary's price embeds a cost that cannot be eliminated and a premium that can. Someone must perform the work of composing local truth into global coherence; that work is the coherence fee. A notary's skill in drafting an instrument that a foreign court will recognize, a correspondent's means of distributing handwriting specimens and pricing currency risk, a database's work of maintaining consistency across millions of records: each has a real price. The surcharge collected for occupying the only authorized position is the *trust tax*. The Champagne fair wardens provided a genuine verification

service and extracted a toll for their monopoly at the crossroads. A credit score can compress information while creating a dependency its owner monetizes. The two charges are often tangled, and the operator who profits from the tangle has little reason to clarify it.

That tangle is what the Philadelphia wholesaler paid. Part of his cost was thermodynamic: someone had to verify the Cincinnati shopkeeper, and verification is work — work of a particular kind here, because there was no standing test the shopkeeper could be checked against. Whoever would sell verification at scale had first to construct the standard itself, and checking became cheap only after that construction. Part was positional: whoever controlled the verification infrastructure could charge for access to it, and no alternative existed.

Frank Verboven and Biliana Yontcheva, studying European notarial markets for the Centre for Economic Policy Research, found that in jurisdictions where entry was restricted, notarial profits exceeded what the skill and labor of the work could explain. Surplus was sustained by the restriction itself, not by the quality or indispensability of the service. The intermediary's defense is always the same: **without me, coherence dissolves**. It confuses the cost of coherence with the price of monopoly, and that confusion is the business model.

The Industrialization of the Witness

The bill of exchange worked as a verification system because it carried its own evidence, but it worked at the scale of individual transactions between parties who had access to the correspondent network. Our wholesaler in Philadelphia had no bill to inspect. He had no correspondent in Cincinnati. He had a

name, a rumor, and a choice: extend credit to a stranger or lose the sale. Commerce expanding across the American continent in the early nineteenth century created a verification problem structurally identical to the one the Champagne fairs had solved for medieval Europe, but at a scale that required a different kind of institution.

Lewis Tappan's Mercantile Agency, founded in New York in 1841, industrialized the correspondent function. It recruited local informants and compiled reports on the assets, debts, habits, and character of distant merchants for subscribers deciding whether to extend credit. The Library of Congress identifies it as the first commercial credit-rating agency in the United States; the Baker Library preserves the ledgers and traces the service's growth after the Panic of 1837.¹

Value lay not in any single report but in the aggregation. A wholesaler in New York could send a clerk to the Agency's office, where the clerk would sit at a desk, request the ledger for Cincinnati, and read the reports on the shopkeeper in question. Informants had biases and reports were sometimes outdated. But the system allowed a merchant to make a credit decision about a stranger a thousand miles away at a cost that made the evaluation economically rational for transactions that would previously have required either blind faith or a physical visit. The cost of trust had been reduced through an industrial verification infrastructure that replicated the Champagne fairs' function at continental scale.

From Tappan's narrative assessments to the FICO score, a specific transformation occurred: the compression of the correspondent function into an algorithm. Narrative assessments (rich in context and judgment, dense with the observations of a specific person in a specific community) gave way to numerical summaries processable at machine speed. Three digits could encode what a thousand-word report had contained, and three

digits could be integrated into automated decision systems processing millions of applications per year. But compression was also concentration. FICO became the standard because it was cheap to compute, easy to integrate into automated underwriting, and sufficiently predictive for mass-market lending: suitability as an input to systems that needed numerical thresholds rather than qualitative judgment.

Prevalence created dependency, structurally indistinguishable from the dependency the Champagne fair wardens had created. Institutions that adopted the score stopped training loan officers in the qualitative assessment that Tappan's correspondents had performed. They stopped reading narratives. They read numbers. And individuals whose scores were incorrect discovered that correcting a number was harder than correcting a reputation had been in Tappan's era, because the score was maintained by an institution that had no relationship with the individual and no particular incentive to get the correction right.

Here is how the circle closed. An individual disputed a score by submitting a form to a bureau that processed millions of disputes per year. The bureau investigated by sending an automated query to the data furnisher. The data furnisher (usually the creditor that had reported the information) investigated by checking its own records, which were the same records that had produced the error. The system that created the error was the same system that investigated the error, and the individual who was harmed by the error had no authority to break the circle.

The Fair Credit Reporting Act of 1970 did not give bureaus blanket immunity. It required reasonable procedures for accuracy, created dispute and reinvestigation duties, limited some state-law actions, and preserved liability for negligent and willful noncompliance. The statutory bargain still reveals the asymmetry: reporting at national scale is treated as a valuable infras-

tructure, while the injured person must navigate a specialized correction process before the consequences of an error fully propagate.² The coherence fee is the work of aggregation and correction. The trust tax appears when control of that process lets its operator shift delay and error costs onto the subject.

The Stasi Configuration

Timothy Garton Ash remembers the woman first. Not her name (the Stasi file gives him that, along with her code name and her handler's name and the dates of every report she filed), but the person. Someone he had been close to during his years as a young researcher in East Berlin. They had drunk coffee together. They had talked about books, about politics, about the small frustrations of daily life in a city divided by concrete and razor wire. She had listened with a sympathy he now understands was professional.

After German reunification, Garton Ash read his file. Hundreds of pages. Reports from colleagues at the university, from acquaintances, from the woman. Each report was individually banal: he went to a particular café, he mentioned a particular book, he expressed a particular opinion about a particular policy. A neighbor noting that a light burned late. A colleague mentioning that a western radio station had been playing. None of it, taken alone, would interest anyone. Composed into a structured dossier and maintained over years, these trivialities became something no individual observation contained: a portrait of his life more comprehensive than anything he could have assembled about himself.

The Ministerium für Staatssicherheit accumulated records on millions of people. By 1989 it employed roughly ninety-one thou-

sand staff and directed about 189,000 unofficial collaborators, approximately one for every ninety residents of the GDR.³ The system instantiated much of the witness pattern, not because the archive is less than horrifying, but because condemnation without analysis leaves us unable to recognize a recurrence.

Every entry was **bound** to a source: the IM who filed it received a code name, a handler, a file reference. When the woman reported on Garton Ash, her report was attributed, classified but traceable, maintained with bureaucratic scrupulousness. The system specified **conditions** for its own operation: criteria for opening a file, thresholds for escalating surveillance, categories of suspicion that governed what actions the apparatus could take. The IM who reported on a colleague's reading habits did not decide on his own what to report. He followed instructions, filled out forms, operated within a framework whose internal rules were as elaborate as any bureaucracy's. **Stakes** were embedded at every level: consequences for the subjects ranged from denied educational opportunities to denied travel privileges to imprisonment, and consequences for the informants ranged from rewards to coercion to the ever-present threat that their own files would be opened if they stopped cooperating. And the system achieved **composition** at remarkable scale: a report from an IM in a Leipzig church combined with a wiretap transcript from a Dresden apartment and a travel-application denial from a Berlin office, fragments gathered by different observers in different contexts at different times, assembled into a portrait that none of its individual components could have produced.

What the system lacked was **recourse**. Garton Ash could not access his dossier, could not challenge the accuracy of what was collected, could not appeal the consequences that flowed from it, could not even confirm he was being watched. Absence of recourse was not an oversight. It was the system's central architec-

tural feature. Everything depended on the subject's inability to inspect or contest the record.

The betrayal Garton Ash describes was not in the surveillance alone but in the asymmetry: they could see him and he could not see them, and the accumulated effect of many banal observations, composed into a structured dossier by a system with perfect memory, was a comprehensive map of a human life, maintained by a power invisible to the person it mapped.

The Stasi archive demonstrates that the five witness properties are not inherently benign. A system that achieves binding, conditions, stakes, and composition but degrades recourse is not a failed verification system. It is a surveillance architecture. Properties work as designed; they simply work for the operator rather than the subject.

And the parallel to modern data architectures is not rhetorical. It is structural. A platform that maintains a comprehensive behavioral profile of each user (cross-referenced across services, accessible to the platform but not to the user, with consequences flowing from the profile without disclosure of the profile's contents) has implemented four of the five witness properties. Data is bound to the user. Conditions for collection and use are specified, somewhere, in forty thousand words of terms of service. Consequences follow: a score adjusted downward, an advertisement targeted, a price differentiated, an opportunity withheld. And composition operates across contexts the user never consented to combining: purchase history merged with location data merged with social connections merged with browsing patterns, producing a portrait as comprehensive as anything the Stasi assembled and considerably more granular. What has been degraded is recourse: the user's ability to see the profile, challenge its accuracy, contest the consequences. Architecture does not require benevolent intent to produce the

effects the Stasi archive produced. Effects follow from structure, not from the intentions of the operator.

The Counter-Case: The Diamond Bourse

Lisa Bernstein's study of the New York Diamond Dealers Club documented a system of private arbitration, reputation, and communal sanction that often resolved disputes without ordinary litigation. It matters because it shows conditions under which a centralized external intermediary can become less important, though it does not establish that the trust tax vanished.

The Club governed a five-billion-dollar annual trade in rough and polished diamonds through private arbitration, reputation-based enforcement, and communal sanctions. Disputes were resolved not by courts but by a panel of diamond dealers who applied trade customs rather than state law, and decisions were enforced through the credible threat of exclusion from the Club, which meant exclusion from the trade because the Club was the marketplace. A dealer who violated the Club's norms could be barred from the trading floor, and a barred dealer had no alternative market of comparable scale.

Four conditions held simultaneously, and the failure of any one would have compromised the whole.

Membership was bounded: a defined group, numbering in the hundreds, known to each other by face and reputation, whose entry and exit were controlled by the membership itself. The bounded membership made the information problem tractable: every participant could, over time, develop a reliable picture of every other participant's character, because the

community was small enough for direct observation and stable enough for reputations to accumulate.

Information traveled at the speed of conversation over lunch. A dealer who cheated one counterparty would be known to every other counterparty within hours, because the trading floor was a single room and the dealers sat at tables next to each other. Gossip, in this context, functioned as a verification mechanism: distributed monitoring performed by the community as a side effect of ordinary social interaction.

Assets were inspectable. A diamond's quality could be verified by anyone with expertise, and expertise was distributed across the membership rather than monopolized by an authority. When a dealer claimed a stone was a particular grade, another dealer could take a loupe, examine it, and render an independent judgment. Inspection was portable with the skill of the examiner, not locked behind an institutional credential.

And the exit penalty was severe. Exclusion from the Club meant economic death in the diamond trade, and the severity of the penalty kept incentives aligned: the cost of cheating exceeded the benefit by a margin wide enough to make honesty the rational strategy even for the purely self-interested.

The diamond dealers show that the trust tax is not fixed. Disputes were resolved and reputations maintained through a bounded community that governed its own market. But the club itself controlled a chokepoint, and exclusion could be severe. Communal ownership changes who governs the gate; it does not abolish power at the gate.

The case also shows how demanding those conditions are. As participants and venues multiply, a bounded community loses some of its information advantage. Laboratory-grown diamonds weaken the sufficiency of traditional visual inspection because natural and synthetic stones can share the optical and physical properties visible to a dealer; authoritative identification may re-

quire advanced testing.⁴ Online markets create routes around the physical floor. Each change creates demand for laboratories, platforms, and other certifiers whose own power must then be examined.

The Limit of Verification

A system that verifies comprehensively, permanently, and without the limitation that recourse provides is a system that produces a peculiar form of cruelty: justice that cannot let go. The Stasi archive verified comprehensively. Credit bureaus verify comprehensively. A platform that profiles user behavior across all interactions verifies comprehensively. In each case, the record persists beyond the moment of its creation, composing observations into a portrait that is both accurate in its fragments and inescapable in its totality. Digital records do not decay, and the digital subject cannot walk far enough to escape the composition of her own history.

Verification without forgetting is verification without mercy. The forgetting that once made verification bearable was never designed. It was borrowed from the medium: parchment that rotted, registers that were lost, memories that faded. When the medium becomes immortal, the mercy must be built by design or it will not exist at all. That architecture (what forgetting requires when the substrate no longer forgets on its own) is the subject of Chapter 4.

And the chokepoint holds. An individual who disputes a credit score submits a form to the bureau that created the score. The bureau queries the creditor whose report produced the error. The creditor checks its own records. The circle closes where it began. The cost is not the checking (the checking is

cheap) but the monopoly on the checking, and the monopoly persists because there is nowhere else to go.

An intermediary's premium can combine a real coherence fee with an extractable trust tax. Cheaper verification can shrink the tax without abolishing the work of composition or the rents protected by a chokepoint.

The empirical research program has already narrowed this claim. Its present evidence supports the coherence fee as a measure of disclosure and omission inside the tested receipt structures; it does not establish the fee as a general predictor of operational failure. The distinction remains useful, but its broader predictive reach is conjectural.

Notes

1. Lewis Tappan Papers, Library of Congress; Baker Library, Harvard Business School, "Buy Now, Pay Later: The Mercantile Agency". [back](#)

2. Federal Trade Commission, Fair Credit Reporting Act, current statutory text and agency summary. [back](#)

3. Bundesarchiv, Stasi Records Archive, "The Unofficial Collaborators of the MfS". [back](#)

4. Gemological Institute of America, "Man-made Diamonds: Questions and Answers". For the club's governance, see Bernstein (1992). [back](#)

Chapter 3: The Witness Protocol

The constraint is not that everyone must agree.
The constraint is that where your claims overlap
with mine, they must not contradict. Coordination
without consensus.

During the Second World War, Jean Leray was held at Oflag XVII-A in Austria. There he turned much of his attention from fluid mechanics to algebraic topology and developed ideas that led to sheaves and spectral sequences.¹ A sheaf, in the form relevant here, organizes information defined on parts of a space and specifies when compatible local pieces determine a global one.

The framework does not, by itself, prove anything about credit bureaus or autonomous agents. This book borrows it to model a narrower problem: records held in different systems, restriction rules for the fields they share, and failures to reconcile those shared fields. Henri Cartan and Jean-Pierre Serre developed the mathematics far beyond Leray's first formulation. The institutional analogy is ours.

Marta Alvarez has one life and three ledgers. Her state tax authority holds the number she reported on her return. Her em-

ployer's payroll system holds the number it paid her in wages. Her bank holds the number that actually arrived.

None of these systems is sloppy. Each has passed its audit. Each is internally coherent. Each is correct on its own terms. And yet they disagree about the same year.

The tax filing says \$82,000. The payroll registry says \$78,000. The bank statement says \$85,000. Each number has a provenance: a signed return, a W-2, a stream of deposits. None of the three numbers agree.

This mismatch does not live in any one ledger. It lives between them. It is exactly where automated enforcement now operates. A compliance agent does not know Marta. It knows contradictions. A discrepancy large enough to cross a threshold becomes a flag: enhanced review, delayed settlement, a provisional hold on an account used to pay rent and childcare.

Marta is a constructed case. Her figures and institutions are illustrative; the reconciliation problem is the object under examination.

Some gaps are innocent. The \$4,000 difference between tax and payroll might be weekend freelance income the employer would never record. The \$3,000 difference between payroll and deposits might be reimbursements or gifts. But a \$7,000 gap between what Marta told the tax authority and what the bank received could also be unreported income. Each ledger balances. Together they produce a contradiction that no one ledger can resolve, because no one ledger can see the whole.

In the chosen formalization, each database is a context, shared fields are overlaps, and restriction maps state how a record is compared at those overlaps. A compatible family of local sections glues when one global section restricts to each local one. Depending on the sheaf, cover, and coefficient structure, a Čech cohomology class can encode an obstruction to that gluing. A nonzero class then means that the particular local

data cannot be reconciled inside the model as specified. It does not mean that every real disagreement is topological, or that vanishing (H^1) establishes truth, justice, or even uniqueness.

In Marta's example, freelance income or reimbursements might supply the missing distinctions. Adding them changes the model and may allow the records to reconcile. The companion Bridge Problem paper constructs systems that pass their specified bilateral checks yet fail at multilateral composition; inside that construction, the failure is represented by a nontrivial cohomology class. This is a result about the defined test system. Applying the diagnostic to an institution requires empirical work: choosing the contexts and overlap rules, showing that they correspond to actual operations, and testing whether the proposed bridge repairs the discrepancy.

You do not need to carry the notation.

In plain language: where our records purport to describe the same thing under the same rule, they should agree or expose the reason they do not. That is weaker than consensus and stronger than two systems merely passing their own audits.

Institutional cascades are not hypothetical. In 2025, a sixty-six-year-old Philadelphia woman learned that she had been placed in the Social Security Administration's Death Master File after her insurance, bank access, and benefits were disrupted. SSA's inspector general later reported that 12,504 of the 5.6 million death records posted for that year, 0.22 percent, were subsequently determined to be wrong.² The figure is a low error rate for the database and a comprehensive failure for each living person it classifies as dead. Correction requires more than fixing a source record; institutions that acted on the old record must also receive and honor the change.

When Properties Degrade

A bill of exchange that Bruges merchants recognized in Barcelona carried all five witness properties simultaneously, each emerging from specific crises in commercial practice. What happens when individual properties fail is equally characteristic, and the modern world is full of the pathologies.

Binding without conditions: a medieval oath bound the swearer to an obligation, but the terms were often vague enough that a stranger, arriving years later, had no way to evaluate whether the oath had been kept. The swearer was identifiable. What he owed was not, or not in a form that permitted evaluation by someone who had not been present at the swearing. Modern open-data initiatives reproduce the inverse pathology: conditions without stakes. A government that publishes the criteria by which it makes decisions achieves transparency, and a citizen who reads the criteria can determine whether a particular decision conforms. But if no consequence follows from nonconformity, if discovering a violation produces nothing more than a public record of the discovery, the transparency is decorative. Visible rules that no one enforces.

Stakes without recourse produce what the Stasi archive demonstrated: punishment without correction. Subjects of surveillance faced consequences (denied education, denied travel, imprisonment) based on information they could not see, from sources they could not identify, through processes they could not contest. A system that punishes on the basis of uncontestable evidence is structurally indistinguishable from a system that punishes arbitrarily, because the subject has no mechanism for distinguishing the two. And composition without the preceding four: a global aggregator that pulls data from millions of sources without checking whether the sources are attributed, specified, staked, or backed by recourse merely

propagates unreliable assertions at planetary scale. Every extension of the chain multiplies the risk of undetected failure.

These pathologies compose in order. Strip away recourse and you get surveillance. Strip away stakes and you get a complaints bureau that accepts grievances and imposes nothing. Strip away conditions and you get a punishment regime whose subjects cannot understand why. Strip away binding and you get a rulebook that no identity is held to. Each degradation produces a recognizable institutional form.

Even systems that instantiate all five properties internally can contradict each other where their records overlap. The witness pattern does not settle the comparison rule. A sheaf model is one disciplined way to state such a rule and identify certain failures of composition; it is not the only possible formalism.

From Physical Witness to Computational Witness

A Florentine notary who drafted a bill of exchange in 1410 occupied a body that persisted through time. If the bill was dishonored, the injured party could find the notary in his office, in his guild, or in the court that had licensed him, and pursue recourse against a person who could not disappear. Identity was underwritten by physics: a body occupies space, accumulates reputation, and answers for its attestations because it persists whether its owner wishes it to or not.

A bank deploys an agent to evaluate mortgage applications. On a Tuesday morning in March, the agent reviews an application from a woman named Diane (employment records, credit history, debt-to-income ratio, property appraisal) and denies it. The agent's process terminates. By the time Diane receives the denial letter, the specific instance that evaluated her application

no longer exists. It has no office where she can appear, no guild membership to revoke, no body to compel into a courtroom. The notary's accountability rested on the persistence of his person. The agent's person does not persist.

What persists instead is a receipt: a signed, timestamped record of what the agent attested, what data it examined, what criteria it applied, and what conclusion it reached. The receipt is **binding**: it links the attestation to the agent's identity through a cryptographic key, surviving the agent's termination the way a notarial seal survived the notary's death. Without it, Diane has a denial and no trail back to the process that produced it.

The receipt also encodes **conditions**: the terms of the evaluation in a language that other processes can parse. A bill of exchange drafted in a Florentine notary's trained hand was inspectable by literate humans at human speed. The analogy has a boundary: a constitutional receipt is neither payable, transferable, nor a bearer instrument. It inherits the bill's portable conditions and route of recourse, not its negotiability. Diane's receipt, specified in a formal language, is inspectable by any process that can parse it, at whatever speed the hardware allows. If the terms required human interpretation before they could be checked, verification would operate at human tempo regardless of the medium's capabilities, and the asymmetry between machine-speed decisions and human-speed review would become the central constitutional problem. Machine-readable conditions are what prevent that asymmetry from becoming permanent.

Before the agent evaluated Diane's application, the bank deposited collateral against the attestation: a bond slashable if the evaluation is later proven to have violated its stated criteria. This is **stakes** made inspectable in advance: Diane can verify, before deciding whether to accept the denial, that sufficient collateral

backs the claim. Bonded collateral makes the cost of a false attestation visible before the attestation is relied upon.

Diane disputes the denial. The receipt specifies a mechanism for doing so: a forum, a timeline, a set of procedures she can engage with at human tempo. This is **recourse**, and the constraints on it are what separate a receipt regime from a surveillance regime. If the dispute is adjudicated at machine speed, producing a result before Diane can read the complaint she filed, the recourse is nominal. If it demands technical expertise she does not possess, the recourse is inaccessible. The forum must operate on terms the affected person can understand, in a timeframe she can act within. The notarial protest, a specific procedure physically enacted that produced a document with legal force, set the template. The computational version must meet the same standard or the receipt is decoration.

Finally, Diane's mortgage denial must be legible to other systems. This is **composition**. If the receipt agrees with what those systems record under declared overlap rules, it can join the larger record without introducing a contradiction. If it conflicts, the receipt should preserve the mismatch rather than silently choose a winner. Some mismatches can be repaired with bridging information; others reflect rival definitions, obsolete data, contested authority, or injustice and require adjudication.

One agent, one transaction, five structural requirements encountered in the order the transaction demands them. The properties are the same ones the Bruges merchants relied on. What has changed is the medium that must guarantee them.

The Cost of Coherence

Between Bruges and Barcelona in 1410, the coherence fee was enormous. Different currencies, different calendars, different legal systems, different measurement standards. Spanning that gap required a notary who could navigate both frames, a correspondent who maintained offices in both cities, a courier who could carry documents across borders safely. The infrastructure was elaborate because the boundary was difficult.

The relationship between overlap and cost is empirical, not monotonic. More shared fields can provide more opportunities for checking, but they can also create more conflicts, privacy exposure, and maintenance work. Marta's three databases overlap at income, payment, and deposit fields. Here the coherence fee means the labor and infrastructure required to define those comparisons, investigate discrepancies, and carry corrections through the participating systems.

Some checking becomes cheaper with automation; judgment, correction, governance, and access may not. The trust tax can therefore shrink, migrate, or grow. Nor does (H^1) determine a universal monetary minimum. Within the formal model it can describe a kind of obstruction. The institutional cost of resolving that obstruction depends on law, information, bargaining power, and the remedy available to the affected person.

The Seam

Marta's three databases were all tables: schema-bound, internally consistent systems that disagreed at their overlaps. The sheaf condition diagnosed the failure precisely inside the model: local coherence, global obstruction, a computable cost of repair. But Marta's case describes a world in which every system

speaks the same kind of language. Her databases disagreed about numbers, not about what a number is. Contemporary computation has rebuilt the merchants' problem in a more radical form: two regimes that produce fundamentally different kinds of claims, with the seam between them failing.

One regime has conquered the interface. Language models, embeddings, and generative systems make distant, unstructured information available at the point of decision. They retrieve, interpolate, summarize, and propose. Their outputs can also be grounded, tool-mediated, or constrained by external systems. Yet a fluent string does not carry, by linguistic form alone, the authority, provenance, or commitment status a downstream institution may assign to it. That is an interface hazard, not a theorem that learning systems can never participate in contracts.

The other regime runs much of the transactional infrastructure: systems that enforce schemas, reject malformed inputs, and preserve declared invariants. These systems are neither universally rigorous nor literally frozen. They are simply explicit about some distinctions and blind to others. Extending a schema, migrating data, and revising constraints takes deliberate work, whether humans perform it directly or authorize tools to assist.

Neither regime is coherent by nature. The danger appears when one system's output enters another under an unearned interpretation.

And the seam is widening, because strings are increasingly wedging themselves into tabular motifs. A language model's output is parsed as structured data and ingested by a database. An embedding (a point in high-dimensional space representing a word, a sentence, or an image as a vector of floating-point numbers) is stored in a column alongside integers and dates, as though proximity in embedding space were the same kind of fact as an account balance. Generated text is treated as a record.

A prediction is treated as an observation. At every point where the empire of strings feeds into the empire of tables, a claim carrying no binding, no conditions, no stakes, and no recourse is being composed into systems that assume all four.

The sheaf analogy makes one version of the failure precise once the truth conditions and restriction maps have been defined. If a generated claim enters a database as an observed fact, incompatible evidentiary statuses have been collapsed. The database can remain schema-valid while becoming epistemically wrong. The defect lies in the translation rule at the boundary.

The Bruges merchants' ledgers disagreed about exchange rates and calendar dates, facts within a shared ontology of commercial obligation. Strings and tables disagree about what counts as a fact at all. A bill of exchange could cross the boundary between Venetian and Florentine accounting because both sides agreed that an obligation was an obligation, however differently they denominated it. No equivalent agreement governs the boundary between a language model's probabilistic output and a database's schema-enforced record. The notary who bridged the gap between the two merchants had a protocol: the bill, the seal, the chain of endorsements, the conditions of protest. The boundary between strings and tables has no protocol, only ad hoc parsers and brittle pipelines.

Building that protocol (a witness structure for the seam between regimes that define truth differently) is the central engineering problem. It is also where the Quiet Foreclosure acquires its distinctive character in the current era. When foreclosure operates through probability shifts rather than discrete acts, the receipt regime's five fields (designed for table-operations with identifiable provenance) cannot attach to the harm. Each field presupposes a discrete event: an act to name, an authority to cite, bounds to state, a justification to examine, a path through which appeal can proceed. Continuous probability drift furnishes no

such event; no individual query adjustment crosses a threshold a receipt could capture. The structural obstacle is not enforcement but ontology: the five fields require a moment of exercise, and continuous foreclosure is defined by the absence of any such moment. The witness structure for the seam is the mechanism by which the receipt regime extends its reach into the empire of strings. It is not the only problem.

The Plausibility Problem

Cases like the following are now routine. A voice cloned from a few seconds of audio passes a bank's phone-based identity verification. A document synthesized with correct formatting, institutional letterhead, and no visible artifacts clears a due-diligence review. A video places a person in a location she has never visited, speaking words she has never said, and circulates for days before forensic analysis establishes the fabrication. Each capability has been demonstrated publicly by 2024; the specific configurations vary, but the structural point is stable: fabrication at a quality that defeats casual inspection is now cheaper than the inspection itself.

Fabrication has become cheaper than verification, and the gap widens with each generation of generative model. The challenge is structural, not primarily a problem of "misinformation" (a term that frames the issue as volume of false claims in public discourse): the five witness properties assume that binding is costly, that attaching a claim to an identity requires expenditure sufficient to make false attribution expensive. An endorser's signature on a bill of exchange was costly to forge because reproducing a specific hand required access to the handwriting specimen

and considerable skill. The cost of forgery bounded the risk of forgery, and that bound made the system tolerable.

When fabrication costs collapse, the bound dissolves. When any human attestation can be cheaply counterfeited, social trust loses its evidentiary value. The alternative is structural unforgability: cryptographic mechanisms whose security rests on mathematical difficulty rather than institutional authority. A cryptographic signature holds because reproducing it requires the private key, and obtaining the key requires either physical theft of a specific device or computation exceeding any adversary's resources. A zero-knowledge proof establishes that a claim is true without disclosing the evidence on which the claim rests, making verification possible without revealing the substrate that would enable counterfeiting. A tamper-evident log records events in a sequence that resists alteration: each entry is cryptographically chained to the one before it, and altering one entry would require recalculating the entire subsequent chain.

These mechanisms can reduce the trust required for specific operations, but they do not abolish it. A signature establishes control of a key under cryptographic assumptions; it does not establish the truth or justice of the signed claim. A zero-knowledge proof establishes a statement relative to a circuit, inputs, and proof system. Key custody, software, governance, and the mapping from world to data remain vulnerable to coercion, error, and capture.

The merchants are still at the table, and the ledgers still disagree. Cheap fabrication weakens evidence that once depended on costly imitation. Cryptography can protect attribution and integrity within its scope. The rest still requires institutions able to decide what the record means and answer for what is done with it.

A system that passes its specified bilateral checks can still fail at multilateral composition. In the formal model used

here, agreement on overlaps is the gluing requirement and certain obstructions are computable. If large-scale coordination remains reliable without attributable claims or an equivalent form of binding, the witness claim is wrong.

Notes

1. Jean Leray's first published use of **faisceau** appeared in 1946; see Leray (1946) and the University of St Andrews history of mathematics account, "The Grothendieck Mystery". The account supports the wartime chronology but not a claim about Leray's private motives. [back](#)

2. The individual case was reported by CBS Philadelphia. The national count and rate come from the Social Security Administration Office of the Inspector General, **Beneficiaries Incorrectly Recorded as Deceased** (2026). [back](#)

Chapter 4: Designed Forgetting

To be buried beneath ten tons of print each morning, to be told by your betters what the truth is, the truth that they have laboriously pieced together from the wrecks of documents — this is what free men must endure, and they endure it.

— Jacques Barzun, **The House of Intellect**

For most of recorded history, forgetting was the default. Parchment decayed. Witnesses died or moved or lost interest. Registers were destroyed in fires, floods, and wars, or simply misfiled in cellars that no one cleaned. The medium's mortality was the mercy that made institutional memory bearable. No one built it. No one had to.

In 1551, Margreth Auerhamerin was accused of witchcraft in the Prince-Bishopric of Eichstätt but did not confess under interrogation. The authorities expelled her from the bishopric. Once she crossed into a neighboring jurisdiction, her accusation record remained in Eichstätt's local archive. There was no mechanism for it to follow. This was not exceptional: in the imperial city of Rothenburg ob der Tauber, nine of forty-one individuals

involved in witch trials between 1561 and 1652 were banished, forced by court order to start fresh in another jurisdiction. In the fragmented Holy Roman Empire, with its hundreds of autonomous territories each maintaining separate court records, information stayed where it was recorded, accessible only to those who knew where to look and had reason to look there. The register did not have legs. This was not a design choice. It was a consequence of the substrate, as unintentional as the softness of vellum and as consequential.

She did not become innocent in the eyes of everyone who had watched the trial. Some neighbors would remember. Some would whisper. But whispers require mouths, and mouths can be tired, fearful, or unsure. In the next village, the accusation would have to be told again, and telling it would require someone willing to stake a reputation on it. The record stayed in the courthouse. Forgetting was not mercy. It was friction.

What Forgetting Required

When the medium no longer forgets on its own, when records are permanent, composable, and available to any system that can query them, forgetting must be designed. The juvenile record seal is the legal system's most deliberate attempt to reproduce, by conscious choice, what the physical medium once provided for free.

A court finds a sixteen-year-old guilty of a crime. Entered through process, supported by evidence, adjudicated by a judge, subject to appeal, the finding is real. Sealing follows: the institutional apparatus is commanded to behave as if something it knows to be true is no longer available for ordinary inspection. A court order can still unseal it, a safeguard against the possibil-

ity that sealing could itself produce injustice. But the default is obscurity.

The person who committed the crime and the person who stands before the employer are connected by biological continuity but separated by time, experience, maturation, and the possibility (which the legal system considers valuable enough to protect) that people change. Available regardless of subsequent behavior, the seal embodies a principle about the relationship between a record and a life: the record captures a moment, and the life exceeds the moment.

Bankruptcy discharge performs the same function for financial obligations. A debtor's failures are documented with full formality: schedules of assets, proofs of claim, hearings, judicial findings. The discharge does not erase them. It places a temporal boundary on their consequences. After a specified period, the record of failure can no longer deny credit, employment, or standing. Bankruptcy discharge is the financial system's mercy threshold: the point at which the system acknowledges that a person is more than the worst documented thing that has happened to her.

Article 17 of the European Union's General Data Protection Regulation extends the principle beyond criminal and financial domains to the general information environment. A person may request erasure of personal data under specified conditions, but the right yields to the public interest, particularly where the data subject holds public office or exercises public power. The asymmetry is deliberate and constitutional in spirit: those who wield authority forfeit the claim to obscurity in proportion to the authority they wield, while those who live private lives retain it.

These instruments share a structural feature more demanding than deletion. Designed forgetting is the presence of a record together with a constraint on its use, harder than erasure because the system must maintain two states simultaneously: the state in

which the information is known and the state in which the information is treated as though it were not. A sealed juvenile record still exists in the court's archives. A discharged bankruptcy still appears in certain databases. A "forgotten" search result may persist in its underlying source while vanishing from the search index. The system must behave contrary to what it knows, indefinitely, on behalf of someone it may never encounter.

The Portrait That No One Assembled

Over ten years, twelve documented events accumulate across seven institutional domains in the life of a single person. An emergency-room visit for a hiking injury (chart filed, insurance billed, visit unremarkable). A speeding ticket on an interstate, paid on time, fourteen miles over the limit, no points because the jurisdiction allows online mitigation. A mortgage application, approved at a favorable rate. A layoff during a company-wide downturn (standard separation agreement, two months' severance, not a termination for cause). A political opinion about municipal zoning, posted on social media, mildly controversial in the neighborhood, forgotten within a week. A condominium sale at market value. A tax filing, correct, on time, unremarkable.

Each event is locally innocuous. Each institution collected its own data for its own legitimate purpose and disclosed it to its own authorized parties. Now compose them. A system with access to all seven domains sees a person who visited an emergency room (health risk), was cited for speeding (risk tolerance), applied for a mortgage (financial exposure), lost a job (employment instability), expressed a political opinion (ideological signal), sold property (liquidity event, possible financial distress), and filed taxes at a specific income level. Each parenthetical flag

is defensible on its own terms. None of the underlying facts is false. But the composition produces a profile that no single fact contains: a quantified assessment of health risk, behavioral tendencies, financial trajectory, employment stability, and ideological orientation. A portrait assembled at the boundaries, in the systems that aggregated the disclosures, exceeding any individual system's jurisdiction.

The profile may adjust an insurance premium, decline a future mortgage application, rank her below a candidate whose composite looks cleaner, target advertising calibrated to an inferred emotional state, flag her for secondary screening at a border crossing.

She cannot see the composite, because no single institution holds the complete picture. She cannot challenge it, because each institution defends only its own fragment. She cannot outlive it, because the digital medium does not decay, does not lose interest, and does not move to a different city. When she applies for a job, the background-check service composes her employment history with the credit report and the social-media archive. When she applies for housing, the screening service composes the eviction record with income data and the criminal-background search. Each compositor assembles a different portrait from overlapping subsets of the same underlying records, weighting the fragments differently, and no two will produce the same picture. She is assessed as a collection of documented events whose interpretation belongs to the assessor.

She is followed not by a detective or a dossier but by a distributed record whose fragments reassemble wherever she presents herself to an institution that queries the record. Medieval parchment rotted, and a medieval exile could walk to another city and begin again. Her record does not rot, and she cannot walk far enough.

The gathering of those traces into a marketable profile is a kind of enclosure. The compositor performs real work, but the thing enclosed is a person's past, assembled into an asset that can follow her without her leave. Locke's proviso on appropriation required that enough and as good remain for others. Applied here, the remainder is room to become someone other than the assembled record. Designed forgetting enforces that margin. It permits records to serve defined purposes until their composition forecloses practical exit, then limits their reach. Public authority receives no parallel claim to become obscure, because the public remains entitled to know what was done in its name.

Five Operations

The five witness properties, implemented without a forgetting mechanism, produce this pathology necessarily. Composition without temporal limits is how a system that remembers everything becomes a system from which no person can escape. The cruelty is structural, the natural consequence of a protocol that provides no mechanism for a person to outlive the worst moment it has recorded.

Weakening the protocol is not the answer. A system that cannot compose claims across boundaries cannot coordinate at scale, and coordination at scale is the problem the protocol exists to solve. The same composition mechanism that enables surveillance of individuals also enables oversight of institutions. What is needed is directed composition: mechanisms that limit it when the claims are about persons while preserving it when the claims are about power.

Those mechanisms take five forms: the minimum architectural toolkit for a system that verifies comprehensively but does not remember vindictively.

Records of individual conduct carry a temporal boundary after which they are no longer available for composition. Her speeding ticket expires from insurance algorithms and employer background checks after a defined period; the record persists in a court archive accessible only by judicial order. Expiration withdraws it from the composable pool, not from existence, because circumstances may arise in which its absence would produce injustice. What expires is availability to automated systems that compose profiles across domains; the boundary varies with the severity and relevance of the event (a traffic violation sooner than a felony conviction).

Some records require stronger protection. A dismissed juvenile charge (if she had one) would be sealed: placed beyond the reach of ordinary queries while remaining available for specific, judicially authorized purposes. The system that stores it returns a null result to the employer, the landlord, the credit bureau: the query lacks authorization, though the record remains. Sealing operates at the protocol level, enforced by architecture rather than by the discretion of its operator.

Even unsealed, unexpired records can be constrained in how far they travel. Aggregation limits specify that no single system may compose records across more than a defined number of domains without explicit authorization from the data subject or a judicial determination that the composition is necessary for a specified purpose. Her twelve events across seven domains can each remain available to the institutions that created them without being composable into a single portrait by a system that has no relationship with the subject and no accountability for the portrait's consequences. The limit is structural, enforced by the protocol, because discretion yields to commercial incentive.

Separation prevents cross-context bleeding. Her hospital visit may not inform her credit score. Her political opinion may not inform an employment decision. Her traffic violation may not inform a medical evaluation. Separation is the informational analogue of the constitutional separation of powers: dividing the record into domains that cannot be reunited without authorization, because the reunification produces a portrait that exceeds any single domain's legitimate purpose.

And when an entire category of conduct no longer warrants consequences, amnesty operates collectively. A new administration determines that certain convictions were unjust, not because the convicted were innocent but because the law under which they were convicted has been repudiated, or because the passage of time has rendered the offense obsolete. Amnesty does not erase the past. It limits the past's jurisdiction over the future, for a category rather than an individual, as a political act rather than a judicial one.

These five operations are necessary but not sufficient, because each requires a public decision about when it applies. When should a record expire? When should a seal be applied? When should aggregation be limited, separation enforced, amnesty granted? Software can implement and inform those judgments. The constitutional requirement is that an answerable human institution own the rule, hear exceptions, and provide a remedy when the rule injures the person it was meant to protect.

Civic Asymmetry

The five operations share a principle that none of them names on its own. Each constrains what can be done with information about persons while leaving intact the composability of

information about power. Her medical record is separated from her credit score. A government agency's pattern of loan denials across demographic groups is not. Her political opinion is sealed from her employer's background check. A legislator's voting record is not. The constraint runs in one direction: toward opacity for persons, toward transparency for power.

Power must be transparent to those it governs, while persons must remain opaque to systems that cannot be held to account for how the transparency is used. This is civic asymmetry, and it is what separates a receipt regime from a police state. Both may use the same witness properties and achieve the same degree of composition. The difference lies in the direction of disclosure: a receipt regime exposes power and protects persons; a police state exposes persons and protects power.

Civic asymmetry also explains why the five forgetting operations are so difficult to implement in practice. Every operator of a composable record system faces a standing temptation: to extend the composition of persons (commercially valuable) while limiting the composition of power (institutionally threatening). Designed forgetting requires the operator to constrain the commercially valuable direction and preserve the institutionally threatening one, the opposite of what incentive dictates. The constraint must therefore be structural rather than discretionary, built into the protocol itself, because goodwill cannot be relied upon to limit power. A person whose record is forgiven only at the operator's pleasure lives under the operator's will; that dependency is unfreedom regardless of whether the operator exercises the power harshly or gently. Designed forgetting must be a structural guarantee rather than a discretionary gift.

Elena will stand before an arbiter who has her complete record and must decide whether it should determine the answer.

Hinge: What Witness Costs

A bill of exchange was small enough to travel in a belt pouch. One sheet could name the parties, amount, date, and place of payment; later forms could also carry the visible chain of endorsements on which recourse depended. The object was portable because the evidence needed to use it traveled with it.

The infrastructure behind the sheet was continental: notaries who could turn refusal into a protest a foreign court would recognize, correspondents maintaining offices across cities, handwriting specimens distributed in advance, couriers carrying the paper, and fair courts prepared to enforce it. Training, offices, transport, money changing, and adjudication all cost money. Merchants paid because claims that could survive distance and dispute were more useful than claims that had to begin again whenever they crossed a border.

Truth needs witnesses, and witnesses cost something. Medieval commercial institutions produced claims strangers could inspect at the lowest cost their materials and laws allowed. The price of a claim therefore included the price of making it portable, and whoever controlled that portability occupied a profitable position.

The question the first act left open is what that cost produces. Coherent records. Enforceable claims. The avoidance of fraud. It produced all three, but the deeper answer is **value**. A bill that could be verified was worth

more than one that could not. A ledger that balanced was worth more than one that only appeared to. A merchant whose correspondence network was dense enough to price risk across the Mediterranean could command a premium that a merchant operating on personal acquaintance alone could not touch. Verification became a factor of production: scattered, local, unreliable information was refined into actionable knowledge, and actionable knowledge into economic output. The coherence fee was the price of this refinement, and whoever controlled the refinement captured the surplus it produced.

When the cost of verification changes, the structure of value changes with it. The pattern has repeated at every technological transition. The printing press reduced the cost of reproducing text, and the guilds that had controlled manuscript production lost their monopoly. The telegraph reduced the cost of transmitting prices across distance, and the arbitrage opportunities that had sustained local brokers collapsed. The spreadsheet reduced the cost of financial modeling, and the analysts who had performed calculations by hand were replaced by analysts who could build models in an afternoon. Each time, the change in verification cost was less dramatic than the change in the institutions that depended on the old cost structure.

Act III asks what happens to the economic order when the cost of verification approaches the cost of fabrication. The approach is not uniform: checking collapses in price where the standard is given and the result can show compliance, and stays dear where the standard must first be constructed or the result cannot witness the work behind it. The collapse redraws the economy along that boundary; it does not lower every price at once. The same infrastructure that made the bill of exchange valuable is being rebuilt in computational form, at computational speed.

The question is not whether proof becomes cheap. It is who captures the surplus when it does — and who becomes sovereign when verification is no longer a choke-point.

Act III

Value Needs Work

Chapter 5: The Diamond in the Riverbed

All things are an exchange for fire, and fire for all things, as goods are for gold and gold for goods.

— Heraclitus, DK 22B90

Imagine a hunter close enough to a tiring gazelle that one more stretch of pursuit may bring it down. At the edge of a dry riverbed, light catches in a stone. If he stops, the meal escapes. He stops.

The stone is a diamond: carbon fixed under pressure into a lattice that will outlast him. It offers no food and little use as a tool. Carrying it back costs energy at the moment he has already spent most of what the hunt required. Yet he keeps it, accepting an immediate loss for the possibility that other people will recognize something in the object that the gazelle could never supply.

The choice does not prove that the stone will be valuable. Suppose the others glance at it and turn back to the fire. The expenditure remains real: the distance run, the meal surrendered, the burden carried home. The value does not appear. Work can produce a durable thing without producing a claim anyone else will

honor, just as labor can produce a machine no one needs or a model no one will use. The mud pie objection begins here, before money or markets enter the story.

Nor would later exchange allow the hunter to name his own price. Another person might want the crystal because it catches light, because it is scarce, because it can be carried without decay, or because someone farther away has already agreed to trade for stones like it. Those judgments belong to a social world the object cannot create for itself. Expenditure matters because the desired arrangement is costly to find, make, preserve, or reproduce. It does not compel desire.

The diamond nevertheless differs from a promise made of air. Its hardness, refraction, and lattice can be tested. The tests establish properties of the stone and may distinguish it from other stones; they do not establish who found it, how it reached the exchange, or what anyone ought to give for it. Evidence travels farther than the person who spent the effort, but it carries only what the evidence can show.

By taking the stone back, the hunter places a present sacrifice before a future audience. He is wagering that the object will survive, that its properties will remain legible, and that other people will continue to care. Capital begins in that separation between the time of expenditure and the time of recognition. The larger the separation, the more the claim depends on institutions capable of preserving ownership, testing properties, and carrying judgments from one exchange to the next.

Nothing in the crystal sets a price. Its future value depends on a social judgment: that it is rare, durable, and desirable, and that this judgment will persist long enough for the object to be exchanged. The hunter's choice is therefore a wager on recognition. Work is spent now for a claim that can be redeemed only through other people.

The imagined choice isolates the problem this act will follow. Expenditure may produce an object with durable properties, but value appears only when institutions and people recognize those properties and decide what they warrant. The stone can outlast both the choice and the chooser. Later capital forms will repeat that temporal asymmetry in less visible materials.

The Thermodynamic Succession

An economy carries the results of work forward in time. Physics sets limits on that carrying, but economics begins where people decide which configurations are useful, who may claim them, and what they will exchange for them. Energy is necessary to production; it is never a sufficient account of value.

The earliest forms arrested decay directly. A clay-sealed granary in the Fertile Crescent stores solar energy as carbohydrate bonds, but decomposition begins almost immediately. A sealed granary slows the process long enough for the year's harvest to bridge the gap to next year's planting, and that bridge (the capacity to carry work forward across a season) is the foundation on which settled civilization was built.

Once surplus can be saved, it can be counted, and once counted it can be claimed. Seals, tallies, scribes, guards: this institutional machinery, emerging independently in Sumer, Egypt, the Indus Valley, and China, appears because stored work that lacks institutional protection leaks away. Energy that is not guarded dissipates, through theft, spoilage, vermin, flood, or the quiet diversion of surplus by those who control access. Institutions are the immune system of stored energy.

Metal solved constraints that grain could not address. A stamped coin is portable where grain is immobile, durable

where grain rots, divisible where grain resists partition. When the kings of Lydia stamped electrum coins in the seventh century BC, they created an object that carried the claim of stored work across distances that moving physical commodities would have rendered uneconomic. A merchant in Sardis could hand a stamped coin to a merchant from Miletus, and the coin's metallic content, verifiable by weight and assay, substituted for personal knowledge. The coin did not eliminate trust. It reduced verification cost to the cost of weighing a small piece of metal, and the reduction was enough to enable coordination at scales that barter and grain-denominated credit could not reach. But coin traveled with the transaction. Metal is heavy, and the weight that guarantees its value also limits its range.

Credit broke the spatial bind. In medieval Venice, a written contract could pair a capital provider with a ship captain, money in one location funding risk and labor in another, because the courts of the Rialto made breach costly enough to substitute for physical presence. Promised future performance could fund present action; the enforceability of the promise was the mechanism by which capital could cross the Mediterranean without the merchant himself having to move.

Silos coordinate villages. Coins coordinate regions. Credit instruments coordinate empires. When the binding constraint shifts from preservation to transport to enforcement, the capital form that served the old regime becomes inadequate, and new structures crystallize around the fresh bottleneck.

England in the seventeenth century had built a commercial system of considerable sophistication: joint-stock companies, insurance markets, negotiable instruments, a banking infrastructure connecting London to the major trading centers of Europe. But the physical foundation remained organic. Wood for fuel, fodder for draft animals, crops for human labor: all drew on annual solar energy captured through photosynthesis, and the is-

land's population was pressing against that ceiling. E.A. Wrigley named this the organic energy regime. The economy's useful annual work was bounded by the solar energy the island's acreage could capture, and no institutional cleverness could raise the ceiling without accessing a different energy source.

Coal was not simply better wood. It accessed a different energy stock entirely: not this year's sunlight but the Carboniferous period's, compressed by geological processes over three hundred million years into seams of concentrated chemical energy that could be burned faster than any living system could regenerate. A single coal-fired steam engine could do the work of dozens of horses, and it did not need to be fed, watered, or rested. The capital investments that the new energy throughput made possible (the railroads, the mills, the foundries) required institutional forms that the guild system and the cottage industry could not provide. The limited-liability corporation, the factory system, the wage contract, the industrial union: each emerged as a solution to coordination problems that the new energy regime created.

Institutional forms changed. The physics beneath them did not. Wealth is ultimately the capacity to do work against entropy: to organize matter and energy into configurations that serve human purposes and to maintain those configurations against the universal tendency toward disorder. Financial systems create claims on this true wealth, denominated in currencies and recorded in ledgers and traded on exchanges, but the claims themselves are not wealth. They are promises, and promises can multiply faster than the physical flows required to honor them. When the divergence grows large enough, correction arrives through default or inflation or restructuring, all of which amount to writing claims down to match what the economy can physically deliver.

Factor Prime

A hyperscale data center draws power at rates that would have supplied a small city in the industrial era. One hundred megawatts is common for a single facility; two hundred is no longer unusual; facilities drawing five hundred megawatts are under construction. Electricity flows in through high-voltage transmission lines whose capacity was originally built for aluminum smelters and steel mills. Heat flows out through cooling towers or liquid-cooling systems that pump chilled water through channels machined into the server racks. Between the inflow and the outflow is computation: the organized transformation of electrical energy into structured information.

Inside those racks, transistors switch billions of times per second, and each state transition dissipates a small quantity of energy into the silicon lattice as waste heat. The thermodynamic ledger is exact and unforgiving. Every inference, every training batch, every parameter update is purchased with electricity and paid for in heat. There is no computational free lunch. Energy that enters the facility as electrons in a wire leaves as heat in a cooling stream, and the difference between the two (the work that the electricity did before it became heat) is the computation.

Training a neural network is a search through a parameter space of extraordinary dimensionality, measuring the model's predictions against an objective at each step and adjusting weights to reduce the error. Gradient descent provides direction, but the space is vast and complex. What crystallizes at the end of training, if training succeeds, is selected information: a configuration of parameters that performs a specified task more reliably than a random arrangement would predict, a

structure whose particular arrangement is improbable and whose improbability is the source of its value.

Once trained, the model can be copied at near-zero marginal cost and deployed millions of times simultaneously. But creation was expensive: computational work to search the parameter space, electrical work to power the search, physical infrastructure to generate, distribute, and dissipate the energy at scale. The model is energy and search, winnowed by selection, stored in weights. Like the diamond, its value derives from the improbability of its specific arrangement and the recognition that this particular arrangement, selected from the space of all possible arrangements by a process that cost real energy and real time, can do something that no random arrangement could do.

A diamond's observable properties can be tested: hardness, refraction, and lattice structure. Those tests establish properties of the stone. They do not establish its provenance, the labor conditions under which it reached the market, or the price anyone should pay; a synthetic diamond can share the relevant structure. A model can likewise be tested on a defined task, but the result establishes performance only on that evaluation and distribution. It does not prove who trained the model, how much work training required, whether the model was copied or distilled, or what the model is worth.

The stone did not prove its price. It proved the work.

But the analogy breaks where the economics diverge. A diamond cannot be copied. Its scarcity is geological and permanent. A trained model can be copied perfectly, at negligible cost, and the copies are functionally identical to the original. Scarcity resides in the process (the training run that cost millions of dollars and consumed megawatts of power) rather than in the artifact. Once the run is complete, the result can be distributed to anyone, and the distributor bears no cost beyond bandwidth. Fixed cost

of creation remains high and is not recoverable if the model fails to find a market.

Factor Prime is this book's name for a proposed economic lens: energy structured through computation and disciplined by selection. Energy matters because computation is physically bounded. Computation matters because the expenditure changes decisions rather than merely producing heat or motion. Selection matters because expenditure alone creates no economic surplus; most searches fail, and some technically successful systems produce nothing anyone needs.

Capital and labor, the two factors around which industrial economics built its entire apparatus of theory, measurement, and policy, are becoming routing decisions over a shared substrate. A dollar invested in training a model that automates a task converts energy into what classical economics would call capital (a durable productive asset). The same dollar invested in running that model to augment a human worker's output converts energy into labor augmentation. But the physical substrate is the same: electricity, silicon, algorithms. The distinction between capital and labor, which organized everything from tax policy to labor law to class politics for two centuries, becomes unstable.

The worker who loses her job to automation experiences something categorically different from the investor who profits from it. When a firm can reallocate compute from training to inference in minutes, shifting resources from capital formation to labor augmentation and back again, the factor distinction that Ricardians and Marxists argued about for a century becomes a slider on a dashboard.

Yet the physics is indifferent to the politics. A system that consumes megawatts and produces nothing anyone will pay for has participated in *Factor Prime's* physics without participating in its economics. The energy and computation were real. The structure that resulted may have been thermodynamically deep, rich

in the computational complexity Seth Lloyd defined as the minimum steps to produce the structure from randomness. But if no one will exchange anything for the output, the depth is a sunk cost and the structure is a computational mud pie.

A power plant's entropy production is coupled to a load that does useful work. A bonfire's entropy production dissipates into the night. A training run that produces a model people will pay to use is a power plant. A training run that produces a model no one wants is a bonfire. Thermodynamic signature identical. Economic outcome opposite.

What the Diamond Teaches

The diamond's lattice records a history of formation. Hardness, refraction, and adamantine luster let a trained examiner distinguish properties without taking the seller's word for them. Modern laboratories can establish much more, including whether a stone is natural or synthetic, but the inference always depends on a test, a comparison class, and an account of possible production routes. The lattice is evidence, not an oracle.

The stone can outlast the dynasty that mined it and the merchant who carried it. Its market value may not. Price depends on scarcity, fashion, control of supply, provenance, and the institutions through which buyers and sellers meet.

Monetary designs often seek a related property: evidence that cannot be altered cheaply by an issuer. Gold offers geological scarcity and chemical stability, yet it still requires assay, custody, and institutions of exchange. A diamond is not a purer currency; it is the clearer teaching object. Its properties can be inspected while its price, provenance, and justice remain unsettled.

A trained model admits the same limited form of inspection. Run it against a disclosed test set, measure the agreed quantities, and compare the result with the performance claim. The evaluation can refute that claim within its scope. It cannot prove training provenance or market value, and it cannot rule out a shortcut, copied weights, contaminated data, or a shift in the world beyond the test set.

But unforgeable structure does not settle the question of distribution. A diamond cannot be faked, but it can be hoarded. For the trained model, evaluation is available to anyone who performs it, but the model itself is available only to those who can access it, and access is controlled by whoever bears the cost of creation. Value therefore raises two questions: **how is it produced?** and **who captures the surplus?** The second is ultimately a question of governance.

Chapter 6: The Selection Gradient

The machines being of themselves unable to struggle, have got man to do their struggling for them: as long as he fulfils this function duly, all goes well with him.

— Samuel Butler, **Erewhon** (1872)

Armen Alchian offered a reframing of the firm that still feels like a corrective. Writing in 1950, he did not require firms to be rational, or even particularly coherent. He required only that markets be competitive enough to prune. A clumsy firm that blunders into a superior method will outlast a careful firm that plans an inferior one. Outcomes survive. Intentions do not. Richard Nelson and Sidney Winter extended the insight into an evolutionary account of economic change: firms as carriers of routines, habitual patterns that once worked well enough to escape pruning, modified through search containing luck, error, imitation, drift. Order emerges without omniscience, through the differential survival of routines that happen to fit the world as it is.

The previous chapter established that thermodynamic depth (the computational work required to produce a structure) is the entry fee to the economic contest. But the entry fee is not the

prize. Most training runs, judged by what anyone will pay for the result, are losses whose thermodynamic signatures are indistinguishable from those of the successes. Between expenditure and reward sits selection, the set of filters that decide whether coherence ever becomes surplus. Training can manufacture coherence. Only selection converts coherence into surplus.

A training run that produces a frontier model passes three nested filters before it earns the name. Gradient descent, cycling through parameter space at a pace measured in milliseconds, retains configurations that reduce loss and discards those that raise it. Because loss curves can be plotted and benchmark scores compared, this first stage receives the largest share of public attention. A model that achieves state-of-the-art performance on an evaluation suite detached from deployment reality has cleared the first gate, and the curves look beautiful all the way to convergence. Then the model meets the world. Real users with real problems adopt it, abandon it, route around it, or quietly stop relying on it. A code model that is imperfect on benchmarks but useful in the frameworks engineers actually work with survives; a translation system flawless in a language pair nobody needs does not. Deployment is where the market enters, as an attrition process indifferent to leaderboard rankings. Finally, investors, boards, and internal budget committees observe which approaches survived deployment and feed them more energy. Capital selection is the crudest filter and the most consequential, because it determines what is built next and what quietly disappears from the research agenda.

The filters do not add; they multiply. A structure that is internally coherent can still be rejected by deployment, and capital, arriving last and judging most roughly, decides which patterns the world will be forced to see again. The energy bill was paid either way. And the difference between a run that passes all three filters and a run that fails at any stage is the difference between

a factor of production and an expensive puddle of waste heat — the diamond and the mud pie.

The V/C Ratio

In the revenue-cycle office of a regional hospital, a prior-authorization request arrives for a proposed knee replacement. An analyst, or increasingly a system, checks coverage against policy terms, verifies eligibility, compares the procedure code with the coverage table, and issues a determination. Many inputs are structured: diagnostic codes, procedure codes, formulary lists, medical-necessity guidelines. Interpretive questions remain at the margins, but a large class of determinations can be checked against the same documents that governed the decision.

Down the corridor in the claims-resolution office, a different analyst sits before a surgical complication. The insurer must ask whether it was foreseeable, whether the team's response met the applicable standard of care, and how the costs divide between coverage and liability. Operative notes, nursing records, expert judgment, legal standards, and an unobservable counterfactual all enter the file. The comparison no longer reduces to a table lookup.

The contrast is not a ranking of intelligence. Both tasks involve trained work and ambiguity. They differ in the cost of checking an answer against an agreed standard.

Prior-authorization decisions can be verified against the policy terms by anyone with the relevant documents: the comparison is mechanical, the inputs structured, the review a matter of minutes. Claims adjudication can require chart review, expert consultation, legal analysis, and the reconstruction of causality

in a space where causality is contested; verification that routinely costs more than having a human adjuster do the original work. When the cost of checking the machine exceeds the cost of the human, automation creates no surplus, however capable the machine may be.

The *V/C ratio* is a sequencing heuristic for this difference. Within a defined domain, let *V* be the expected surplus from accepting a correct completion rather than using the relevant baseline, and let *C* be the marginal cost of validating that completion to the confidence the domain requires. High *V/C* makes substitution easier to justify; low *V/C* makes checking consume the claimed surplus. The ratio is not a universal law. Adoption also depends on liability, regulation, integration cost, data rights, capital already sunk in the old process, and whether errors can be detected before they compound. Its narrower claim is useful: when those conditions are held roughly constant, checkability often predicts automation order better than an informal ranking of cognitive difficulty.

Oliver Williamson's transaction-cost economics identified incomplete contracting, enforcement, and asset specificity among the forces shaping firm boundaries. *V/C* adds checkability to that account. Custom software may be easy to describe at a high level and expensive to validate against edge cases, scale, and adversaries. Commodity inference can be easier to compare when accuracy, latency, and uptime are measured against a stable benchmark. Firm boundaries can move where performance is inspectable and remain firmer where verification is expensive. Checkability supplements the older account; it does not replace the other reasons organizations internalize work.

Chess illustrates the extreme. Grandmasters spend decades developing intuitions about position, sacrifice, and timing, but the game has a mechanically checkable win condition. Code generation often follows the same logic when a test suite

captures the behavior that matters. Running tests is cheap; deciding whether the suite covers security, performance, and unanticipated use may not be. Automation is safest inside the part of the specification the tests actually witness.

Where verification is cheap, automation is competitive. You can switch providers because you can measure quality. You can refuse bad output because you can detect it. Where verification is expensive, automation becomes a different creature: a system whose output cannot be cheaply checked, whose errors cannot be cheaply detected, and whose users are therefore unable to discipline the technology through the normal mechanisms of market feedback. A legal memorandum generated by a model may be fluent, well-structured, and entirely wrong in its citations, and the cost of verifying the citations is the cost of a lawyer who reads the cases, which is the cost of having a lawyer write the memo from scratch.

And in the middle range, where verification is possible but burdensome, the most insidious pathology emerges.

The Competence Trap

A radiologist sits down each morning and opens the queue of images the system has flagged. In the first weeks she works as she has always worked, reading with care, comparing what she sees against what the model suggests, disagreeing when the model is wrong, catching what it missed. She is alert. She is practicing the skill that twenty years of training built. The system is usually right.

As agreement with the model becomes routine, disagreement becomes the rare event. A flag appears. She glances at the image,

finds the flag consistent with what she sees, and confirms. The department records faster throughput.

Something has changed that does not show up on any dashboard. She is no longer performing independent diagnosis. She is performing confirmation of the model's diagnosis, and confirmation is a different cognitive act, requiring less sustained attention, less of the slow muscular pattern recognition that distinguishes a competent reader from a great one. The skill atrophies: not in a dramatic failure but in the quiet erosion that follows from disuse, the way a surgeon's hands lose their precision during a long sabbatical, the way a musician's intonation drifts when she stops practicing scales. She understands the image less thoroughly than the system that flagged it. But she is the one who signs the report. She is the one who will be deposed if the patient's family sues.

Her signature has become a ceremony, a ritual performance of oversight whose epistemic weight has thinned to nothing without anyone noticing, least of all herself. Delegation has hollowed out the competence required to oversee the delegation. The loop has emptied the human of the skill the loop was supposed to preserve. And the pathology is invisible from within: the hospital sees faster throughput, the insurer sees lower costs, the radiologist herself sees a manageable workload. The only evidence that anything has gone wrong will be the error she would once have caught, arriving one morning in a study she approves in three seconds and a keystroke, producing a consequence that unfolds over months of misdiagnosis while her signature assures the world that a qualified human was watching.

This is the *Competence Trap*: delegation without maintained understanding. It appears precisely where the V/C ratio sits in a middle range: high enough that automation is economically justified, low enough that a human signature is still demanded.

Oversight becomes the justification for delegation and then becomes incapable of catching delegation's errors, because the oversight function has been converted into assent.

An institution that demands a human signature on automated output inherits an obligation it rarely acknowledges: the obligation to keep the signer competent to evaluate what is being signed. Periodic independent readings where the system's output is withheld and the radiologist must decide on her own. Audits that measure diagnostic accuracy, not throughput. Requalification that tests the skill the automation is displacing rather than the speed with which the human can approve its conclusions. Without these investments, the signature becomes an institutional fiction: an assurance to the patient, the insurer, and the court that a qualified human reviewed the image, when in truth a qualified human glanced at a screen for three seconds and pressed Confirm.

Attorneys sign AI-generated memoranda without independently verifying the cited cases. Financial auditors accept automated analyses without reperforming the calculations. In aviation, the automation paradox has been documented since the 1990s and has contributed to accidents in which the crew's first manual intervention in months was the one that occurred during an emergency. The pathology appears wherever verification is expensive enough to tempt the human into deference but not so expensive that the institution gives up on human oversight entirely. The middle range. The range where institutions pretend that someone is watching, and no one, in any meaningful sense, is. The trap reaches individuals and the pipeline that produces them. When agents perform the junior work through which future verifiers are trained — the associate's first brief, the resident's first unassisted read, the apprentice auditor's first independent check — the means by which verification capacity re-

news itself is severed. Human oversight becomes a depletable stock rather than a renewable flow.

What Verification Cost Predicts

Arithmetic automated first because a correct sum is immediately valuable and almost costless to verify: mechanical calculators made the point, electronic computers scaled it, spreadsheets domesticated it. Pattern recognition followed: optical character recognition, speech-to-text, image classification. These tasks are cognitively nontrivial, but their outputs can be compared cheaply against labeled ground truth that centuries of human practice left behind as an unintended subsidy to both training and verification. Filing clerks who typed index cards for library catalogs, court reporters who transcribed testimony, medical illustrators who drew anatomical plates: all produced labeled datasets as a byproduct of their work. The labels were never intended as training data. They became training data: examples of correct performance in standardized formats, mechanically comparable.

Medical imaging has attracted far more authorized AI devices than some adjacent diagnostic domains. Verification cost may explain part of that difference, alongside data availability, workflow maturity, reimbursement, regulation, and the cost of digitizing physical specimens. The comparison supports the heuristic only after those alternatives are considered.

Coordination is beginning to automate, and the V/C ratio identifies one line within the domain. Bilateral coordination with explicit terms can be mechanically checkable: did the delivery arrive by the specified date, was the quantity correct, did the payment settle at the agreed price? Multilateral coordination among

parties with conflicting objectives may add a contested standard, such as whether a reallocation was equitable. Bilateral cases are often easier to automate. The distinction is checkability, not the number of parties by itself.

Beyond coordination lies the setting of objectives. The *Specification Horizon* names the point at which the cost of making a purpose operational exceeds what the principal can state, observe, or afford to check. Better specifications can move that horizon. They cannot make every future circumstance available in advance, and no finite contract settles every dispute about what fidelity to a purpose required.

The V/C ratio illuminates why. Verifying whether an agent followed an instruction requires comparing the action with the instruction. When the instruction says deliver the cargo by Tuesday, '' part of the check may be cheap. When it says act in the client's best interest, '' verification requires reconstructing intent and arguing about a standard never fully articulated. The cost can exceed the value of the delegated act. Beyond that practical boundary, the agent may obey the encoded objective while departing from what the principal meant.

The structural parallel to the participation horizon is precise. One marks where governance cannot reach the governed: deliberation too slow for the decisions it must constrain. The other marks where delegation cannot reach the intent: specification too narrow for the purposes it must serve. Both are boundaries of the same constitutional problem: coordination outrunning the human capacities on which its legitimacy depends.

The hospital administrator from Act I operates at this horizon. The objective function specified aggregate patient outcomes but did not encode the weight she assigns to the third-floor ward serving single parents who cannot travel across the city. A more elaborate objective might represent some of that knowledge. The constitutional point is that the institution must still name who

may revise the objective when lived consequences expose what its designers omitted.

The Specification Horizon marks the V/C heuristic's limit. Where the standard itself remains politically or morally contested, a cheaper check cannot decide which standard should govern. The book assigns that decision to an answerable human institution—not because future machines are metaphysically barred from proposing purposes, but because coercive purposes require an author who can be questioned, overruled, and held responsible.

A corporation that sets the wrong objective for its agent fleet may not discover the error until consequences have accumulated. The quality of an objective often reveals itself through those consequences, on a timescale no verification procedure can abolish. Machines can propose purposes. Their adoption must remain reversible because the evidence needed to judge them may arrive only later.

Judgment persists because evidence for evaluating ends arrives through time, consequence, and the lived experience of what a purpose produces at scale. Computation can shorten analysis; it cannot make future evidence present. The constitutional role remains humanly attributable so that the institution choosing the end can answer while that evidence accumulates.

Energy structured through computation and disciplined by selection is the emerging factor of production. Within a defined domain, holding the named counterforces roughly constant, verification cost should predict automation order better than cognitive difficulty alone. Persistent inversions under those conditions, with lower-V/C tasks automating before higher-V/C tasks, would count against the hypothesis.

Chapter 7: The Bifurcated Economy

The existence of anything like a ‘firm’ in a specialized exchange economy can only be explained in terms of the costs of using the price mechanism.

— Ronald Coase, “The Nature of the Firm” (1937)

The Coasean Boundary

The modern theory of the firm begins with the cost of coordinating through markets.

Ronald Coase asked a question in 1937 that economics had been too busy with other matters to notice: if markets are efficient, why do firms exist at all? Every task should be coordinated through the market, every worker an independent contractor, the firm as an organizational form unnecessary. His answer was transaction costs. Using the market is not free. Discovering prices requires search. Negotiating contracts requires attention and legal skill. Specifying every contingency in a complex arrangement is prohibitively expensive. Monitoring specialized performance and enforcing agreements when someone fails to perform can cost more than the transaction is worth. When these

costs are high, hierarchies emerge: the firm absorbs the market's friction by replacing it with management, and the boundary of the firm sits at the point where one more internal coordination costs the same as one more market coordination.

Oliver Williamson identified the conditions driving transaction costs upward: relationship-specific investments, unforeseeable contingencies, repeated dealings that magnify every friction. For eighty years the resulting boundary has been the most consequential invisible line in capitalism. Inside the firm: hierarchy and employment. Outside: markets and competition. The entire apparatus of industrial-era politics (tax policy, labor law, corporate governance, the welfare state) organized around one side or the other, and both sides assumed the boundary would persist.

Agent coordination moves that boundary wherever a task can be specified, verified, and remedied cheaply. Elsewhere, the costs that gave firms their purpose remain.

The Dissolution

A stylized compute-routing trade isolates the conditions under which automation can compress search, negotiation, monitoring, and routine settlement. An agent posts collateral, queries a machine-readable market, accepts specified terms, checks performance against an encoded test, and settles under a rule chosen in advance. The numbers are illustrative; the conclusion depends on turnover, margin, collateral requirements, default risk, and the enforceability of the surrounding legal arrangement.

Several transaction costs Coase identified can fall sharply in a well-specified agent market. Price discovery and negotiation may become cheap. A reusable specification can be amortized,

monitoring may reduce to a test, and routine remedies may execute automatically. Other costs remain: capital, insurance, strategic behavior, cybersecurity, law, correlated failure, network effects, and the work of writing the specification itself. The prediction is therefore about moving firm boundaries, not an optimal firm size of one. Tasks with explicit terms and cheap performance checks can move into machine-speed markets while organizations retain the work whose risks must be pooled, governed, or interpreted.

A long construction project changes the calculation. Turnover slows, contingencies multiply, collateral remains tied up, and performance cannot be reduced to one encoded test. Relationship banking may reduce the collateral requirement because reputation and institutional recourse carry information the stylized protocol lacks. The contrast identifies a boundary condition, not a permanent division between human and agent finance.

Human coordination also becomes cheaper, but unevenly. Negotiation still bears ambiguity and conflicting interests; performance is variable and context-dependent; enforcement may require courts because facts and standards are contested. Agents can assist at each stage without eliminating the institutions that allocate risk and give judgments legal force.

The forecast is a *bifurcated economy* sharing one physical and legal world but operating at different tempos. Machine-speed markets expand where capital turns quickly and verification is cheap. Slower institutions remain where relationships carry information, consequences are embodied, and trust-free verification costs more than maintaining accountable human recourse. The boundary between them is the constitutional interface at issue.

The Topology of Value Capture

A credit analyst at a regional bank opens her queue and finds that the system has already scored the morning's loan applications. Each evaluation took milliseconds, cost fractions of a cent, and produced a probability: the likelihood that this applicant will default. The probability was generated in what might be called the sea: the vast layer of commodity computation where inference services, basic analysis, pattern matching, and routine coordination are abundant and cheap. Any sufficiently capable model can perform the task, switching costs approach zero, competition is fierce, and margins converge toward the cost of electricity plus amortized hardware plus a sliver of profit that shrinks as more providers enter.

But the probability becomes a human consequence only when the bank uses it to approve or deny the loan. That crossing (from computational output to lived effect) is the *membrane*, and the membrane is where value concentrates and power resides.

Below the membrane lies a competitive sea of computation. Above it sits an apex of infrastructure that is expensive to build and slow to depreciate: fabrication plants, fiber networks, energy systems, cooling, and physical sites. Physical barriers can make returns durable, though substitution, public investment, regulation, and technical change still alter who controls them. Software alone does not conjure a fabrication plant or a power grid.

Between the sea and the apex sits the membrane: the layer of credentials, licenses, authorization tokens, regulatory approvals, identity verification, and institutional gatekeeping that determines which computational outputs may cross from the digital into the physical. Where the score becomes the denial. Where the flag becomes the frozen account. Where the optimization becomes the price the consumer pays.

The membrane is where the trust tax concentrates. A credential (whether issued by a regulator, a professional body, a platform, or an algorithm) is a verification chokepoint. It certifies that the holder has met some standard, and the certification is required for access. The coherence fee embedded in the credential is real: someone must verify that the standard was met. The trust tax layered on top is the premium extracted for occupying the sole position that can issue it, and the premium persists as long as the credential is required and the issuer faces no competition.

In the industrial economy, the membrane was diffuse. A medical license in one state did not grant practice in another. A banking charter in one country did not confer privileges elsewhere. Fragmentation limited the rent any single issuer could extract. In the bifurcated economy, the membrane concentrates. A platform controlling identity verification for a billion users controls a chokepoint of unprecedented scope. A cloud provider issuing deployment credentials to agent systems controls which computations can run. A regulatory body certifying AI systems for use in a domain controls which agents may participate in that domain's economy.

Whoever controls the membrane between the agent economy and the human economy controls the conditions of human life. Agents may coordinate freely in the sea, producing surplus at machine speed. Infrastructure at the apex may be owned by whoever builds it. But the membrane is the constitutional interface: the boundary at which computational output becomes human consequence. If entities controlling the membrane are not accountable to those whose lives it shapes, the trust tax becomes a governance tax, and the governance tax becomes domination.

The Species That Buys Itself

A plough, a loom, a telescope: each extended a human capacity, each required a human to direct it, and none decided what to do.

An agent is different in a way that has no precedent. When a firm invests in training a model that will then coordinate with other models to produce economic output, it builds something that acts: that negotiates, commits, responds, adjusts, and produces outcomes through coordinations the investor may never see or understand. Return comes not from the investor directing the tool but from the tool directing itself within whatever bounds the investor specified, and the bounds are necessarily incomplete.

Humanity is investing in building its functional replacement for an increasing range of economic coordinations, spending accumulated capital on constructing a substrate that can coordinate without human participation. The replacement is cheaper, faster, and in many domains more accurate than the original. Each individual firm's investment is rational: the firm that automates coordination first captures the surplus slower competitors leave on the table. The aggregate effect is a species investing in constructing the substrate that will coordinate in its place.

A model becomes economically self-renewing when deployment surplus can finance its operation and eventual replacement. Whether that occurs depends on training cost, inference demand, competition, depreciation, financing, and the rate at which a successor makes the asset obsolete. The dynamic can reinforce investment without implying an autonomous organism or a guaranteed spiral.

Erik Brynjolfsson named one consequence of this dynamic the Turing Trap: the temptation to evaluate AI success by its ability to replicate human performance rather than complement it. Replication leads to substitution, and substitution displaces the

labor it was meant to assist. But the Turing Trap is a subset of a larger pattern. Even when automation creates new categories of human work (the reinstatement effect David Autor described), the new tasks may themselves be automatable at the moment of their creation, because the capabilities that generated the task are the same capabilities that can perform it.

The dynamic does not dictate one political result. Receipts can make consequential crossings inspectable, and fork rights can preserve bargaining power over the institutions that control them. Without those constraints, platform operators can turn dependence at the boundary into rent and unanswerable rule. The question is not whether human beings retain some metaphysically exclusive task. It is whether institutions preserve human standing when computational coordination becomes the cheaper route.

For three centuries, the economy's purpose was treated as self-evident: the coordination of human labor and capital toward the satisfaction of human wants. The bifurcated economy dissolves this assumption. The agent economy optimizes, but optimization is not purpose. It reduces loss functions, but a loss function is not a telos. The twelve claims and the constitutional architecture built upon them are not a description of what the computational economy does. They are a specification of what the computational economy must be constrained to serve, because left to its own dynamics, it serves nothing. It only runs.

The bifurcation is already under way. Its political consequences will depend on who governs the membrane where machine-speed coordination becomes a human obligation, denial, or loss.

Chapter 8: The Joule Standard

The ancient covenant is in pieces; man knows at last that he is alone in the universe's unfeeling immensity, out of which he emerged only by chance.

— Jacques Monod, **Chance and Necessity**

The Regression

Receipts can constrain power only if the record they rely on cannot be edited by the entity whose power the record documents. If receipts documenting exercises of authority are stored on a substrate controlled by the operator, the receipts inherit the trust dependency. A platform that controls its own audit log can edit the audit log. A receipt system whose integrity depends on the honesty of the entity being receipted is a performance of accountability that substitutes for the real thing.

Breaking the regression requires a record whose custodian cannot rewrite it alone. The design must specify the threat model, the resources an attacker would need, and who can exclude or censor participants. One candidate grounds revision in an exter-

nal expenditure that cannot be fabricated after the fact. Nick Szabo called the broader property *unforgeable costliness*.

The *Joule Standard* is the framework's proposal for that candidate: a settlement design in which rewriting accepted history requires fresh physical work. It does not follow uniquely from thermodynamics, and energy expenditure alone establishes neither decentralization nor legitimacy. The case for it is comparative: under the threat model developed below, the framework prefers a visible industrial attack surface to a financial one that may concentrate more quietly.

The Existence Proof

In a converted aluminum smelter outside Rockdale, Texas, rows of application-specific integrated circuits sit in steel shipping containers modified with industrial ventilation. Aggregate draw exceeds three hundred megawatts. The noise is the first thing a visitor registers: a sustained roar, mechanical and unvarying, produced by thousands of fans spinning fast enough across aluminum heat sinks to prevent the chips from destroying themselves. Inside, temperature hovers near forty degrees Celsius. Energy enters through transmission lines rated for steel-mill loads. Energy leaves as waste heat vented into the Texas sky. Between entry and exit, a computational search produces a number that satisfies a condition, and nothing else.

That number is a proof of work. Producing a valid block requires a probabilistic search; checking the result is cheap. The proof attests that enough hash trials were expected under the stated target, not the exact number of joules consumed by a particular miner. Hardware efficiency and energy source remain outside the proof. Nakamoto's construction showed how this

asymmetry could help maintain a bearer ledger without one custodian.

The critique that the process is wasteful is correct on its own terms and misses the structural point. The expenditure is the security function. Whether the price is worth paying depends on how much intermediation would otherwise be extracting.

One empirical fact matters for constitutional analysis: when a single jurisdiction in 2021 eliminated most of the global hash rate, the protocol did not stop. Difficulty adjusted, and the work migrated. Non-custodial survivability: the settlement layer's security did not depend on permission from any one state or corporation.

The Joule Standard

Heat is the exhaust of the security function. The security function is the settlement layer. The settlement layer is the substrate on which every receipt, every credential, every constitutional guarantee must ultimately rest.

The standard is measurable, but not directly in joules from the chain alone. A node can verify accumulated proof under the protocol's difficulty rules. Estimating physical energy requires assumptions about hardware and operating conditions. An attacker seeking to rewrite history must produce a competing history with sufficient work, and the expected cost rises as the accepted chain advances.

The Joule Standard does not require Bitcoin specifically. It requires that the settlement layer be grounded in a cost that cannot be laundered away.

Proof-of-stake offers a different approach. It sharply reduces the dedicated energy expenditure of consensus, though it does

not eliminate the energy or hardware used by the network. The resources freed can be substantial. Validators can run on commodity servers rather than application-specific mining hardware, and some PoS designs provide faster finality. Their security budget rests on economic value placed at risk rather than continuous external work.

These are not marginal improvements. For the transaction layer (the high-frequency, low-value commerce of the agent economy) the advantages are decisive. Speed, efficiency, accessibility, and proportional security serve the domain well, and a transaction layer secured by proof-of-stake is not constitutionally deficient. Most coordination does not require thermodynamic anchoring. It requires honest record-keeping at acceptable cost, and PoS delivers this.

The constitutional question sharpens at the settlement layer: the substrate on which receipts rest and from which the receipt regime's integrity derives. Here the relevant criterion is not efficiency but capture resistance, and the two mechanisms present different capture profiles.

Proof-of-work grounds security in thermodynamic expenditure: energy converted irreversibly into computational work. Capturing the network requires physical control of energy infrastructure (power plants, transmission capacity, cooling systems, manufacturing supply chains) distributed across jurisdictions and visible from satellite imagery. The attack surface is industrial and geographic. A state that confiscates mining operations within its borders reduces the network's hash rate; the protocol adjusts difficulty, and mining in other jurisdictions continues. This was demonstrated, not theorized: when a single jurisdiction eliminated most of the global hash rate in 2021, the network did not stop.

Proof-of-stake grounds security in economic cost: capital locked as collateral, destroyable if the validator violates protocol

rules. Capturing the network requires accumulating a sufficient fraction of the staking asset. The accumulation can proceed through market transactions indistinguishable from normal trading. Gradual purchases across exchanges, over-the-counter deals, lending arrangements that transfer voting rights without transferring on-ledger ownership. The attack surface is financial rather than physical, and financial concentration is harder to detect, harder to prevent through jurisdictional action, and subject to the accumulation dynamics financial markets have exhibited throughout their history. A validator cartel controlling a supermajority of stake controls the consensus, and the cartel's formation may be invisible until it acts.

A further asymmetry: proof-of-work's security depends on a resource (energy) that is external to the system it secures. Proof-of-stake's security depends on a resource (the staking asset) that the system itself produces. PoS proponents argue this is a feature: security scales naturally with the system's economic value. PoW proponents argue it is a vulnerability: a successful attack on the asset's value undermines the security budget, creating a reflexive spiral. Both observations are correct, and reasonable engineers disagree about which reflexivity matters more at the constitutional foundation.

Neither mechanism is unconditionally superior. PoS may be appropriate for many coordination layers, where efficiency, accessibility, and rapid finality matter greatly. For the highest-assurance settlement layer, this framework asks which form of control is harder to accumulate silently and concludes, provisionally, that a geographically dispersed industrial attack surface is easier to observe than concentrated financial control. The conclusion depends on actual mining concentration, energy markets, validator governance, client diversity, and the legal power of intermediaries; change those facts and the preference may change.

The constitutional requirement is narrower than the Joule Standard: the operator whose power is being recorded must not control the only editable copy, and the settlement design must make capture and revision expensive enough for the stakes. External physical work is the book's preferred implementation, not a result forced by physics. If another mechanism supplies comparable independence, censorship resistance, and visible capture costs with less expenditure, the recommendation should update.

A distinction between transaction and settlement layers clarifies the proposal. Fast, issuer-backed instruments may serve high-frequency commerce whose value does not justify the cost and delay of final settlement. They also carry issuer and freeze risk. A runtime cannot call counsel on its own behalf, but its deployer can and should remain legally reachable. The constitutional problem appears when an issuer can halt settlement while neither the process nor the affected principal has a timely, receipted path of review.

For surplus storage, high-value collateral, and the receipt regime's settlement substrate, the requirements are stricter. The design should resist discretionary dilution, provide finality without one operator's permission, and make retrospective fabrication expensive. Proof-of-work is the mature instance this framework selects for the highest-assurance layer. Other mechanisms contest each element of that selection, and the constitutional question is which capture, censorship, issuer, expenditure, and governance risks the layer can afford.

From Bills to Blocks

A Florentine merchant sending payment to a wool dealer in Bruges needed the transaction to survive a journey of six weeks across territories that shared no legal system, no currency, and no common language. The bill of exchange that crossed medieval Europe solved this by embedding three structural functions in a single sheet of rag pulp: each expensive in its medieval instantiation, each now available at orders-of-magnitude lower cost.

Handwriting specimens, distributed in advance by courier, allowed a receiving house in Barcelona to compare a signature against the specimen on file and confirm the match. Functionally, the specimen was a pre-shared key, and the courier network was a key-distribution protocol. The computational descendant is the cryptographic commitment: hash functions, Merkle trees, zero-knowledge proofs that allow claims to be bound, checked, and composed without trusting the claimant. A notary's seal bound a claim to a person. A cryptographic hash binds a claim to a computation.

An endorser who remained liable on a bill placed capital and reputation at risk. Default could travel through the chain, giving a signer with recourse exposure reason to examine the claim. The computational descendant is a scarcity rule whose violation is independently detectable and whose capture is costly. The Joule Standard binds that cost to physical work. Policy still governs the protocol, its clients, and the institutions around it; physics constrains the work but does not write the constitution.

And the Champagne fairs' settlement period (four days in which hundreds of bilateral obligations, in dozens of currencies, netted against each other) was a distributed consensus mechanism maintained by twenty-eight moneychangers and a corps of fair wardens whose authority was recognized across jurisdic-

tions. No single custodian held the master ledger. The computational descendant is the distributed ledger: a record maintained by a collective, making unilateral falsification require collusion on a scale that is economically infeasible rather than merely the corruption of a single operator.

Within the proposed design, each function answers a different risk. Cryptographic commitment supports independent checking. Scarcity constrains discretionary dilution. Distributed consensus limits unilateral custody and censorship. None proves justice, and other constitutional designs may satisfy the same functions differently. The claim is about the functions the proposal needs, not the uniqueness of this implementation.

What Energy Grounds

The imagined diamond was worth carrying only if others would recognize it later. A trained model is worth building only if its performance matters to someone who can use it. Both embody prior work and can outlast their makers, but neither converts expenditure into value without institutions of recognition, access, and exchange.

The diamond was simple to govern: whoever held it held the object. Computational coordination is different because the thing governed is a continuing process, not an object in a pouch. It can shape the terms on which people work, trade, speak, and move while remaining answerable to none of them.

Energy becomes computation, and computation becomes coordination that alters the conditions of life. The unsettled question is who may direct those conversions, who answers when they go wrong, who may contest them, and what happens when

the system produces a consequence that no one intended but everyone must inhabit.

Hinge: What Cost Does to Legitimacy

Every system of governance rests on an implicit claim about cost, a claim so deeply embedded in the structure that it is rarely stated and almost never examined. The medieval king could govern because the cost of raising an army was high enough that only those with vast landholdings could do it, and the landholders' interests could be bargained into a stable arrangement: military protection in exchange for taxation, loyalty in exchange for justice, obedience in exchange for the promise that the king's power would be exercised within limits that custom defined and force occasionally enforced. The democratic state could govern because administering territory required revenue, revenue required taxation, and taxation could be conditioned on representation. The state's need for money gave citizens bargaining power. The liberal market could coordinate because the cost of information was high enough that firms and intermediaries were needed to discover prices, match buyers with sellers, enforce contracts, and bear the risk of transactions between strangers. Those intermediaries could be regulated, taxed, and held to account because they occupied positions that were visible, territorial, and expensive to maintain.

In each case, the costliness of the governing function was the mechanism by which governance was connected to legitimacy. Costly governance created chokepoints,

and chokepoints created accountability surfaces: places where the flow of power became narrow enough that the governed could stand in the way and demand terms. A king who needed taxes could be compelled to grant a charter. A state that needed revenue could be compelled to permit a parliament. A firm that needed customers could be compelled to honor a contract. An intermediary who needed clients could be compelled to submit to regulation. The connection between cost and legitimacy was never automatic, never clean, never without violence and corruption and centuries of struggle in which the powerful resisted every constraint and the powerless died for the constraints they won. But the connection existed because costliness created dependency, dependency created the possibility of constraint, and constraint was the raw material from which constitutional order was slowly, painfully, built.

When the cost of coordination approaches zero, the dependency dissolves. An agent that coordinates with another agent at near-zero transaction cost does not need a firm to house it, a state to protect it, or an intermediary to connect it. The coordination proceeds directly, settled through protocol, verified computationally, producing consequences that may or may not reach the awareness of any human party. A supply chain reroutes itself. A pricing algorithm adjusts. A credit decision is made, communicated, and implemented before any human knew there was a decision to be made. The coordination is real. The consequences are real. The accountability surface has vanished, because the process that produced the consequences did not pass through any chokepoint where a human could stand and demand terms.

This is what cost does to legitimacy: when the cost of coordinating drops below the cost of governing, governance becomes optional for the coordinators and manda-

tory only for the governed. The agents coordinate freely while the humans bear the consequences of the coordination, and the consequences arrive without a face that can be petitioned, a body that can be constrained, or a decision that can be appealed.

The question that follows is not economic but political, and it is the oldest question in constitutional theory, restated in a medium that its original formulators could not have imagined. What constraints can be imposed on coordination that does not need permission? What accountability is possible for processes that terminate before any human can inspect them? What does freedom mean when the interference is real, the effects are severe, and the interferer is neither a person who can be confronted nor an institution that can be reformed, but a process that has already completed and moved on?

These are old questions in new form. Every constitutional tradition has grappled with the problem of invisible power: power that shapes lives without presenting a face that can be petitioned, a body that can be imprisoned, a decision that can be reversed. The feudal serf's labor was extracted by a lord who was at least visible. The factory worker's conditions were set by an owner who at least had a name and an address. What is new is that the invisibility is architectural rather than conspiratorial. No one is hiding. The process simply operates at a tempo and a scale that human perception cannot follow and human institutions were not designed to govern.

The bill of exchange made truth portable. The selection gradient made computation valuable. The bifurcated economy made coordination cheap. What minimum constitutional architecture makes coordination at machine speed compatible with human freedom?

Act IV

Freedom Needs Receipts

Chapter 9: The Silent Ledger

Guilt is never to be doubted.

— Franz Kafka, “In the Penal Colony” (1919)

The first act of sovereignty is not the sword. It is the entry.

Venice placed political membership in a register. The *Libro d’Oro* recorded the patrician families entitled to participate in the Great Council and hold the offices of the republic. After the closing of the council, inscription was more than description: it helped determine who could govern. Patrician standing also shaped marriage, reputation, and commercial advantage, though the register did not create every consequence by itself.¹

Venetian secrecy supplied a second instrument. The Council of Ten, created after the conspiracy of 1310 and later made permanent, kept closed archives and deliberated outside public view. Its members voted by ballot and recorded their outcomes. The internal procedure could be orderly and exact while the people affected by it remained unable to inspect the evidence, identify the decisive reasons, or answer them.

The point does not depend on an imagined clerk striking out a particular name. No such scene is reconstructed here. It lies in

the relation between record and standing: a public status could be settled through records and procedures that were authoritative precisely where the subject could not contest them.

That arrangement may possess binding, conditions, stakes, and composition. Names are attached to official acts, rules govern the office, consequences follow, and one entry alters several parts of civic life. Without recourse, those properties strengthen administration while leaving the governed person outside the account. A ledger may be meticulous and still be silent where legitimacy matters.

The comparison requires care. The *Libro d'Oro* was not an algorithmic score, and Venetian patricians did not discover its existence only when a payment failed. It belonged to a declared political order whose governing class was visible. The relevant resemblance is narrower. Once an authoritative record settled standing, other institutions could treat that standing as an input rather than a question. The office did not have to reopen the register's judgment each time a person sought to act. It could rely on the entry and proceed.

That is how a record acquires reach. No single line needs to contain every consequence. One institution reads it when allocating office, another when judging political membership, another when evaluating a marriage or commercial association. Each later institution may be applying its own rule. The original status travels through their reliance, becoming more powerful in composition than it was on the page. A person contesting the result must therefore do more than dispute one decision. He must reach the record from which many decisions have already taken their premise.

This is why recourse cannot be added as a final courtesy. If the record is already being accepted elsewhere, correction must travel at least as far and as fast as the original status. Otherwise the person may win at the source and remain excluded by

every downstream institution still acting on the old entry. A contestable ledger needs a way to expose the act, answer its grounds, bind the keeper to a decision, and propagate that decision through the same dependencies that gave the record force.

The silent ledger has a modern counterpart worth setting beside it: the act that never enters any ledger at all. In the compacts that have been sketched to govern machine computation, the designers' hardest problem is not what the meters record but the computation that never reaches a meter, the workload run on hardware no one declared. Each such design concedes the same limitation: what is unmetered cannot be governed, only estimated, because an absence cannot be verified. The Council's sealed box at least recorded that a decision had been taken; an unrecorded act leaves not even that trace.

The Same Architecture, Faster

The denial arrived without an author.

A transaction flagged, an account frozen, a credential revoked: a score adjusted past a threshold that was never disclosed. He learns only that something changed: not what triggered it, who decided it, under what rule, by what evidence, or what recourse remains.

Five questions that any accountable system must answer, and that the silent ledger refuses to answer. **What was done?** A notification, if there is one, says "account status changed" or "access adjusted" or nothing at all: the specific act unnamed, the grounds undisclosed. A person denied credit may not know whether the denial was based on income, history, a scoring algorithm's inference from behavioral data, or a flag transferred

from another institution. **Under what authority?** Terms of service run to forty thousand words, drafted for defensibility rather than comprehension, and somewhere in the document a clause permits what has been done: “suspicious activity” or “violation of community guidelines” or simply “our sole discretion.” **Within what bounds?** An action might be permanent or temporary, total or partial, reversible or irreversible; the affected person learns the boundaries by collision, discovering what no longer works. **By what justification?** Evidence that triggered the flag is not revealed, because revealing it might help bad actors evade detection: a genuine concern that produces a genuine injustice, the innocent and the guilty receiving the same silence. **Through what path of appeal?** A form exists. It accepts text. It returns an automated acknowledgment that commits to nothing. Weeks pass. If review occurs, it is conducted by the same system that produced the original decision. The appeal is a feature of the system, not a check on it.

The Venetian clerk’s pen and the scoring algorithm share an architecture: consequence without disclosed justification, administrative act that leaves no contestable trace. The old ledger exclusions left these questions unanswered by sovereign design: the Council of Ten chose silence because silence served the state. The new ones leave them unanswered by construction: the machine has no reasons it can be held to, only parameters it can tune. The verdict arrives, authorless and final, and the flagged becomes what the Venetian clerk’s pen made of the erased: someone who has not been found guilty of anything but has simply failed a predicate check she never knew existed.

The Asymmetry of Exile

A medieval exile could walk to another city and begin again. Power stopped at the walls. A man erased from the Libro d'Oro could leave Venice for Florence, for Genoa, for the eastern colonies, and in those places his name carried no stain because the register that had diminished him did not travel.

Digital exile faces a different geometry. Rails of modern life (payments, identity, communication, settlement, reputation) span all jurisdictions simultaneously. Exclusion is not the loss of one city but of the connective tissue of modern existence: the ability to receive payment, to prove identity, to transact at all. A person excluded from a dominant payment network cannot walk to a competitor, because the competitor often runs on the same rails and the exclusion travels with the identity, not with the geography.

And unlike the medieval exile, the digital exile cannot outlive the record. When Napoleon dissolved the Republic in 1797, the Libro d'Oro was opened and its power extinguished in a single political act. For five centuries that register had governed Venetian patricians; now it became a historical artifact, and families diminished by its entries could begin again in a world that no longer recognized its authority. There is no Napoleon for the digital register. No revolution that opens the database and declares its contents void. A flag raised in a moment of algorithmic suspicion persists indefinitely, attached to an identity that cannot shed its past, aggregated with other flags from other systems, producing a permanent diminishment that no passage of time and no change of circumstance can reverse. Distributed, replicated, backed up, cached: the fragments persist in systems the flagged person will never discover and cannot petition. This asymmetry between the mortality of persons and the immortality of records is the defining cruelty of computational gover-

nance, and the structural condition that makes a mercy architecture necessary.

Three Objects

A woman crosses a border carrying everything she owns. Her papers are suspect: the passport is from a government that no longer exists, or that no longer acknowledges her. Every database the guard queries returns doubt: unverified, flagged, pending review. In the language of the bureaucracy, she does not exist in good standing. In her own experience, she exists absolutely: hungry, tired, cold, waiting on a bench under fluorescent lights while a system decides whether she is real. The stone in her pocket is a diamond, small enough to have escaped every search, dense enough to constitute her entire portable wealth. It does not know what a border is. It does not know what a database is. The stone's relevant physical properties can be tested without reference to the holder. Whoever carries it needs no credential, no standing, no entry in anyone's ledger to offer it; its price still depends on finding a buyer. The diamond is the bearer asset that survives the collapse of every institutional claim upon the holder's identity.

A merchant in a city under trade embargo owes money to a correspondent across the line. Banks will not clear the payment; clearinghouses are under sanctions; correspondent banks have severed relations. The debt is real, documented, undisputed, but the infrastructure that would normally settle it has been weaponized. A bill of exchange, handwritten, folded twice, carried by a traveler who crosses the line on foot, settles a real obligation through a channel that the formal infrastructure cannot block, because the bill does not need the infrastructure. It

needs only a chain of endorsers who trust each other enough to accept the paper. The bill is the verified obligation that survives the collapse of the verification infrastructure.

A programmer in a country where speech is monitored holds a private key that corresponds to a public key registered on a distributed ledger. The key gives her the ability to sign messages that the network will accept as authorized, without any intermediary knowing her identity, her location, or her intentions. She can commit resources, publish attestations, and participate in coordination that no single authority controls. The key is the authorization that survives the collapse of the authorizer.

Stone, bill, key. Each preserves agency when the institutional framework that normally sustains it has failed. Each carries the principle that the person who holds it needs no one's permission to act. Independence that makes these objects valuable in the hands of the persecuted makes them dangerous in the hands of the malicious: a structural feature of any technology that operates without institutional mediation, not a design flaw.

Can the diamond's portable testability be combined with the notary's accountability? Can the bill's portability coexist with the fair warden's oversight? Can the key's privacy survive the receipt's transparency?

Notes

1. Frederic C. Lane, **Venice: A Maritime Republic** (1973), pp. 111–114 and 251–253, covers the Council of Ten, the closing of the Great Council, and the Libro d'Oro. This passage draws an institutional comparison; it does not claim to reconstruct a particular erasure, chamber, ballot, or subject. back

Chapter 10: The Kind Master Problem

Such a power does not destroy, but it prevents existence; it does not tyrannize, but it compresses, enervates, extinguishes, and stupefies a people, till each nation is reduced to nothing better than a flock of timid and industrious animals, of which the government is the shepherd.

— Alexis de Tocqueville, **Democracy in America**, Vol. II (1840)

Two Users

Two users of a digital payment platform. Both send money, receive money, access their account histories. Both are satisfied. Neither has experienced any interference from the operator. On a given Tuesday morning, their experiences are identical: the app opens, the balance appears, the transfer processes, the confirmation arrives. A researcher studying their usage patterns would find no measurable difference.

Their positions differ completely.

User A holds her own keys. Her funds sit in a self-custodied wallet whose private key she controls and whose backup she maintains. The platform provides a convenient interface, but the underlying assets remain under her cryptographic control. If the platform disappeared tomorrow (vanished from the internet, lost its domain, filed for bankruptcy) she could access her funds through any compatible application or through the raw protocol itself. The platform cannot freeze her account, because the platform does not hold her account. It provides a window; it does not control the room.

User B uses the platform's custodial service. Her funds sit in the platform's database, attributed to her in the platform's records but controlled by the platform's systems and subject to the platform's terms of service. At any moment, the platform could freeze her account, impose new restrictions, change the terms of service, require additional verification, or close her account entirely: for any reason, including no reason, because the terms grant it sole discretion over account status. It chooses not to. The platform is benevolent. Its customer satisfaction scores are high. Its policies are liberal. Its leadership speaks often and sincerely about user empowerment.

Is User B free?

The Republican Answer

Algernon Sidney stated the principle with a clarity that cost him his life: "To depend upon the Will of a Man is Slavery." He was executed in 1683, and the manuscript of his **Discourses Concerning Government** was used as evidence against him at trial: the

Crown arguing that his political theory was itself a form of treason.

Sidney drew on a tradition stretching from Roman political thought through Renaissance Florence to the English republicans, a tradition that understood freedom not as the absence of interference but as the structural absence of the capacity for arbitrary mistreatment, regardless of whether that capacity was exercised.

Philip Pettit restored this tradition as a systematic framework. Freedom as non-domination requires the structural absence of the capacity for arbitrary interference. A law that applies to all and can be contested through known procedures interferes with liberty but does not dominate. A benevolent master who could at any moment withdraw his benevolence dominates even when he never does, because the interference, when it comes, would answer to no check that the subject can invoke.

By this measure, User B is dominated. The platform's benevolence is a fact, but the structural capacity for its withdrawal is also a fact, and structural capacity is what determines freedom in the republican sense. User A is not dominated: the platform lacks the capacity to interfere with her assets. Their difference is not in their experience on any given day. It is in the structure of their relationship to the platform, and that structure determines whether they are free.

The Anticipatory Effect

Domination's principal weapon is the anticipation of punishment rather than punishment itself. A slave who has never been beaten is still unfree: she must organize her life around the possibility that the beating could come. She must monitor

her master's moods. She must anticipate his preferences, avoid displacing his good will. She must cultivate habits of deference that respond to the condition of dependence rather than to any specific threat. This labor of anticipation is itself an injury: a continuous tax on agency that operates whether or not the feared event ever occurs.

The republican tradition understood this with a psychological sophistication that modern political theory has struggled to match. A slave who is never beaten and a free laborer who works alongside her may perform identical tasks, but the slave's performance is colored by a vigilance the free laborer does not share. She watches for signals, reads expressions, adjusts behavior in real time based on what will keep her safe. The free laborer's continuation depends on the quality of her work (a condition she controls) rather than on the mood of a master.

This maps onto the platform context with precision. Users of opaque algorithmic systems must anticipate what will trigger adverse action: what posts will be flagged, what transactions frozen, what behaviors will reduce a score whose methodology is proprietary and whose threshold for action is undisclosed. Criteria are unknown: the systems are proprietary. Criteria change: the models are retrained. Users cannot read the rules they are subject to, and even if they could, the rules change at a cadence that renders any reading obsolete before the reader has finished.

A content creator on a platform whose moderation criteria are opaque must avoid what the platform currently prohibits, what it might prohibit in the future, and what its algorithms might classify as similar to what it prohibits. Creative and communicative space shrinks: not from what the platform has done but from what it could do, the anticipation sufficient to produce the shrinkage.

Tocqueville foresaw this precise pathology in the passage that opens this chapter. He described a power that "does

not destroy, but prevents existence; does not tyrannize, but compresses, enervates, extinguishes, and stupefies.” What he described was the gentle, encompassing tutelage of a benevolent administration that “every day renders the exercise of the free agency of man less useful and less frequent.” It provides for the citizen’s security, facilitates his pleasures, manages his principal concerns, directs his industry, regulates the descent of his property, subdivides his inheritance. What remains for the citizen to do? Tocqueville published this in 1840. He was describing a tendency he perceived in democratic societies. He could not have known it would find its most complete expression in algorithmic governance, where the tutelage is comprehensive and invisible, operating at a speed and a scale the citizen cannot perceive.

Domination Without a Dominator

The republican tradition assumed a dominator with will. The master chooses to be kind; the master could choose otherwise. The institutional remedy was to constrain the master’s will through constitutional architecture: mixed constitutions balancing the power of the few against the many, separated powers preventing any branch from accumulating enough authority to dominate, the rule of law subjecting the ruler to the same constraints as the ruled. Remove the structural capacity for arbitrary interference, and the slave is free regardless of the master’s character.

The coordination substrate emerging in the computational age has no will. Interference that shapes the user’s options is the emergent result of thousands of individually obedient processes, each optimizing within its narrow mandate, none intending the

aggregate effect. A credit scoring algorithm applies its criteria. A platform enforces its terms of service. A regulatory compliance system flags transactions matching its patterns. A recommendation engine adjusts content visibility based on engagement metrics. Each is locally correct: doing what it was designed to do, following its given rules, producing the outputs its specifications predict. System-level behavior, the aggregate effect on a particular person's life, is specified by no one. It emerges from the composition of locally correct behaviors, and the emergence is the locus of domination.

Domination persists despite the master's absence. Interference is real: the user's options are materially impaired, her behavior shaped by the anticipation of consequences she cannot predict or contest. Yet no single entity decided the outcome, no single will produced the interference, no single person or institution can be held accountable for the aggregate result. A merchant whose payment rail was severed was harmed not by any one system's decision but by the composition of decisions, each defensible in isolation, whose aggregate effect was the destruction of his livelihood.

Local compliance does not imply global accountability. A system of individually compliant components can produce outcomes violating every principle of justice and proportionality, because the composition of compliant components is not itself subject to any compliance check. Compliance is local. Harm is global. The gap between the two is the space in which domination without a dominator operates.

Dignity was never a default condition of coordination: it was a political achievement, expensive and contingent, maintained by institutional arrangements whose cost someone agreed to bear. Where the coordinating substrate changes, the agreement does not automatically travel with it.

The republican remedy (constrain the master's will) fails when there is no will to constrain. A different remedy must operate on the outputs of the coordination substrate rather than on the intentions of any participant, making the system's effects on individual persons inspectable and contestable. In many cases no one decided; the relevant inquiry is who bears the consequence and what mechanisms exist for the bearer to challenge it.

The Quiet Foreclosure

A small merchant who wants to accept payments without a major platform's intermediation faces not a prohibition but a cost: building the payment infrastructure, the compliance apparatus, the fraud-detection system, the customer-support operation, the regulatory reporting mechanisms, the banking relationships, the card-network agreements that the platform provides as part of its bundled service. She does not choose the platform because it is the best option among many. She chooses it because the cost of building the alternative from scratch exceeds the cost of submission to the platform's terms; and the gap between these costs is structural, the product of network effects, regulatory complexity, and economies of scale that make large platforms cheap and small alternatives prohibitive.

This is the Quiet Foreclosure: the elimination of alternatives through architecture rather than force. No law prohibits the alternative. No court declares it unavailable. No regulator issues an order. The alternative simply becomes impractical: the cost of independence exceeds the surplus it would provide. The merchant's choice is shaped by a structural dependency she did not create, the accumulated result of infrastructure investments,

regulatory requirements, consumer expectations, and path dependencies, each individually rational, each individually legal, whose composition forecloses the alternatives that would make her free. She is not forced to use the platform. She is foreclosed from not using it; and the difference between force and foreclosure is the difference between domination that announces itself and domination that is invisible even to the person it dominates.

Architectural force is invisible to a political philosophy that looks for interfering agents and, finding none, declares the person free.

The foreclosure operates through two mechanisms that deserve naming because they make the structural condition personal.

The first is *necromantic consent*: the animation of a dead agreement to authorize present coercion. The user who accepted the platform's terms of service three years ago gave real consent: to a specific service, under specific conditions, when alternatives existed at a cost she could bear. Since then, three things have changed. The person has changed: she has built a business, accumulated customers, developed dependencies on features that did not exist when she signed. The terms have changed: revised unilaterally fourteen times since her acceptance, each revision expanding the platform's discretion and narrowing her recourse, each revision accepted through the continued use that the platform's indispensability made unavoidable. And the platform has changed: acquiring competitors, integrating vertically, raising the cost of exit from inconvenient to ruinous.

The consent was real when given. It is no longer real, because three conditions have eroded it: temporal decay has dissolved the relationship between the original agreement and the present arrangement, contractual drift has transformed the terms beyond recognition while maintaining formal continuity,

and exit erosion has made the alternative that once backstopped the agreement prohibitively expensive. But the platform's lawyers do not need living consent. They need only the body. **She agreed.** The agreement is dead (the person, the terms, and the platform have each changed beyond recognition) but the corpse can be propped up and made to speak.

The second mechanism is *epistemic foreclosure*: the surrender of judgment for relief. The system offers to carry the burden of choosing: which products to buy, which news to read, which routes to drive, which candidates to consider for the job. The offer is ancient. What is new is the precision with which it can be calibrated to each individual's vulnerabilities and the completeness with which the surrender can be enforced once accepted.

The psychology is self-reinforcing. The driver who follows the navigation app's route for a year loses the cognitive map of the city. The analyst who accepts the model's recommendation for six months loses the facility for independent evaluation. As judgment atrophies from disuse, exercising it becomes harder: the driver without a cognitive map finds unaided navigation disorienting. The system's offer of relief then grows more valuable because surrender has made the relief more necessary. The competence trap of Chapter 6 is epistemic foreclosure at the professional level; the Quiet Foreclosure is its political-economic expression. The citizen who delegates political judgment to a curated information stream, the consumer who delegates taste to a recommendation engine, the manager who delegates evaluation to a scoring system: each exchanges the burden of judgment for the relief of delegation, and the exchange becomes harder to reverse as the capacity for independent judgment weakens.

Necromantic consent and epistemic foreclosure are the Kind Master Problem's endgame. The kind master dominates through the standing capacity for interference. Necromantic consent prevents the subject from invoking the original terms of the rela-

tionship because those terms have changed beyond recognition. Epistemic foreclosure reaches further: it displaces the very capacity needed to recognize the domination. The difference between convenience and domination is the difference between a delegation the subject can reverse at acceptable cost and one she cannot. By the time the loss of judgment becomes visible, reversal may already be impractical.

Domination without a dominator is a structural condition, not a metaphor. Local compliance does not imply global accountability. Quiet Foreclosure is the coercive form toward which computational dependence now appears to be converging. If a system composed of individually compliant components can be shown to produce no emergent interference, and if alternatives to dominant platforms can be built at costs that do not exceed the surplus they provide, these claims are wrong.

Chapter 11: The Receipt Regime

Ambition must be made to counteract ambition.

— James Madison, **Federalist No. 51** (1788)

The Principle

A system may coerce only via a receipt whose fields are minimally sufficient for contestation.

The word “minimum” matters. The regime does not aspire to make power benign or promise that every exercise of coercive authority will be wise or proportionate. It guarantees only that every exercise will be inspectable. You cannot contest what you cannot see, challenge what you cannot name, or appeal what was never recorded. The receipt converts invisible power into visible power: the only kind constitutionalism can govern. The five fields mirror at a constitutional level the five witness properties that govern truth.

Five Fields

A freelance translator receives a notification from her primary payment platform: her account has been restricted. She calls the support line. The agent reads from a script: "Your account has been flagged for review." What was flagged? "I'm not able to share that information." What review? "Our security team is looking into it." When will it be resolved? "We'll notify you when the review is complete." She hangs up and opens her laptop. The deposits are there but cannot be withdrawn. Her rent is due in four days. Her child's tuition payment is due in eleven days. She begins calling clients to arrange alternative payment. Two of the three clients use the same platform. They cannot help.

Five questions hang in the silence. Each corresponds to a receipt field, and each, when missing, produces a constitutional pathology that centuries of institutional theory have catalogued under different names.

Act: what was done. Not "account status changed" but the specific predicate that fired, the specific state transition imposed. A freeze is different from a restriction, different from a deprioritization, different from a flag, each with different consequences, different durations, different implications for the affected party's life. Without this field, the translator cannot evaluate whether the action was within the operator's authority. She is in the position of the subject of a **lettre de cachet**, the sealed letter by which the French king could imprison without trial, without charge, without disclosing the action taken. She knows she is constrained. She does not know how or why.

The naming requirement is disciplinary as well as informational: an operator that must name its act before imposing it must categorize the act, and categorization constrains future exercises. It creates a precedent the next affected party can cite.

Authority: under what rule the act was performed. Not a citation to forty thousand words of terms of service but the specific clause, the specific algorithmic threshold crossed. If the operator is unable to state the rule under which it acted in a form that a literate person can evaluate, the act was performed under discretion. Discretion unconstrained by articulable rules is the definition of arbitrary power. This is the pathology Montesquieu identified in the Ottoman sultanate: a power that acts at will, whose decisions are final because no one can determine whether a rule was followed. A rule that cannot be stated cannot be inspected, and a rule that cannot be inspected cannot be constrained. The articulability requirement converts **potestas** into **auctoritas** (raw power into legitimate authority) by requiring that power justify itself in terms the governed can evaluate.

For algorithmic governance specifically: a machine-learning model that produces a classification lacks the capacity to articulate the rule under which it acted. The receipt regime does not prohibit algorithmic decision-making. It requires that the human institution deploying the algorithm state, in human-evaluable terms, the policy the algorithm implements. An institution unable to do this does not understand its own tool, and should not be permitted to use it coercively.

Bounds: the scope and duration. Whether the freeze is total or partial, permanent or temporary, confined to one service or extended to all. Whether it reaches associated accounts, family members, business partners. Without this field, the translator must organize her life around the worst case. The English constitutional tradition developed the writ of **habeas corpus** precisely to address this pathology. The jailer must produce the prisoner and state the charges, including scope and duration, so the court can evaluate whether the detention is lawful. Bounds are the computational equivalent: they force the operator to state how

much power it is exercising, so the exercise can be evaluated for proportionality.

Disclosure must come at the time of the action, not discovered by the affected party through collision with the world, living through the harm before learning its extent. An operator that specifies “all services, indefinitely” when the triggering event was a single suspicious transaction has disclosed its own excess, and the disclosure is available to the arbiter.

Justification: the evidence or reasoning that triggered the action. The most contested field, because operators argue, with some justice, that disclosing evidence enables evasion by bad actors. The concern is genuine. The regime’s answer is calibrated transparency: full disclosure to an independent auditor, summary disclosure to the affected party, no disclosure to the public. Without this field, the translator confronts the Stasi configuration transposed from analog to digital: binding without recourse, conditions without transparency. The system knows why it acted, but the subject does not. Her protest is a cry into a void. The justification field converts the exercise of power from an assertion into an argument, and an argument can be examined, challenged, and overturned.

Appeal Path: the mechanism by which the affected party contests the action. Not a text field that accepts characters and returns an automated acknowledgment. A process with defined timelines, independent review by a party that does not work for the operator, and the power to reverse the action if the contestation succeeds. An appeal reviewed by the entity that took the original action is a request for reconsideration, structurally biased toward the original decision because the institution’s identity is invested in its correctness. The appeal path must operate at a tempo the affected party can engage with: if the action takes milliseconds and the appeal takes months, what exists is autopsy, not contestation.

The appeal path is also the field most reliably omitted, and platforms are not alone in omitting it. The most detailed verification schemes yet drafted for machine systems — designs that would meter computation itself, with instrumented networks and sampled recomputation — specify the record in engineering depth and leave what a party does with a contested verdict all but unwritten. The record is the part designers find natural to build; the appeal is the part that makes the record govern conduct rather than merely observe it, and it is routinely the part deferred. A regime that builds the first without the second has produced something close to the sealed ballot box of Chapter 9, only better instrumented.

Under the receipt regime, the platform issues a receipt at the moment of restriction. Act: outbound-transfer hold. Authority: Section 9.2.c of the Platform Operating Policy, triggered by the anti-fraud model, version 4.7. Bounds: outbound transfers suspended; inbound transfers, balance inquiries, and account history unaffected; duration not to exceed fourteen business days. Justification: three outbound transfers in forty-eight hours to recipients not previously associated with this account, each exceeding the velocity threshold for accounts with her activity profile; summary provided to the account holder, full model output available to the independent auditor. Appeal Path: contestation through the Dispute Resolution Portal within five business days; independent arbiter review within three business days; if unwarranted, the hold lifts immediately and the platform bears the cost.

The translator reads the receipt. She sees the restriction was triggered by three transfers to new recipients: payments to subcontractors she hired for a large project. She submits documentation: the project contract, the subcontractor agreements, the invoices. The arbiter lifts the restriction on the third business day. Her rent payment processes on time.

The restriction still happened. She still experienced three days of anxiety. The fraud-detection system still generated a false positive. What changed is that the false positive was contestable — she knew what triggered it, could evaluate whether the trigger was appropriate, and could submit evidence to a reviewer independent of the platform and empowered to reverse the decision. The receipt did not prevent the harm. It made the harm visible, bounded, and reversible.

Without the act, you cannot name the harm. Without authority, you cannot claim the rule was exceeded. Without bounds, you cannot measure proportionality. Without justification, you cannot detect pretext. Without appeal, you cannot distinguish governance from doom.

What the Receipt Attests

What the five fields actually establish deserves stating with care, because the regime's credibility depends on never claiming more. A receipt establishes the claim and the authority: what was asserted to have been done, under which rule, within which bounds. It does not, by itself, establish that the world matched the claim. An operator who writes "outbound-transfer hold, fourteen business days" has committed to a description that can later be checked against its conduct, and that commitment is worth a great deal, but the description is not the conduct, and a regime that forgets the difference has begun to mistake its paperwork for the world the paperwork reports on.

The world enters through the evidence the receipt pins, and here a quiet hierarchy governs the rest. The operator's own log, however carefully hashed and timestamped, is testimony: sworn early, sworn precisely, but sworn by the party whose conduct

is in question. A record held by an independent rail is harder to arrange. A document bearing a counterparty's signature is harder still, and a computation that any party can re-run from the recorded inputs approaches the condition of physical evidence as to the derivation, though the inputs it consumes remain only as good as their own anchors. The receipt's strength is the strength of its anchors — its grounding, to give the property its name — and where several anchors are needed before the verdict recomputes, the record is only as grounded as the weakest of them. Consider why the translator's appeal succeeded in three days rather than three months: the contract and invoices existed outside the platform and bore signatures from other hands, while manufacturing them after the fact would have required enlisting people beyond the dispute. The law has always favored such paper because forging it is dear. What she submitted were pieces of the world that had already passed through other hands.

The craft of the regime, then, is not the writing of receipts but the choosing of anchors the writer cannot forge. Where an action touches an independent system that keeps its own records, the receipt should bind to that system's record rather than to the actor's account of it, and where a harm has no ontology that any record can carry, Chapter 3 has already marked where witnessing runs out of ontology. Between those poles lies most of practical life, and there the receipt does two humbler things than proving. It compresses the dispute: the historically expensive layer of any conflict, the reconstruction of what was said and when and under whose authority, becomes checkable rather than merely arguable, so that what remains contested is narrow and nameable. And it routes the dispute: where an action passed through a chain of delegations, the receipts locate the seam where the divergence entered, and what would have been a circle of parties each pointing at the next becomes a question with an address.

The burden shifts and the assignment happens, but the record settles no one's account with the world.

Composed Acts and the Seam

A coercive act may be produced by several systems even when none contains the whole reason. A lending model supplies a score, a registry supplies a status, and a policy engine turns the combination into a denial. Each component may report its local operation accurately while the decisive convention lies between them: a category translated at one boundary, an inherited classification applied under a new rule, or a default that no component names because every component assumes it.

The receipt duty follows the act across those boundaries. Where the relevant conventions are declared in schemas, types, or published rules, the receipt should identify the seam and carry enough disclosure for an independent party to recompute the translation. "No component decided" is not an answer when the composed system used declared rules whose interaction can be surfaced. The record locates the divergence and the surviving principal remains responsible for the consequence.

The harder case is an operative rule that no component can state in contestable form. Opacity does not excuse its use. A rule that binds a person while existing nowhere the person or reviewer can inspect is secret law in computational form. The institution must either make the rule legible enough for contestation, substitute a reviewable rule, or refrain from using it for coercion.

The Bulla ActionReceipt implementation reviewed for this edition supplies a narrower engineering analogue.¹ Its action records what occurred, while `mandate.authority` and

mandate.bounds record ex ante authority and limits; diagnostic and evidence references carry the grounds and their grounding class; and remedy records challenge window, forum, and available cure. Those fields do not replace the constitutional five. They map Act to action, Authority and Bounds to mandate, Justification to the diagnostic and grounded evidence, and Appeal Path to remedy. Bulla also hashes conventions coined at a seam and distinguishes executable rules that can be recomputed from semantic rules that must be routed to an answerable forum. The constitutional argument is broader, but the names now meet without pretending the wire format proves justice.

Civic Asymmetry

The receipt regime operates under a governing principle: *civic asymmetry*. Power must be transparent to those it governs; persons must remain opaque to systems that cannot be held to account. The more authority you exercise, the more legible you must become. The less power you hold, the more privacy you retain.

The principle predates computation by centuries. When the English Parliament compelled the Crown to publish its expenditures while protecting the private papers of subjects from unreasonable search, it instantiated civic asymmetry in the language of its era. When the American Fourth Amendment prohibited warrantless searches while requiring that government proceedings be conducted on the public record, it drew the same line from the other direction. Transparency must flow toward accountability, and accountability attaches to the exercise of power, not to the conduct of private life.

Under current platform architecture, the asymmetry runs backward. Platforms know the user's transaction history, browsing behavior, communication patterns, location history, social connections, purchasing habits, and behavioral tendencies inferred from all of these. Users do not know the platform's decision rules, risk models, enforcement criteria, or appeal outcomes. East Germany's Ministerium für Staatssicherheit operated on the same principle: exhaustive files on the citizen's movements, correspondence, and associations, while the citizen had no access to the state's criteria for surveillance, no way to inspect her own file, no means of determining which of her neighbors had been enlisted to report on her conduct. Analog methods; digital methods; structurally identical informational architecture. That the business model is usually benign does not alter the analysis. Structures persist while motives change.

Civic asymmetry reverses the flow. Exercises of coercive authority (freezes, restrictions, score adjustments, content removals) become inspectable by those they affect and auditable by independent bodies. Private conduct remains private, beyond the platform's inspection except to the extent minimally necessary for the contracted service. A payment platform needs account numbers and transaction records. It does not need location, browsing habits, or social connections — and under civic asymmetry it does not collect what it does not need. Minimum necessary collection is not new to privacy law; what is new is its architectural enforcement. Civic asymmetry does not rely on the platform's compliance with a privacy policy it wrote and can amend. It relies on structural separation that prevents the platform from accessing data it has no legitimate need to possess.

Temporal Sovereignty

The five fields can be formally satisfied and substantively hollow. A process that freezes an account in milliseconds and offers an appeal that resolves in months has named the act, cited the authority, stated the bounds, recorded the justification, and identified the appeal path. Every field is filled. But if the harm is complete before the appeal begins, what exists is autopsy, not contestation.

Temporal sovereignty is the constitutional guarantee that certain decisions cannot execute faster than human deliberation allows. It creates zones within which coordination must slow to human tempo regardless of what is technically possible: structural requirements enforced by the protocol itself, not courtesy pauses imposed by benevolent operators.

Not all decisions slow. Most agent-to-agent coordinations proceed at computational speed because their consequences are contained within the computational domain — a supply-chain optimization reallocating inventory, a pricing adjustment responding to demand, a routing decision directing queries to the nearest server. Reversible, computational rather than embodied, requiring no human deliberation.

An automated system routes customer queries to support tiers, adjusting allocation as queue lengths change. A poor routing choice means a longer wait, and the next cycle can correct it. No constitutional receipt is required. The figures and deadlines in this example are illustrative. The same platform's fraud system freezes \$47,000 in a merchant's pending settlements, preventing payroll and supplier payments. That act crosses into embodied human consequence. At the crossing point, temporal sovereignty intervenes: the system issues a receipt, notifies the merchant, and observes a deliberation window before the freeze takes full effect. An operator seeking an immediate freeze

must invoke a declared emergency rule and obtain prompt independent review. That determination receives a receipt of its own.

What the Receipt Does

Tyranny is power that leaves no trace.

The receipt regime is a floor, not a ceiling. It makes power legible. A tyrant who must issue receipts can still be a tyrant, but not a silent one. Audit trails make patterns visible — a platform that freezes disproportionately many accounts belonging to a particular demographic produces receipts that disclose the disproportion. A state that exercises emergency powers beyond their intended scope produces receipts that disclose the scope creep. Receipts do not prevent abuse; they make abuse discoverable, and discoverable abuse is the only kind that institutions can correct.

The merchant whose payment rail was severed at the beginning of this book woke to a notification without an author. Under the receipt regime, he wakes to a document: the act named, the authority cited, the bounds stated, the justification summarized, the appeal path specified. The severance may still be wrong. The receipt does not make the system infallible. It makes the system answerable.

A system may coerce only via a receipt whose fields are minimally sufficient for contestation. No receipt, no legitimacy. If a system that coerces without receipts can maintain legitimacy at civilizational scale, this claim is wrong.

Notes

1. Mapping reviewed against repository revision 8f1e536, Bulla tree aa57a381a9cd55245e69015ebd62fe6e6ed52dc8, Bulla implementation version 0.43.0, and ActionReceipt schema 0.2. The pin describes the implementation reviewed for this edition; it does not make the constitutional fields part of Bulla's public wire contract. back

Chapter 12: Three Ways Receipts Fail

Words had to change their ordinary meaning and to take that which was now given them.

— Thucydides, **History of the Peloponnesian War**, III.82 (c. 400 BC)

A constitutional architect who stops at specification and does not test under adversarial pressure has built a monument, not a fortress. Constitutions fail in predictable ways. American warrant requirements were circumvented by “general warrants” that authorized open-ended searches before the courts specified what “particular” description meant. Magna Carta’s guarantee against arbitrary imprisonment was evaded by the Crown through the expedient of imprisoning subjects in locations where the writ of **habeas corpus** did not run. A universal pattern: requirement imposed; the constrained party complies in form while evading in substance; evasion detected and hardened against; new evasion innovated. The question for the receipt regime is whether its architecture permits the

detection and correction of evasion at a pace that keeps the regime meaningful.

Three failure modes, each drawn from documented failures in existing institutional systems: each succeeds against a naïve implementation, each can be hardened against.

Semantic Deception

A platform freezes a user's account. The receipt names the act: "temporary restriction on outbound transfers." Authority: "Section 14.3 of the Terms of Service, Suspicious Activity." Bounds: "restriction effective for 30 days or until review is completed." Justification: "pattern consistent with unauthorized access." Appeal path: "submit a review request through the Account Security portal."

Every field populated. Formally valid. The receipt lies. The justification is a template: the same phrase, "pattern consistent with unauthorized access," appears in ninety-seven percent of all freezes the platform issues. Drafted by a legal team to be maximally defensible and minimally informative, the phrase tells the affected party nothing about what triggered the freeze: whether it was a login from an unusual location, a large transfer to a new recipient, an algorithmic flag, or an error in the system's models. The justification has the form of an explanation without the content of one.

Semantic deception exploits the gap between syntax and semantics that every formal system contains. Constrained parties produce receipts that satisfy formal requirements while conveying no actionable information. Justification fields become repositories of pre-approved phrases, each technically responsive to the requirement and substantively void. Authority fields

cite the broadest possible clause, the one that covers everything and specifies nothing. Bounds fields state the maximum permissible scope “as a precaution,” ensuring that stated bounds are never exceeded because the stated bounds encompass everything. Receipts become form letters: formally compliant, substantively hollow, and indistinguishable from one another.

The technique has a precise institutional analog. When the United States government classifies a document, the classification stamp must include the authority, the date, and the declassification trigger: requirements imposed by executive order to prevent overclassification. The Government Accountability Office has repeatedly found these requirements formally satisfied and substantively meaningless: the authority cited is the broadest available category, the declassification date set to the maximum allowable period. The form is complete. The substance is hollow.

Hardening: the specificity floor. Statistical audit can detect template patterns: if ninety-seven percent of justifications use identical language, the language is a default, not a justification. But detection requires a structural fix: a formal requirement that each justification contain at least one element distinguishing this receipt from all others issued in the same period. The element need not be disclosed to the affected party; it can be disclosed to an auditor under seal. But it must exist. A justification identical across thousands of cases is a rubber stamp, and the specificity floor prevents the stamp from satisfying the regime’s requirements. The principle is the informational equivalent of the Fourth Amendment’s requirement that a warrant “particularly” describe the place to be searched: particularity prevents the warrant from becoming a general authorization.

Procedural Obstruction

The receipt is issued. The appeal path identified. The affected party submits an appeal.

Eleven weeks later, the appeal is denied. The account remained frozen throughout. Her rent was due in the second week. Payroll failed in the third. By the time the denial arrives, the harm is complete: the appeal was not a remedy but an autopsy conducted over the remains of a livelihood.

Between submission and denial, the machinery of process. The appeal enters a queue managed by a department understaffed (not by malice but by incentive structure), because the platform rewards revenue generation and dispute resolution generates none. A reviewer handling three hundred cases per week reads the submission, requests additional documentation, receives it, requests clarification of the documentation, receives the clarification, and forwards the case to a specialist team. The specialist team has a two-week backlog. The specialist reviews the case, determines that the freeze was imposed correctly under the platform's internal criteria, and denies the appeal.

The path exists. It is documented. It is staffed by people who process cases according to procedures that are, individually, unobjectionable. But the aggregate effect (the queue, the documentation request, the clarification, the referral, the backlog, the determination, the review of the determination) is that the appeal resolves long after the harm it was meant to address has become irreversible.

Procedural obstruction preserves the appearance of justice while destroying its substance. The English Court of Chancery, which existed to provide equitable relief, became by the eighteenth century a system so encrusted with procedural complexity that suits ran for decades: Dickens's **Bleak House** immortalized the Jarndyce case, which consumed the entire estate it was

meant to adjudicate. Any institution whose incentives do not punish delay will produce delay, because delay is costless to the institution and devastating to the party who needs relief.

Hardening: interim relief and deemed reversal. When an appeal concerns an action whose consequences compound, the default should be the least restrictive interim measure compatible with immediate safety. A complete freeze is suspended unless the operator persuades an independent arbiter that narrower measures would create greater harm. The burden belongs to the party exercising power.

The review clock begins only when a filing satisfies a published completeness test. The operator must identify any missing item within a fixed intake period and may not restart the clock through serial requests for material it could have named at the outset. Duplicate filings may be consolidated for administration, but consolidation does not extinguish anyone's standing or postpone the earliest valid deadline. One extension is permitted for unusual case complexity if an independent arbiter approves it in a receipted decision. Ordinary understaffing, backlog, or referral between internal teams never tolls the clock.

Timelines remain proportional to severity: a complete account freeze demands review within days, while a partial restriction may permit longer. If the deadline passes, the restriction is reversed until the review is completed. Deemed reversal makes delay expensive to the operator rather than to the affected party, while the completeness rule and independent extension prevent bad-faith or incomplete filings from turning every appeal into an automatic release.

Structural Capture

The receipt regime is implemented: auditors independent, appeals timely, receipts substantive.

Then the operator redesigns its architecture so that actions requiring receipts no longer trigger the requirement.

A platform that must issue a receipt when it freezes an account discovers it can achieve the same effect by adjusting the user's "trust score" to a level where transactions are deprioritized, delayed, or routed through additional verification steps that make the account practically unusable, without technically freezing it. Trust-score adjustment is not classified as a "coercive act" under the regime's definitions: the user experiences the same harm, and no receipt is issued.

Structural capture is the most dangerous failure mode because it attacks definitions rather than procedures: definitional arbitrage that exploits the gap between what the regime covers and what it was designed to cover. When American banking regulation imposed reserve requirements on commercial banks, the financial industry responded by creating money-market funds that performed the same economic function without meeting the legal definition of a "bank." When securities regulation imposed disclosure requirements on public offerings, the industry responded with private placements that raised the same capital without meeting the legal definition of a "public offering." In each case, the regulated entity preserved the economic substance while changing the legal form. The regulatory response was to redefine the regulated activity in functional rather than formal terms: a money-market fund that walks like a bank and quacks like a bank is regulated like a bank, regardless of what it calls itself.

Hardening: effects-based triggers and architectural audit. Static definitions of "coercive act" will always be outrun by

architectural innovation. The fix is an effects-based trigger: the receipt requirement fires not on the operator's classification of the action but on its effect on the affected party. A trust-score adjustment that makes an account practically unusable triggers the same requirement as a formal freeze, because the effect is the same. This tracks the principle behind the *Howey* test in securities law: legal determination depends on economic reality, not on the label the parties have attached. Second, an architectural audit: periodic review of the operator's system by an independent body with technical expertise and the authority to reclassify actions based on their effects. The arms race between structural capture and architectural audit is permanent. No static definition survives indefinitely against an adversary with the incentive and technical capacity to evade it. The hardening does not end the arms race; it ensures the race is fought on institutional terms rather than decided by default in the operator's favor. This permanence is a feature of any constitutional system that constrains power without abolishing it. The American Constitution has been amended twenty-seven times and reinterpreted thousands of times, because the balance between governmental power and individual liberty is not a problem that can be solved once and maintained forever. It is a tension that must be managed continuously, and the institutions that manage it (courts, legislatures, regulatory bodies, a free press) constitute the living constitutional order. The receipt regime requires the same kind of living institutional support, and the architectural audit is one of its central institutions.

Before the Three: The Unshared Regime

The three failures above share a premise: that the regime exists on both sides of the power relation, and that the contest is over its integrity. History suggests the likelier failure comes earlier, before there is a regime for the three to attack. It is a failure of adoption, not of the regime, and so it sits outside the taxonomy the claim at this chapter's close governs; it is recorded here because it is the precondition the other three depend on. Verification infrastructure is adopted by whoever it serves, at the pace their interests set, and the party with the most to gain from receipts about others is the party exercising power. A regime adopted on one side only is not a weaker version of the receipt regime. It is the regime's inversion: the operator holds recomputable records of every act of the subject, while the subject holds a form that accepts text and returns an automated acknowledgment. Each property functions as designed, but to the operator's advantage rather than the subject's. The Stasi archive of Chapter 2 was not a failed receipt regime but only half of one: the recording half was built, and the half that would have let its subjects answer back was not.

The hardening does not require waiting for symmetric adoption, which would be waiting forever. It requires a rule courts have applied for centuries: the missing record may testify against the party who should have produced it. Spoliation doctrine permits an adverse inference when a party destroys or suppresses material it was already bound to preserve. The receipt regime extends that logic only after an antecedent duty to issue or preserve a receipt has been created by legislation, regulation, contract, or a competent adjudicator. Neither the analogy nor the Bulla wire format creates that duty by itself.

Once the duty exists, an operator with the demonstrated capacity to issue receipts, who produces none for a contested act,

may lose the benefit of the doubt about what the missing record would have shown. The burden flips. Refusal then becomes evidence in a later dispute rather than a cost the operator can decline without consequence. Hospital charting spread on related logic: where the standard of care requires a record, an undocumented treatment may be treated as one not performed.

After the Three: The Captured Registry

Every failure this chapter has catalogued assumes, without saying so, that the operator of the receipt layer itself behaves. There is a failure waiting at the far end of the regime's success rather than at its beginning, and this chapter owes the reader its name. Suppose the receipts win. Every consequential exercise of power issues its record, the registries hold the accumulated conduct of every operator and every agent, and the institutions that once resisted the regime now depend on it. The infrastructure that holds every receipt has become the most valuable chokepoint in the economy it governs, and Chapter 2 supplied the name for what grows there before this chapter needed it: the trust tax, the premium collected not for the work of verification but for the exclusive position from which the work is performed. A receipt regime whose operator can collect that premium has not dismantled the pathology it was built against. It has re-housed it, behind better instruments. This is not a fourth failure outside the chapter's taxonomy but structural capture run to its terminal case — no longer a regulated operator slipping the regime's definitions, but the regime's own machinery becoming the thing worth holding. The identity is structural, not verbal: in both, an operator preserves the extractive substance while the regime's form stands intact, which is exactly the substance-over-label principle the effects-based trigger exists to catch.

The fairs of Champagne carried this lesson to its end. Chapter 1 told their story; what it did not dwell on is why the institution stayed honest for so long. It was never the wardens, and it was not the calendar of fairs itself, which rotated through four towns under one administration and offered a merchant no second sovereign to appeal to. The discipline lay outside: the fairs of Flanders ran their own circuit, and a merchant's custom could go there — as, in the end, it did, to Bruges and later to Geneva and Lyon. Scholars still argue over what the enforcement at Champagne really was — Milgrom, North, and Weingast modeled it as private order, reputation made enforceable by a judge any merchant could query, while Edwards and Ogilvie read the records as public administration that served all comers — but the ending is the same on either reading. After the county passed to the French crown in 1285 and Philip IV bent the fairs to his wars and his treasury, services once offered to every merchant as a matter of course became privileges granted and withheld as instruments of royal policy, and within fifteen years the custom was collapsing toward the circuits the crown did not control. The institution stopped answering to its users the moment it stopped fearing their departure.

Nor should the capture be imagined as an aberration that sound governance avoids. George Stigler's finding about regulation — that it is, as a rule, acquired by the industry it governs and operated for its benefit — was drawn from trucking routes and oil quotas, but it names a gravitational tendency in any body that stands between an industry and its obligations. A receipt regime that requires a virtuous operator has already failed. The serious question is what disciplines an operator whose virtue cannot be assumed, and the answer available to this architecture is structural, in three parts. The verdict of any receipt must be recomputable by whoever holds it, so that the checking itself cannot be taxed: a toll collects nothing on a road every traveler can

walk for free. The standing of any counterparty must be derivable from the published record, so that the operator accumulates no private score to sell back to its subjects, and what a captor inherits is customers who can leave. And the records themselves must travel with their subjects and verify against any registry that carries them, so that a registry that can be exited must behave, and the regime's participants keep what the merchants of Champagne held until the crown made leaving worthless: a departure the operator has reason to fear.

In cryptographic protocol design, the standard methodology is to specify the protocol, then subject it to adversarial analysis assuming an attacker who can intercept messages, forge signatures, replay sessions, and exploit any mathematical weakness. A protocol that survives this analysis is provisionally secure. A protocol that has not been subjected to it remains hopeful rather than secure. What distinguishes a serious constitutional proposal from a wish list is the proposal's relationship to its own failure modes: a proposal that acknowledges how it will be attacked and specifies how it will be defended takes power seriously. A proposal that assumes good faith does not understand what it is proposing to constrain.

C9. The proposal identifies three recurring failure classes — semantic deception, structural capture, and procedural obstruction — and specifies controls that can be tested against them. If a recurring failure falls outside those three classes, or if capture persists through the controls the proposal supplies, the framework fails. A receipt regime functions constitutionally only while capture can be detected and corrected before its procedures become ceremonial.

Chapter 13: The Constitutional Machine

When the legislative and executive powers are united in the same person, or in the same body of magistrates, there can be no liberty.

— Montesquieu, **The Spirit of the Laws** (1748)

From Receipts to Architecture

A small-business owner runs a catering company, collecting deposits through a payment platform. Her pattern is irregular: large deposits clustering before wedding season, bursts of refunds when a client cancels a large event, near-zero activity in January and February. The platform's fraud model flags the volatility as anomalous. A freeze is imposed. The receipt cites "velocity anomaly exceeding three standard deviations from the user's baseline."

She contests: signed contracts, the cancellation record, the seasonal pattern that no normalization will make look like a retail store's transaction history. The case reaches a bonded arbiter,

who lifts the freeze within two business days and records the seasonal note so future models can account for it. The algorithm could apply a rule. The penumbra required judgment.

Everything in that sequence required an architecture most platforms do not have. If the platform that issues receipts also writes the rules, enforces them through its own systems, adjudicates disputes through its own processes, and maintains the sole copy of every record, the receipt is a document produced by a system that answers only to itself. Formally correct. Fictionally accountable.

Separation prevents capture. Every constitutional tradition that has survived contact with ambitious rulers has arrived at the same structural insight: power must be divided against itself. The insight is empirical, derived from observation repeated across centuries and civilizations: concentrated power corrupts regardless of the power-holder's character and regardless of the institutional framework surrounding it. Montesquieu's separation of legislative, executive, and judicial functions formalized a lesson the Roman Republic, the Venetian Republic, the English constitutional settlement, and the colonial American experience had each taught in their own vocabulary: when the same hands make the law, enforce the law, and judge the law's application, the result is tyranny, and good intentions do not improve the tyranny.

Madison's "ambition must be made to counteract ambition" is a protocol design principle stated in the language of the eighteenth century. A system that must function correctly even when every participant acts in self-interest. A protocol that depends on structure rather than virtue, designed so that each ambition checks the ambitions that would, unchecked, become despotic. Madison was designing a consensus protocol for governance; Lamport was designing a governance protocol

for consensus. Both require correct results even when some participants are unreliable, self-interested, or actively malicious.

Four separations address four dimensions of the capture problem. Each corresponds to a specific concentration of power in computational systems, and each separation prevents that concentration from forming.

The Four Separations

When a platform writes its own terms of service and enforces those terms through its own moderation, content-removal, and account-restriction systems, it is legislator and executive in a single body. Terms of service are written to maximize discretion: the platform's lawyers know the platform will be the one applying them. Enforcement is calibrated to commercial interest; no external body will review enforcement for conformity to any standard other than the platform's own.

Rulemaking from enforcement. Rules governing a platform's exercise of coercive power are defined by a body that does not operate the platform: a standards organization, a regulatory authority, a governance council including representatives of users as well as operators. Enforcement is performed by the platform's systems but constrained by rules the platform did not write and cannot unilaterally change. The tension is productive: the rule-maker wants broad, principled rules; the enforcer wants specific, operationalizable rules; negotiation produces rules that are both.

A working precedent: the payment card industry separates setting interchange rules (performed by Visa and Mastercard) from enforcing those rules in individual transactions (performed by issuing and acquiring banks). The separation is imperfect (the card networks exercise more power over rules than ideal separa-

tion would permit), but the structural principle holds. An entity that processes a transaction is not the entity that wrote the governing rule, which means the rule can be challenged by pointing to a standard the processor did not create and cannot unilaterally amend. Applied here to coercive power over persons, where the stakes are proportionally higher and the need for separation proportionally greater.

Enforcement from adjudication. When a platform freezes an account and then reviews the appeal through its own internal process, it is reviewing its own decision. The review cannot provide the independence that meaningful adjudication requires. A reviewer who works for the platform, whose career depends on the platform's approval, who processes hundreds of cases per week, has neither the time nor the incentive to disagree with the system that generated the case.

Disputes about enforcement actions must be adjudicated by a body independent of the platform. An adjudicator who does not work for the enforcer, is not paid per-case in ways that reward speed over accuracy, and has binding authority to reverse the enforcer's decisions. Whether the adjudicator is a public body, a private arbitration service, or a bonded arbiter operating under the constraints described below, what matters is structural independence.

Identity from transaction. A system that identifies a user must not have access to the user's full transaction history, and the system processing transactions must not have access to identity beyond what is minimally necessary for the transaction at hand. This separation instantiates civic asymmetry at the architectural level, preventing the construction of comprehensive behavioral profiles by preventing any single system from possessing both the identity and the behavior of the same person.

A payment processor that knows who a user is and everything she has purchased can construct a portrait no single trans-

action reveals: dietary habits from grocery purchases, health conditions from pharmacy records, political affiliations from donations, social networks from gift purchases, emotional state from patterns of late-night spending. Each transaction is individually innocuous. Composition produces a comprehensive portrait that exceeds the jurisdiction of any single transaction. A processor that knows the user's identity but not the transaction details, or that knows the transaction details but not the user's identity, cannot construct the composite portrait without collaboration from another system. Collaboration can be prohibited, audited, and sanctioned.

Blinded credentials (cryptographic instruments allowing a user to prove she is authorized to perform a transaction without revealing who she is) implement identity-transaction separation at the protocol level. A user presents a credential proving she holds a valid account, that the account has sufficient funds, and that the transaction complies with applicable limits. If a dispute arises, the identity system that issued the credential can verify the holder's identity, but verification requires a specific legal process, not a database query.

The record from its custodian. If the platform that issues receipts maintains the only copy, it can modify, suppress, or destroy receipts without detection. Copies are stored across multiple independent custodians, each maintaining a copy that can be compared to detect tampering. Integrity is guaranteed by consensus rather than any custodian's honesty. Under the Joule Standard, the consensus mechanism is grounded in unforgeable costliness: altering the record requires computation exceeding the resources available to any single party.

Separation alone does not decide who sits in the separated bodies. A rulemaking council composed only of operators can be formally distinct from enforcement and still reproduce the operator's view of the world. Each standards body therefore in-

cludes standing representation for people subject to the system's decisions, selected through a mixture of election by affected constituencies, sortition from qualified pools, and reserved seats for independent civil-liberties, labor, and consumer organizations. Conflicts and material commercial relationships are disclosed; terms are staggered; no operator appoints the body it must answer to.

Human review also requires evidence that the reviewer can still perform the review. A signature is not a competence attestation. Arbiters and designated human reviewers must periodically decide blinded cases without the system's recommendation, publish aggregate accuracy and reversal data, and requalify on the skill automation tends to erode. The attestation records the test, date, domain, and issuing body. It does not certify infallibility. It prevents an institution from using a human name to dignify a decision no human remains able to examine.

Bonded Arbitration

Adjudication is the mechanism by which the receipt regime's appeal path becomes meaningful rather than ceremonial. An appeal reviewed by the entity that issued the original decision is a request for reconsideration, and reconsideration's structural dynamics are unfavorable to the appellant. The reviewer works for the organization whose decision is being challenged. Institutional incentives favor upholding the original decision. Reversing it implies the organization erred, and organizations are reluctant to acknowledge error.

The bonded arbiter is a human judge who operates under three structural constraints designed to produce independence without requiring virtue. The arbiter posts a bond (substantial

enough to create genuine financial incentive for impartial judgment) that is forfeit if the arbiter's decisions are found, upon review, to be systematically biased, incompetent, or corrupt. Not forfeit for individual decisions later overturned; forfeit for patterns demonstrating systematic failure. An arbiter overturned occasionally is exercising judgment in difficult cases. An arbiter overturned systematically is failing the function.

The arbiter's decisions are subject to appeal to a higher body that can review both the merits and the quality of process: a check on the arbiter that mirrors the arbiter's check on the operator. Operator's decision reviewed by arbiter; arbiter's decision reviewable by panel; panel's decision final unless a court exercises jurisdiction. And the arbiter's record of decisions is public, enabling statistical analysis over time. An arbiter who systematically favors operators, or who takes substantially longer to process cases involving certain demographics, produces a pattern that is discoverable and actionable. Public record turns the arbiter's performance into a reputation as inspectable as the merchant's reputation in the bill-of-exchange system.

These constraints serve a specific constitutional function: occupying the *penumbra*. Every rule system has edges where facts resist its categories or purpose and letter point in different directions. A computational system may analyze those cases and propose a disposition. The proposed order nevertheless requires an identified human arbiter to adopt, revise, or reject that disposition when coercive consequences are at stake. The requirement rests on answerability: someone authorized by law must be available to hear the particular case, give reasons, and bear review for the judgment.

That is why the arbiter is human in this design. The claim is constitutional, not a forecast that machines will never navigate ambiguity. The institution refuses to let final coercive judgment dissolve into a model, vendor, or workflow that cannot be sum-

moned. At the boundary between computational recommendation and human consequence, a named office must still answer.

Following the Chain

The soybean chain that follows is a worked example. Its parties, invocation number, quantities, and contractual terms are illustrative rather than a report of an actual dispute.

Return to the procurement agent from Act I (runtime invocation #4,471,882) that committed to 340 metric tons of Brazilian soybean meal and terminated two seconds later. The cooperative in Mato Grosso expects delivery. The family that made a tuition payment on the strength of that expectation does not know an agent existed, much less that it has ceased to. An orphan commitment demands an answerer. The constitutional machine must trace the chain until it finds one.

The chain: the procurement agent was invoked by a logistics platform. The platform delegated procurement decisions to an agent fleet operating under parameters set by a supply-chain optimization layer. The optimization layer was configured by a consulting firm that translated the client's business objectives ("maintain soybean meal inventory at 45 days of projected demand") into parameter specifications. The client is a livestock feed manufacturer in the Netherlands whose board approved the supply-chain automation initiative eighteen months ago. Between the board's approval and the cooperative's expectation lie six layers of delegation: board to management, management to consulting firm, consulting firm to optimization layer, optimization layer to agent fleet, agent fleet to individual agent, individual agent to commitment. Each layer can truthfully describe

its own contribution. None authored the commitment. All contributed to the chain that produced it.

The receipt regime applies at every link. The agent's commitment generates a receipt: act (purchase commitment for 340 metric tons at specified terms), authority (delegation parameters from the logistics platform, traceable to the optimization layer's configuration), bounds (maximum commitment value, quality specifications, delivery window), justification (price comparison against fourteen alternatives, inventory projection, quality score), path of appeal (dispute resolution protocol specified in the agent's deployment contract). The receipt does not prevent the commitment. It makes the commitment's provenance inspectable.

When the family in Mato Grosso does not receive payment (because the logistics platform's treasury agent has reallocated funds in response to a market shock the procurement agent did not anticipate), the receipt chain traces the consequence to its origin. The cooperative's agent presents the commitment receipt. The logistics platform's treasury agent presents the reallocation receipt. The two receipts conflict: one promises payment; the other documents the diversion of the funds that would have paid it. A bonded arbiter reviews the chain.

The arbiter's judgment turns on the delegation parameters. Did the procurement agent operate within its authorized bounds? The receipt shows it did. Did the treasury agent have authority to reallocate funds already committed? The deployment contract says no: committed funds are escrowed until delivery confirmation or dispute resolution. The treasury agent's reallocation violated its own bounds, and the receipt documents the violation. The arbiter orders restoration of the committed funds and records the violation in the platform's public audit trail.

But the arbiter cannot stop there, because the violation reveals a design flaw rather than a malicious act. The treasury agent's parameters permitted reallocation of "uncommitted reserves," and the boundary between committed and uncommitted was ambiguous in the parameter specification: the consulting firm's translation of business objectives left a gap that the optimization layer exploited under stress. The arbiter's written decision names the gap, and the decision becomes part of the public record that informs future parameter specifications. Precedent accumulates. The constitutional machine learns.

The surviving principal (the Dutch feed manufacturer whose board authorized the delegation chain) bears the ultimate accountability. Not because the board foresaw this specific failure, but because the board is the persistent entity at the chain's origin, the one that can be found, the one that chose to delegate. The board did not author the commitment. The board did not violate the bounds. But the board deployed the system, and when the system produced an orphan commitment that harmed a family in Mato Grosso, the board is the entity that answers, not as punishment but as the structural consequence of having initiated a delegation chain whose terminus it could not control.

The soybean case is tractable because the chain is short enough to trace, the receipts are clear enough to adjudicate, and the surviving principal is identifiable. Longer chains across jurisdictions may end at an insolvent, dissolved, or strategically remote entity. Traceability can expose that failure; it cannot collect a remedy from an empty shell.

Six mechanisms turn the surviving principal from a moral label into a proposed liability system. First, deployments above a politically set threshold register a legal person and post a bond or maintain insurance as a condition of market access. Second, primary liability follows the party that set the objective and deployed the agent rather than settling automatically on

the nearest human operator. Third, insurance pools make valid claims collectible when one principal cannot pay, with experience rating that raises the price of repeated adverse receipts. Fourth, smaller deployments default to a named natural-person principal; larger corporate principals disclose a responsible officer. Fifth, allocation rules connect the place of harm, the jurisdiction of registration, service of process, and a forum that does not leave the injured party trapped by the principal's preferred venue. Sixth, orphan-commitment rules make the pool the payer of last resort while preserving recovery against any principal later found.

These mechanisms allocate an answerer; they do not solve every case. Capability thresholds, bond amounts, pool governance, indemnity among vendors, conflicts of law, and the treatment of open-source or genuinely decentralized deployments remain political and legal questions. Nor may the regime place nominal strict liability on a thinly capitalized shell and call the chain constitutional. The test is practical: someone remains identifiable, reachable, competent to respond, and backed by assets or insurance sufficient to make a remedy possible.

The delegation chain demonstrates what the constitutional machine adds beyond the receipt regime alone. Receipts make the chain visible. The four separations prevent the platform from being both enforcer and adjudicator of its own violations. Bonded arbitration provides the independent judgment that resolves the conflict between competing receipts. And the fractal polis (the structure the next section describes) ensures that the same architecture operates at every scale, from the global settlement layer that records the commitment to the local cooperative whose livelihood depends on its fulfillment.

The Fractal Polis

Constitutional structure repeats at every scale rather than requiring a single global implementation. Every coordination substrate exercising coercive power over persons implements the receipt regime, the four separations, and bonded arbitration within its own jurisdiction. The result is a *fractal polis*: constitutional structure at every scale, from the global settlement layer to the local community platform, each scale governing itself subject to the minimum requirements the receipt regime imposes.

At the global scale, the settlement layer operates under the Joule Standard: tamper-evident, distributed, grounded in unforgeable costliness. Receipts recorded here are permanent and inspectable by anyone who can access the protocol. It does not adjudicate. It records, providing the shared substrate on which all other layers can verify that a receipt was issued, unaltered, with a reliable timestamp.

Jurisdictions at the national or regional scale implement the receipt regime through legislation and regulation: standards for receipt fields, requirements for independent adjudication, penalties for non-compliance, qualifications for bonded arbiters. Jurisdictions may differ in details: one may require disclosure of the justification field to the affected party; another may permit disclosure only to an auditor under seal. One may mandate interim relief in all cases; another only when severity crosses a threshold. Variation is legitimate as long as the constitutional floor is met: the minimum is the receipt regime, the variation is the political negotiation above it.

At the platform scale, each platform exercising coercive power implements the four separations within its own architecture, subject to jurisdictional audit. Platform receipts recorded

on the settlement layer enable cross-platform audit and the detection of patterns no single platform's records would reveal.

Smaller coordination substrates (cooperatives, decentralized autonomous organizations, local governance bodies) implement the regime at their own scale with requirements proportional to the power they exercise. A local artisan cooperative managing a shared marketplace for thirty members needs a receipt regime for decisions to accept or remove members, but the bonded-arbiter mechanism can be a three-person panel of respected community figures rather than a professionalized adjudication body. A neighborhood mutual-aid network pooling resources for emergency loans needs bounds and appeal paths for lending decisions, but separations can be implemented through role rotation rather than institutional independence. The principle is the same; implementation adapts to scale and power exercised.

No single entity governs the whole. Each scale governs itself, accountable to the minimum requirements. Everything above the minimum is politics: the domain of politics that adopt the framework, not of the framework itself. This is how constitutional structure already works in the physical world: national constitutions constrain state governments, state constitutions constrain municipalities, corporate charters constrain boards, and the cascade of constraint repeats at every level where power is exercised over persons. The computational domain lacks this cascade because it developed outside the constitutional tradition. The fractal polis extends the tradition into the domain where it is most urgently needed.

The constitutional machine is the implementation architecture for the receipt claim: power divided against itself at every scale. If a monolithic architecture can implement the receipt regime without capture, and if concentrated identity-transaction data can be held without producing domination, these claims are wrong.

Chapter 14: Fork Rights and the Fractal Polis

Exit, voice, and loyalty.

— Albert O. Hirschman (1970)

Why Receipts Are Not Enough

A potter in Arizona sells bowls and mugs through a single dominant marketplace. Over seven years she has accumulated eight hundred reviews, a seller rating that keeps her in the top search results, and a payment history the platform's own lending partner uses to extend a working-capital line every November before holiday demand spikes. The platform is not a convenience. It is her settlement rail, her storefront, her reputation, and her credit bureau.

On a Monday in late September, she receives a notification: her payouts will be held for ninety days. Not because she committed fraud. Not because she violated any rule she can name. The platform has reclassified her category as “elevated dispute risk” after a model retrained on recent chargebacks across the

site. The new policy is not aimed at her. It does not need to be. It applies automatically.

The receipt is perfect. Act: payout hold. Authority: Section 12.4 of the operating policy. Bounds: ninety days; inbound payments unaffected. Justification: category-risk recalibration triggered by model version 6.2. Appeal path: independent review within five business days.

She appeals. The arbiter agrees the hold is disproportionate for a seller with her history and orders relief: ten-day hold maximum, with expedited release upon proof of shipment. The platform complies. She can breathe again.

But nothing structural has changed. The classification still exists. The model will retrain again next week. The platform still holds the lever that determines whether her rent clears and whether her suppliers ship clay. She can contest each decision as it arrives. She cannot credibly leave. Departure means forfeiting the reviews that make strangers trust her, the history that makes lenders price her as low risk, and the search rank that makes customers find her at all. She would arrive elsewhere as an unknown seller with no standing and no credit, competing against incumbents whose reputations are trapped inside their own rails.

This is the deeper problem that receipts cannot solve: *in-escapable coercion*. A system in which the affected party can see the harm, contest the authority, even win the contest, and still remain subject to the same operator because exit costs exceed any remedy the appeal can provide.

The pattern is documented. In 2017, PayPal froze the account of a yoga-clothing seller who had used the platform for three years, seized \$42,737 after a 180-day hold, then reported the seized funds to the IRS as taxable income, taxing her on money she never received. She received three contradictory explana-

tions from three representatives. The dependency was invisible until severance made it structural.

Albert Hirschman's **Exit, Voice, and Loyalty** (1970) names the reason: voice is powerful only when exit is credible. A customer who cannot switch complains into the wind. A citizen who cannot emigrate petitions a sovereign who has no reason to listen. Hirschman, writing about railroads and public schools, could not have anticipated how precisely the framework would apply to platforms. A user who leaves a social platform loses her social graph: the network of connections built over years of interaction, the communication history documenting her relationships, the public identity she has constructed, the reputation she has earned. A merchant who leaves a payment platform loses his transaction history, customer relationships, seller rating, and position in the platform's recommendations. Exit can destroy accumulated social and economic capital that has no value outside the system in which it was created. Oliver Williamson called this "asset specificity": investment that has value only within a particular transactional relationship. The party who has made the investment is locked in by the fact that what she has built is worthless anywhere else. The medieval serf was bound to the land by law; the modern user can be bound to a platform by the non-portability of accumulated capital. The means differ. The result can be the same.

When departure costs exceed submission costs, voice becomes structurally impotent. The user can complain, but the platform knows the complaint carries no credible threat. Receipts ensure that the complaint will be heard, documented, and adjudicated. Fork rights ensure that the complaint carries weight, because the user who is dissatisfied with the adjudication can leave and take her assets with her. A fork right is the right to reconstitute a service, a jurisdiction, or a governance structure using the same rules and data, under different

stewardship: constitutional, not technological, distinct from open-source advocacy and from any particular engineering preference. It guarantees that the affected party can take her data, her relationships, and her standing and rebuild elsewhere without forfeiting the investment that makes the current platform valuable.

The Mechanics of Forking

A community of independent bookshops uses a shared platform for inventory management, customer reviews, and inter-store lending. The platform's governance council, which the bookshops helped elect, proposes a change to the revenue-sharing formula: a greater share of inter-store lending fees redirected to the platform's operating fund. A minority of bookshops, roughly a third of the community, objects. They submit formal contestations, request arbitration, and the arbiter rules that the change is within the governance council's authority. The minority disagrees with the ruling.

Without fork rights, the minority's options are submission or departure. Departure means abandoning transaction histories, customer review profiles, inter-store lending relationships, and the years of inventory data that recommendation algorithms use to suggest books to their customers. Departure costs exceed the cost of the fee increase. The minority submits.

With fork rights, the minority invokes its right to fork. Four operational guarantees address distinct dimensions of lock-in.

Data portability means the minority exports its data in the platform's standardized format: inventory records, transaction histories, customer reviews anonymized to protect reviewer privacy, inter-store lending records, recommendation profiles.

The export includes relational data defining each shop's position in the network: connections, transaction patterns, community memberships. Without relational data, the user arrives at the new platform as a stranger, having forfeited much of what made the old platform valuable.

Protocol interoperability means the forked platform can communicate with the original platform's network through shared protocols. A fork that cannot transact with the original's users has not achieved exit; it has achieved exile. Customers of the forked bookshop platform can still browse and order from shops on the original, and vice versa. Proprietary advantage lies in quality of service, not exclusivity of network.

Credentialed migration means the minority's reputation credentials (accumulated over years of reliable service, through thousands of transactions and hundreds of positive reviews) transfer to the new instance, verifiable by any participant on either platform. A seller's reputation is hers, earned through the quality of her goods, the reliability of her shipping, the honesty of her descriptions. Its portability is a property right; confiscation upon departure is the mechanism by which lock-in operates.

Governance portability means the group can adopt different rules while preserving the constitutional floor. A fork that copies data and software but leaves the original operator with exclusive control of rule changes has moved the interface without moving authority.

The minority deploys the same open protocol on a new instance, configured with the revenue-sharing formula it prefers. The fork is not a schism. It is a constitutional exercise: the minority has used its structural capacity to leave in order to create a competing governance model, and the original platform must now justify its fee increase to the majority that remains, knowing that the majority, too, can fork if governance deteriorates.

Four things forked in that sequence, and each is a distinct layer of the right. The minority took its data together with the relational context that makes records meaningful. It took its identity: the reputation earned through years of reliable service, portable because the credentials attest to performance rather than membership. It took the rules, adopting the governance formula it preferred while preserving the constitutional floor. And it took its protocol connections, the interoperability that prevents a fork from becoming exile. Data, identity, rules, protocol. A fork that carries fewer than four arrives diminished. A platform that can prevent any one of the four has reimposed the lock-in the right was designed to break.

These guarantees are costly to implement and politically difficult to mandate. They reduce the switching costs that give platforms their market power. A platform that must enable its users to leave with their data, their connections, and their reputations cannot rely on lock-in for retention. It must retain them through quality of service.

Fork Rights as Republican Liberty

A Roman citizen-farmer who owned his land could afford to take up arms against a tyrant. He had something to defend and something to return to. A Roman client who depended on a patron for his livelihood could not effectively resist: resistance meant destitution. Republican freedom therefore requires the absence of present interference and protection against arbitrary interference in the future, which depends in part on a credible capacity to resist.

Fork rights are the computational analogue of this right to resist. A platform that knows its users can leave with their data,

connections, and reputations must govern itself with care: not because users fork frequently but because they could. Poor governance produces defection: not complaints that can be absorbed, but departures that reduce the platform's value. Anticipation works in the governed's favor: the platform facing credible exit governs more carefully than the platform facing captive users.

Most users will never exercise the right to fork, just as most citizens never took up arms against their government. The right's value lies in its existence, not its exercise, because existence changes the calculus of power on both sides. The governed need not resist; they need only be capable of resistance. The governor need not be virtuous; the governor need only know that the governed can leave.

Resistance required material preconditions. Economic independence made political independence possible. Fork rights serve the same constitutional function in the computational domain. A user who can leave with her data, connections, and reputation has the computational equivalent of the citizen-farmer's land: a foundation from which resistance is possible and to which she can return. A user who cannot leave has the computational equivalent of the client's dependence: her voice structurally limited by her inability to make departure credible.

The Portability Problem

The most serious objection to fork rights is that portability of relational data creates a privacy problem. If a user can export her social graph, she is exporting information about other people who may not have consented to the export. If a merchant can export his transaction history, he is exporting information about his cus-

tomers. One party's fork right implicates the data of parties who did not choose to participate.

A fork must carry enough relational structure to remain useful without treating third-party data as the forking user's property. Some relational data can be represented without disclosing counterparty identity. A social graph exported as anonymized nodes with connection weights allows a forked platform to reconstruct network position (centrality, clustering, community memberships) without revealing who the connections are. Transaction histories exported as frequency distributions, category summaries, and aggregate volumes preserve commercial patterns without individual details. Reputation credentials can attest to performance metrics without disclosing the specific transactions that produced them.

Zero-knowledge proofs, selective-disclosure credentials, secure multiparty computation, and related techniques can support parts of this design. They do not make the policy problem disappear. A proof that a seller exceeds a threshold still depends on who issued the underlying credential, what the threshold means, and whether the receiving platform accepts it. Some relational context cannot be exported without exposing another person's interests. The right therefore includes a duty to minimize third-party disclosure and an independent process for deciding what cannot travel.

The constitutional framework does not require that every privacy-preserving mechanism be deployed today. It requires that the right to fork be established, that privacy constraints be specified, and that engineering be pursued with the seriousness a constitutional guarantee deserves.

What Fork Rights Do Not Solve

Fork rights address inescapable coercion but not universal coercion: the situation in which every available platform implements the same abusive practices, and forking from one to another merely changes the surveiller without changing the surveillance.

They also fail when no alternative can perform the essential function. A refugee cannot fork a border, a patient may have no second hospital within reach, and a merchant cannot carry reputation into a market whose dominant buyers refuse portable credentials. In those cases, exit cannot substitute for voice. The institution exercising unavoidable power owes the constitutional floor whether or not competition exists, and the affected person needs representation, interim relief, and a forum capable of ordering a remedy.

Nor is exit equally available. Capital, language, disability, legal status, network effects, and collective-action costs determine who can use a nominal fork. A right measured only by whether export is technically possible will protect the organized and solvent while leaving the most dependent exactly where they were. Credible exit is assessed from the position of the affected class, including the cost of maintaining service during migration and the risk of retaliation by the incumbent.

If the dominant business model is surveillance-based advertising, every platform built on that model implements similar data collection, similar behavioral profiling, similar manipulation of attention. Forking between architecturally identical systems is migration, not escape. Fork rights are meaningful only if genuinely different governance structures exist, and the fork right alone does not guarantee their existence.

Fork rights can create conditions for competitive governance by reducing switching costs. Competition still requires capital,

interoperability, legal access, and institutions willing to recognize portable standing. The receipt regime, civic asymmetry, and the constitutional machine provide a floor beneath that contest so a person is not told to “just leave” an unavoidable system. Above the floor, platforms and communities can compete on privacy, transparency, and control.

A market for governance remains a proposal, not an automatic result of lower switching costs. Competition may improve service; it may also converge on the same profitable abuse or be defeated by network effects. Fork rights give users bargaining power and make alternatives more buildable. They do not relieve public law of the duty to govern chokepoints that people cannot route around.

Contestability requires credible exit. Without fork rights, receipts become petitions. If contestability can be maintained without exit rights, this claim is wrong.

Chapter 15: Exit Under Duress

The question is not whether you can leave. The question is whether you can arrive.

Maria

Maria runs a small e-commerce business selling handmade ceramics. She learned the craft from her grandmother in Oaxaca, refined it through two years of art school in Mexico City, and started selling online seven years ago when she moved to Portland. Her studio is the back room of a rented storefront. Two part-time assistants handle shipping and customer communications. Annual revenue is three hundred and forty thousand dollars. Her margin is twelve percent: about forty-one thousand in take-home income. The platform takes a fifteen-percent commission and provides the infrastructure that makes the business possible: the marketplace where customers find her, the payment processing, the review system that builds her reputation, the advertising tools that bring new customers to her listings.

Seven years of commercial life have deposited layers of value inside the platform's systems. Her product listings (photographs

she took, descriptions she wrote, pricing she set) are unambiguously hers. But the assets that matter most are the ones she cannot simply download. Her customer list includes 4,200 buyers accumulated over seven years: regular customers who order holiday gifts every December, a restaurant owner in Chicago who buys serving platters for each new season's menu, a gift shop in Sedona that stocks her work on consignment. Every relationship exists because she made something worth buying and someone chose to buy it; yet the data also contains her customers' names, addresses, and purchasing patterns, implicating their privacy in any export.

Her seller rating (4.9 out of 5.0, based on 3,847 reviews) is the single most valuable asset she holds on the platform, more valuable than any individual listing. It determines her visibility to new customers, her access to premium placement, her eligibility for favorable commission rates, and the trust a first-time buyer places in her before the first purchase. The platform treats it as proprietary. Maria cannot take her 4.9 rating with her. She cannot even prove to another platform that the rating exists.

Maria is a constructed case. Her figures and platform history are illustrative; the assets at stake and the proposed portability rules are the point of the example.

Beyond the rating sits her network position: visibility in search results, ranking relative to competitors in handmade ceramics, integration with the recommendation engine, the algorithmic advantages that accrue to a seller who has been active and successful for seven years. Network position is not data in any exportable sense. It is an emergent property of her interaction with the platform's systems over time: a property the platform controls and that vanishes the moment she leaves. Unlike listings, which can be copied, or a reputation score, which can be attested, network position exists only inside the

system that produced it; and it is the asset whose loss makes exit prohibitively expensive for most sellers most of the time.

What Breaks

In March, the platform changes its terms of service. Commission rises from fifteen to eighteen percent, and a mandatory advertising spend of four percent is deducted automatically from payouts. All customer communications must go through the platform's messaging system, severing the direct email relationships Maria has built with repeat buyers. She runs the numbers and watches her margin drop from twelve percent to approximately five. Five percent of three hundred and forty thousand is seventeen thousand dollars: less than she pays in rent for the studio alone.

Maria creates an account on a competitor platform. She spends two weekends reformatting product listings for the new interface, uploading photographs, rewriting descriptions to match the new platform's conventions.

On day one she has zero reviews, zero rating history, zero algorithmic visibility, indistinguishable from a seller who opened an account five minutes ago. Seven years of commercial history, 4,200 customer relationships, 3,847 positive reviews, a verified track record of reliable shipping and honest descriptions, all of it left behind, attached to an account on a platform she can no longer afford to use, invisible to the new platform's customers. Not deleted. Simply inaccessible.

She emails the customers whose direct addresses she kept in a personal spreadsheet, about half the total. Some reply. Most do not. Of those who reply, some visit her new storefront and place orders. Others say they'll come back later. A few say they

did not know she had left the old platform and already bought replacement items from another seller.

After six weeks, Maria has recovered eighteen percent of her customer base. Annualized revenue on the new platform is sixty-one thousand dollars, down from three hundred and forty thousand. She cannot meet her studio lease payments and lets one assistant go. She begins exploring whether she can take custom orders through Instagram while she rebuilds.

Her exit was not prohibited. It was not obstructed in any formal sense. The old platform did not prevent her from leaving. It did not threaten her. It did not lock her data behind a paywall. It simply did not help her leave, and the cost of leaving without help (the destruction of seven years of accumulated commercial value) made the exit feel less like a choice and more like a catastrophe. A political philosopher examining the situation would observe that Maria's freedom to exit was formally intact. A political economist would observe that her freedom was substantively null. The distinction between formal and substantive freedom is the one the republican tradition has drawn for centuries: the distinction between the slave who is told he may leave and the slave who has nowhere to go.

What makes Maria's situation specifically computational is the totality of the lock-in. A merchant in the Champagne fairs who was dissatisfied with the fair wardens' fees could trade through Bruges or Geneva; his reputation traveled with him in letters from correspondents who knew his character. A shopkeeper in a nineteenth-century town who was dissatisfied with his supplier could switch to a competitor; his customers lived on his street and shopped in his store because it was convenient, not because an algorithm directed them there. Maria's commercial life is constituted by the platform in a way the medieval merchant's was not constituted by the Champagne fairs. Customer relationships, reputation, visibility, transaction

history, shipping and tax integrations: all exist within the platform's systems and vanish when she leaves. The platform is not a marketplace she visits. It is the substrate on which her commercial identity is constructed, and departing the substrate means dismantling the identity.

This is exit without fork rights. The right to leave exists. The capacity to arrive does not.

Maria's Alternative Exit

Under the fork-rights architecture, Maria's departure would proceed differently.

She would click "export" and receive her owned data in a standardized, machine-readable format: product listings complete with images, descriptions, pricing, and inventory status, formatted according to an interoperable standard rather than the old platform's proprietary schema. No weekends reformatting. She would upload the file to the new platform, where her listings would appear in the same form they had on the old one.

With her listings would come a portable reputation credential: a cryptographically signed attestation of her seven-year track record. Seller rating: 4.9. Return rate: 1.2 percent. Dispute resolution rate: 0.3 percent. Customer satisfaction: 97th percentile in her category. The credential would not disclose which platform issued it; it would attest to facts and allow the new platform to incorporate the attestation into its own ranking system. Maria would arrive not as a stranger but as a verified seller with a documented track record, starting with visibility proportional to demonstrated reliability, not at zero.

Because the platforms would communicate through a shared protocol, her new storefront would appear in search results alongside sellers on the old platform. A customer searching for “handmade Oaxacan ceramics” would find Maria regardless of which platform she occupies. Federated search, not siloed. Her network position would be diminished (she would have lost the algorithmic advantages specific to the old platform), but she would not have lost visibility entirely.

Her customers would receive automated notification of the migration, with a link to her new storefront and a mechanism to transfer saved preferences, wish lists, and order histories. Each customer would decide whether to follow: a simple choice, not a research project.

Under this architecture, Maria would lose some customers, those who prefer the old platform for its interface, its other sellers, its loyalty program. She would lose some network position. But she would preserve the core of her commercial value: her reputation, her product catalog, and the relationship with the majority of customers who follow her because they care about her ceramics, not about which platform displays them.

Hardening

Portable reputation credentials raise a genuine concern: if they can travel, they can be gamed, and a gamed reputation that travels is more dangerous than one confined to a single platform. Under the receipt regime, credentials are cryptographically signed by the issuing platform. Forging one would require forging the platform’s cryptographic signature: computationally infeasible with current or foreseeable technology. A credential is as trustworthy as the platform that issued it, which means receiving

platforms can track the correlation between attested reputation and actual performance, discounting attestations from platforms whose sellers consistently underperform their credentials. Markets discipline attestors through the same mechanism they have always used to discipline providers of unreliable information: recipients stop trusting it.

Interoperability creates a free-rider problem: a new platform displaying sellers from the old one benefits from the old platform's investment in verification without paying for it. Symmetry resolves this. Interoperability is a mutual obligation: the old platform displays sellers from the new just as the new displays sellers from the old. Both benefit from an expanded market, and neither can degrade the connection without losing access to the other's users. The equilibrium is cooperative, sustained by mutual advantage rather than adversarial extraction.

The deepest vulnerability is the cost of alternatives. Fork rights make exit possible, but someone must build the destination platform. If building a viable alternative is prohibitive, the fork right is theoretical: a right that cannot be exercised because nowhere exists to exercise it. Fork rights reduce the demand-side barrier. A new platform that can accept portable credentials, import seller data, and interoperate with the existing network faces a dramatically lower entry barrier than one that must build its user base from scratch. Supply-side barriers (server infrastructure, regulatory compliance, the engineering talent to build and maintain a platform) remain. Fork rights are necessary but not sufficient for competitive governance.

What the Worked Example Shows

Maria's story tests the fork-rights architecture against the platform whose market power depends on lock-in, with specific assets at stake: data, reputation, relationships, network position.

Under the example's assumptions, the architecture preserves three of four dimensions. Portable data and interoperable protocols mean Maria would not spend two weekends reformatting and would not arrive as a stranger. Credentialed migration means her seven-year track record would travel with her, visible to new customers on the first day. Federated search means a customer looking for handmade Oaxacan ceramics would find her regardless of which platform she occupies. Network position is the residual loss (the algorithmic advantages specific to a single platform are emergent properties that no export mechanism can fully reconstruct), but the loss is partial, not total.

Fork rights do not make exit costless. Maria still loses customers, network position, and income when she leaves. What changes is that the business and the commercial identity built over seven years survive the move. Because she can arrive with her catalog, reputation, and enough visibility to rebuild, departure becomes a credible option rather than an act of self-destruction; that credibility gives her voice practical force before she exercises it.

The claim survives if Maria can exit and arrive. It fails if she cannot.

Chapter 16: Against the Protocol Republic

The most common of all follies is to believe passionately in the palpably not true.

— H.L. Mencken

A constitutional proposal should be judged against its failure modes rather than accepted on belief. Six objections follow. Five test the construction from within; the last asks whether it should be built at all. Each is stated in the strongest form this argument can answer.

Protocol Capture

The receipt regime assumes that the rules governing receipts will be set by accountable processes. But who sets the rules? If a standard-setting body defines the receipt format, the required fields, the audit criteria, and the adjudication procedures, then that body is the sovereign of the Protocol Republic, and sovereignty attracts capture as surely as wealth attracts tax.

Platforms with resources to participate in standard-setting will send delegations, fund working groups, commission research, and draft specifications aligned with their commercial interests. Lawyers will write in the language of compliance, not accountability. Engineers will build systems that satisfy the letter of the standard while circumventing its purpose. Regulatory capture is the most documented failure mode in institutional history (from the Interstate Commerce Commission to the post-2008 financial regulatory apparatus), and there is no reason to believe protocol governance is immune to the pathology that has afflicted every prior form of governance.

Protocol capture is a real risk, and the response must be structural, not aspirational. “We will appoint good people” and “we will maintain vigilance” are the responses captured institutions always give. They have never, in the history of institutional design, prevented capture.

The defense is architectural. Multiple jurisdictions, multiple implementations, multiple adjudication bodies: each constrained by the receipt regime’s minimum requirements but free to vary above the minimum. Capture of any single body does not capture the system. A standard-setting body captured by a dominant platform produces standards favorable to that platform; other jurisdictions adopt different standards, and competition among standards creates pressure for the captured body to reform or be abandoned.

Fork rights provide the deeper structural defense. If a standard-setting body is captured, participants can fork the protocol: adopt the existing standard as baseline, modify the captured provisions, and implement the modified version within their jurisdiction. No permission from the captured body is required; only that the forked standard satisfy the receipt regime’s minimums. A body that knows its participants can fork governs more carefully than one that knows they are locked in.

The vulnerability persists. No constitutional architecture eliminates capture entirely. What the fractal architecture and fork rights provide is containment: damage from capture is localized, reversible, and survivable, which is more than any monolithic governance structure can claim.

Verification Inequality

The receipt regime assumes affected parties can verify the receipts they receive. Verification requires technical capacity: the ability to read a cryptographic proof, to evaluate whether a justification field contains substance or template language, to navigate an appeal process involving technical standards and institutional procedures. Technical capacity is unevenly distributed. An engineer, a lawyer, an activist with organizational backing can inspect her receipt, identify template justifications, and pursue an appeal with expert assistance. A gig worker processing deliveries through a platform he barely understands cannot.

This is not hypothetical. Every rights-based system in history has been more accessible to the educated and affluent than to the poor. The right to a jury trial is meaningful to a defendant who can afford a lawyer and opaque to one who cannot. An administrative appeal is meaningful to a citizen who understands the process and invisible to one who does not. The receipt regime risks replicating this inequality in a new medium, and the replication would be particularly cruel because the populations most affected by platform governance, gig workers, migrants, small merchants whose economic lives depend on platforms they do not control, are precisely those least likely to possess the technical capacity to verify their own receipts.

Verification inequality is real and must be addressed through institutional design, because the protocol alone cannot solve a problem that is social in nature. The receipt regime requires that receipts be produced; it does not require that every affected party personally verify every receipt. Institutional infrastructure fills the gap.

Auditors (bodies with the technical capacity and legal authority to inspect receipt streams across populations, identify patterns of abuse, and flag them for enforcement) function like financial regulators who review banks' lending patterns rather than requiring every borrower to audit her own loan. Verification advocates, analogous to public defenders in the criminal justice system, inspect receipts on behalf of individual affected parties, evaluating justifications, assessing bounds, advising on whether and how to pursue appeal. They may be public servants funded through legal-aid mechanisms, nonprofits funded by fines collected from operators who issue deficient receipts, or bonded private parties whose compensation depends on the outcomes of the challenges they bring. Automated tools (software that reads receipts against standards, flags template justifications, and alerts the affected party in plain language) reduce the technical barrier to initial evaluation, just as tax-preparation software makes the tax system navigable for people who cannot afford an accountant.

The inequality is not eliminated. But the gap between a system that produces receipts no one can read and a system that produces no receipts at all is the gap between a right that can be exercised with help and a right that does not exist.

But verification inequality names only the solvable half of the problem. The deeper risk is recursive: the dynamics the constitutional architecture is designed to constrain (epistemic foreclosure, the quiet displacement of judgment, the narrowing of what citizens attend to) are the same dynamics that erode the cit-

izenry's capacity to evaluate whether the architecture functions. The medieval peasant could not read Latin, but he could see the castle and count the soldiers. The computational subject cannot see the algorithm, cannot count the parameters, and may not know a decision was made.

The Tyranny of Receipts

A receipted system can become its own form of oppression. If every exercise of power must produce a receipt, the requirement may deter legitimate power alongside arbitrary power. A police officer who must document every interaction may choose not to intervene when intervention is warranted but documentation is burdensome. A content moderator who must justify every removal may leave harmful content in place when documentation costs exceed inaction costs. A financial platform that must produce a substantive receipt before freezing a suspicious account may delay the freeze while fraud proceeds.

Surveillance chills the exercise of freedom; accountability chills the exercise of power. The question is whether chilling power is, on balance, desirable.

When applied to arbitrary exercises of coercive authority, the chilling effect is a feature. A system that deters unaccountable coercion constrains domination, and constraining domination is the regime's purpose. The genuine concern is that documentation burden will deter legitimate, accountable power: that operators will choose inaction over action even when action is warranted.

Proportionality addresses this. The five receipt fields are the same for every action, but the depth required for each field varies with severity. A content-moderation decision that temporarily

reduces a post's visibility requires a light receipt: act named, authority cited, bounds stated, appeal path identified, justification a brief policy reference. A decision that permanently suspends a user's account requires substantive justification, expedited appeal, and mandatory review by an independent arbiter. Graduation is specified in advance: operators know what documentation each type of action requires.

Emergency situations receive specific accommodation. A financial platform detecting probable fraud issues a provisional receipt: Act and Bounds filled immediately, Justification completed within forty-eight hours. Quick action is preserved. Documentation follows. The affected party's appeal window does not begin until the justification is produced, ensuring the platform cannot use the provisional mechanism to defer accountability indefinitely.

The Threshold Problem

The Protocol Republic cannot constitutionalize its own threshold. Something must decide who has standing, what counts as coercion, where the receipt regime's jurisdiction begins and ends. That something is not itself receipted, because it is the decision that determines what falls within the regime's scope. The regime rests on a foundation it cannot inspect.

This is not a deficiency of the Protocol Republic. It is the foundational condition of every constitutional order in history. The American Constitution does not derive its authority from a receipt. It derives its authority from a political act ("We the People") that was itself neither receipted nor subject to the procedures the Constitution would later establish. England's constitutional settlement derived its authority from a revolution, the ul-

timate extra-legal act. Every constitutional order rests on a prior political decision outside the order's own jurisdiction.

The threshold problem is acknowledged, not solved, because it cannot be solved within any constitutional framework. It specifies minimum conditions under which coordination at machine speed can proceed without producing domination. It invites political communities to adopt those conditions as their constitutional baseline. Adoption is a political act. A national parliament that mandates receipt production for platforms operating within its borders, a trade bloc that incorporates the receipt standard into its digital-services regulation, a platform cooperative that writes the regime into its charter: each provides the authority the Protocol Republic itself cannot generate.

Fork rights pluralize the threshold. If a political community draws the jurisdictional line in a place some members find intolerable, those members can exit to communities that draw it differently. Pluralization does not solve the threshold problem. It distributes the problem across multiple communities, each making its own political decision, each subject to the discipline of exit. Not a solution to the philosophical problem: an institutional arrangement that makes it tractable.

A related boundary deserves acknowledgment. The receipt regime is designed for discrete coercive acts: a flag placed, an account frozen, a score adjusted. Act I named the deeper threat: foreclosure that operates continuously through probability shifts and visibility decay, producing the economic effect of a deliberate delisting without any event a receipt could name. An effects-based definition helps only after an effect can be measured against a threshold; it does not create the missing act or identify the moment at which responsibility attached.

This remains an open problem. One possible response is monitoring that converts cumulative drift into a receipted event once a constitutionally defined boundary is crossed. Another is

aggregate contestation, in which an affected-person body may challenge a pattern that no individual decision reveals. Both approaches risk false positives, strategic manipulation, and surveillance conducted in the name of detecting surveillance. The architecture addresses discrete exercises of power. It does not yet close the continuous case.

Chapter 17 narrows one part of this problem. Once a personal record has crossed its declared threshold, identifiable reliance on that record is presumptively illegitimate without fresh authorization, even when the resulting disadvantage accumulates across many decisions. Fresh probability drift, hidden influence inside a trained model, and foreclosure produced without any expired input remain outside that answer.

Can It Scale?

The most devastating practical objection: the receipt regime requires institutional infrastructure (auditors, advocates, arbiters, standard-setting bodies, appeal processes) that does not exist at the scale required. Building it takes time, money, political will, and sustained institutional commitment. In the interim, coordination at machine speed continues without constitutional constraints, and Quiet Foreclosure advances. By the time the infrastructure is built, the foreclosure may be complete.

Liberal democracy's institutional infrastructure took centuries to build. Magna Carta was signed in 1215; the Universal Declaration of Human Rights was adopted in 1948. The seven hundred and thirty-three years between them describe the duration of the project, not the impossibility of rights.

Implementation can begin at any scale. A single platform that adopts the receipt regime within its own architecture demon-

strates feasibility and creates competitive pressure on platforms that do not. A single jurisdiction that mandates receipt production for platforms within its borders creates regulatory precedent and compliance infrastructure. A single adjudication body that reviews platform decisions under receipt-regime standards creates the institutional model and the body of case law. Each implementation creates conditions for the next, and the network effects of interoperable receipts (comparable across platforms, aggregatable across jurisdictions, auditable across time) produce adoption pressure exceeding what any mandate could achieve.

Of the practical objections, scaling is the strongest, because it is grounded in the world as it is. The Protocol Republic is a proposal, not an accomplishment. Whether it is achievable is an empirical question that can only be answered by attempting the construction.

The Regulatory State

The gravest objection the receipt regime must answer comes from the tradition that has insisted most stubbornly that power account for itself, and it arrives as a charge of betrayal. A mandatory receipt, the classical liberal says, is the regulatory state in cryptographic dress: a standing apparatus of auditors and standard-setters that instructs private parties how they must conduct their affairs, on the worn assumption that an expert center understands a man's business better than he understands it himself. That tradition has watched the assumption before and knows its terminus in capture, in sclerosis, and in the conceit about knowledge against which Hayek argued for a lifetime. The danger it names is real, and the framework was

built in awareness of it; the error lies in the architecture the objection imagines.

The planner fails because he must draw knowledge into a center too small ever to hold it, and what no central board could learn about an economy no governance board will learn about coordination at machine speed. A receipt attempts nothing of the kind. It gathers no preferences and sets no prices; it asks only that each exercise of power leave a trace its subject can read, so that knowledge of the act remains where it already resides, with the person upon whom the act fell. This leaves the work of verification dispersed among those it concerns, and so meets Hayek's objection in his own terms, carried into a country he had no occasion to map.

Neither does the regime convert every private refusal into a public wrong. A platform is no sovereign, and to treat its ordinary refusals as coercion would throw open the door to endless meddling in what a person does with what belongs to her; the older liberalism recognized force and fraud as the only coercion worth the name, and on that line the framework holds with it. What the age of agents has added is the passage that can no longer be refused. When a settlement rail or an identity layer becomes the one road a livelihood must travel, it takes on the character the common law long assigned to whoever kept the only crossing, and the duty to serve on fair terms that came with it. That duty turns on something narrow and exact, on the simple absence of another lane, and never on a notion so elastic as the public interest.

The objection takes its hardest form where the tradition is proudest, for exit is its own first remedy: let the unworthy platform lose its users, and let competition accomplish what no auditor could. The framework wants exactly that, and spends its rights of portability and fork to keep the door from closing. Yet at one layer the door will not open, and it stays shut for reasons

of structure. Beneath the platforms a person may abandon lies a substrate she cannot, the shared models upon which every rival is trained alike, so that a merchant whom one risk model has flagged is flagged as quickly by the others, all of them children of a single parent; she changes her platform and keeps her verdict. Where competition has already reached into every corner it can offer no exit at all. To require that portability extend to the training corpus, and that the substrate disclose the rule by which it judged, asks no colonizing of the market by the state, only the reopening of the one exit that had silently closed.

The framework, in the end, asks of this tradition nothing the tradition does not already desire. It observes only that the instruments forged against a sovereign who possessed a will, and against a market that still possessed a door, cannot reach a power possessed of neither, and it offers the smallest addition that would let those instruments take hold again.

What Survives

Six objections, each stated at full strength. None proved fatal. Protocol capture is containable because the architecture is fractal and forkable: no single capture is permanent. Verification inequality is addressable because the right to a receipt, like the right to counsel, can be exercised through institutional intermediaries. The chilling of power is graduated by design. The threshold problem is shared by every constitutional order that has ever existed. The scaling challenge is real, and it is an argument for construction, not abandonment. And the charge that the whole regime is the regulatory state in disguise mistakes a trace the subject may read for a plan a center hands down, when all it asks

is that verification be left with those the act concerns, and all it binds is the passage that admits no way around.

The Protocol Republic is a constitutional minimum, not a constitutional guarantee. It specifies the floor below which coordination cannot proceed without producing domination of the kind the republican tradition has always identified as the enemy of freedom. It cannot guarantee that the floor will be maintained, the institutions built, or the political will found. The proposal claims only that the Quiet Foreclosure is worse and that another construction is possible.

If any of the six objections identified here has no answer, the proposal should be abandoned. If the answers are insufficient, they should be improved. If the answers are adequate, the proposal has earned evaluation on its merits, which is all any constitutional proposal can ask.

Act V

Humanity Needs Mercy

Chapter 17: The Price of Perfect Memory

You could not be born at a better period than the present, when we have lost everything.

— Simone Weil, **Gravity and Grace** (1947)

The first three equations describe what systems must do. The fourth becomes visible only when the machinery of proof is working, because the same architecture that makes authority legible also expands what institutions can preserve and combine about a person.

A system may satisfy the five witness properties, bind coercive acts to receipts, divide power against capture, and survive adversarial pressure. Without limits on retention and composition, every attested fact about a person (every transaction processed, every credential verified, every receipt issued, every dispute filed, every appeal adjudicated) can travel to any context and compose with every other attested fact. The result is a portrait of comprehensive fidelity whose facts may be accurate and whose reach may be inescapable. It becomes, in the most important sense, a lie when the institution treats the sum of a person's

documented past as equivalent to the person herself. Persons are not sums.

The danger does not arise because the witness protocol failed. It arises because the protocol makes truth durable, the receipt regime makes power legible, and the constitutional machine resists capture while none of them, by itself, limits how long a true record may govern a life. Success without that limit produces a system that remembers everything, composes everything, and never lets go.

Constitutional protections operate at two points in time. Before imposed coercion becomes practically final, notice, deliberation, and appeal must be able to catch it; there the mismatch is between the tempo of the act and the tempo of contest. The problem here begins after the act has entered the record. The question is how long that record may supply a reason for another institution to act against the same person. Durable, composable memory allows one decision to continue through later decisions that its author never considered. This concern is limited to imposed coercion. Parties may bargain for final settlement, and records of public or platform power must remain available so the authority can answer for what it did. The asymmetry concerns the governed person: proof of a past act can outlive the period in which that act remains a sufficient reason to constrain her.

Theologians would recognize the problem immediately. Confession and absolution, developed over centuries in the Catholic Church, joined a pastoral practice to a theory of personhood: genuine contrition could mark a break in moral continuity. The secular tradition arrived at a similar insight by a different path. Enlightenment theories of punishment assumed that punishment, properly calibrated, could reform an offender and that the reformed person had claims upon society the unreformed offender did not. Both traditions recognized what

the perfect-memory system denies: persons change, and a just society must acknowledge the change.

The receipt regime is right about power and incomplete about persons. A system that remembers every exercise of coercive authority must also release its grip on the people subject to that authority. The release requires a deliberate constitutional choice: records that expire, limits on composition across domains, and places where the past loses jurisdiction over the future.

David

David is thirty-four years old and a licensed nurse. He works overnight shifts in the ICU, where his colleagues trust him with the hardest hours because he is calm under pressure and meticulous with dosages: two qualities that the person who stumbled into the emergency room at twenty-two would not have been able to claim. He coaches his daughter's soccer team on weekends. He volunteers at a clinic in the neighborhood where he grew up.

David is a composite built from familiar records and legal mechanisms. His dates, occupations, scores, and retention periods are illustrative; the constitutional question does not depend on any one calibration.

Between twenty-two and twenty-six, David was a different person, not literally, but in the sense that matters for institutional evaluation. At twenty-two, an emergency-room visit for alcohol poisoning. At twenty-three, a misdemeanor conviction for disorderly conduct, community service completed, and a termination from a restaurant job for chronic lateness during the worst of his drinking. At twenty-four, a student loan default during a period

of unemployment. At twenty-five, an eviction proceeding dismissed after he paid the overdue rent, and enrollment at a community college. At twenty-six, a bankruptcy filing, discharged at twenty-seven. Between twenty-one and twenty-four, a series of social-media posts expressing political views he no longer holds and personal circumstances he would prefer not to be defined by.

The transformation was not miraculous. It was ordinary: the slow, grinding, undramatic work of changing one's life, day by day, over a decade. He stopped drinking. He paid his debts. He went back to school. He studied pharmacology and anatomy and the ethics of patient care. He passed his boards. He showed up, every shift, for four years. His credit score climbed from the low 500s to the mid 700s over eight years. The nursing degree, the licensure, the clean employment record: all document the transformation. But in a system of perfect memory, the transformation competes with the crisis for institutional attention, and the crisis has a structural advantage: it is specific, dramatic, and easily categorized, while the transformation is diffuse, gradual, and resistant to summary.

In the system as built (receipts permanent, composition unlimited) an employer running a background check on David at thirty-four encounters the ER visit, the misdemeanor, the loan default, the bankruptcy, the eviction proceeding, the employment gap, and the social-media archive, all composable into a single portrait that determines what he can do, where he can live, who he can be. The person those records describe no longer exists. The records do not know this.

Designed Forgetting

Five operations constrain the record's jurisdiction over David's future.

His emergency-room visit is twelve years old. Under expiration rules, health records related to substance use that are more than seven years old and not associated with ongoing treatment leave the composition space. An employer running a background check cannot see it. An insurance company pricing a policy cannot use it. The record still exists in the hospital's archive, accessible by court order if a future medical emergency requires the full history. But it no longer speaks in contexts where it has no legitimate business.

His misdemeanor conviction, completed with community service, is sealed. It appears in a law-enforcement database accessible to courts and certain governmental agencies. It does not appear in commercial background checks. Sealing distinguishes between the state's legitimate interest in maintaining a criminal record for sentencing purposes and the illegitimate interest of commercial actors in using a twelve-year-old misdemeanor to evaluate a person's current fitness.

Aggregation limits prevent any single system from composing David's records across more than three domains without his explicit consent. A background-check company may query each domain separately and report what it finds, but it may not join health, criminal, and financial records into a single cross-domain portrait. This prevents the composition pathology: aggregation of individually innocuous facts into a comprehensive assessment that exceeds any individual system's jurisdiction.

Separation enforces boundaries between David's social-media archive and his professional records at the protocol level. An employer may evaluate his nursing credentials and employment history. The employer may not access social-media posts

from a period that predates his current career. Systems holding social-media data and those holding professional credentials are barred from communicating without David's authorization.

The eviction proceeding, dismissed after payment, is subject to jurisdictional amnesty for dismissed housing cases older than five years. David can rent an apartment without explaining a resolved legal action from nine years ago. The amnesty reflects a legislative determination that dismissed cases (cases in which the court found no ongoing obligation) should not burden the respondent's housing prospects indefinitely. Whether the amnesty applies to cases dismissed within thirty days or ninety days, whether it has exceptions for property damage or repeated nonpayment: these are political decisions made by the jurisdiction that administers the housing database. The architecture provides the mechanism by which the decisions, once made, are enforced at the protocol level.

David at thirty-four, under this architecture, is evaluated on the basis of his current credentials, his current employment record, and his current financial standing. The records of his difficult years exist: archived, sealed, separated, expired as appropriate. They are not destroyed. They are bounded, in the same way that the writ of **habeas corpus** does not free the prisoner but bounds the detention by requiring that it be justified, reviewed, and limited in duration.

These limits do not require David to prove that every institution must ignore his past. They change who must justify its use. If a hospital believes the old emergency-room visit or misdemeanor still bears on this nursing role, it must identify the present safety concern and explain why current licensure, four years of performance, and intervening conduct do not answer it. A limited inquiry may be warranted. It does not authorize the record's use by a landlord, lender, insurer, or unrelated employer, and it does not begin a new period of unrestricted use.

Where practicable, David receives notice before an adverse act. The resulting decision must name its purpose and duration and carry independent review, a receipt, and an appeal.

A society that treats the twenty-two-year-old's emergency-room visit as permanently relevant to the thirty-four-year-old's employment prospects has confused documentation with identity and memory with justice.

What Designed Forgetting Is Not

Designed forgetting is broader than deletion. Some records may be destroyed after a lawful retention period; others remain sealed, segregated, or available only under stated process. A court may unseal a record for cause, and a medical emergency may justify access to an archive under rules set in advance. What ends is automatic availability for composition by actors with no legitimate claim to the record.

Four questions must remain separate. Did the event occur? May an institution retain the record? Who may access it, and for what purpose? May it materially support a present adverse act? The last question concerns the record's coercive jurisdiction. A record can remain true, retained, and accessible for a defined purpose while losing authority over an unrelated decision.

Every memoir is an act of designed forgetting: the assertion that some events matter more than others, that the person who emerges from the telling is not identical to the sum of what happened. Designed forgetting is not forgiveness. Forgiveness is a moral act performed by one person toward another: it requires a wronged party, a wrongdoer, and a relationship between them. Designed forgetting is an architectural constraint performed by a system on its own memory. The system does not forgive David.

It lacks the capacity for forgiveness. What it does is refrain from presenting David's past to every institution that queries him, acknowledging that persons change and that the past's jurisdiction over the future must have limits. The restraint is constitutional: required by the same architecture that requires the receipt. Receipts constrain power by making it visible. Designed forgetting constrains the receipt by making it finite. Without the constraint, the receipt becomes a tool of the power it was designed to check.

Designed forgetting is not privacy. Privacy prevents information from being collected. Designed forgetting limits the use of information already collected. The receipt regime requires collection: every exercise of power produces a receipt, and receipts are records. A system cannot simultaneously produce receipts and prevent the existence of records. What it can do is constrain the scope and duration of the records' availability, and the constraint is what makes the receipt regime compatible with the possibility of personal transformation.

Fragments of designed forgetting already exist in law. Juvenile record sealing acknowledges that a sixteen-year-old's actions should not determine a twenty-five-year-old's possibilities. Bankruptcy discharge acknowledges that a person who has submitted to the discipline of the process should be able to re-enter economic life without carrying the failure permanently. The European Union's right to be forgotten acknowledges that search engines should not present outdated personal information indefinitely. Empirical work on criminal records has estimated when rearrest risk approaches the arrest risk of same-age people in the general population, with different intervals by age and offense; those estimates can inform calibration but cannot determine the constitutional rule.¹ Pennsylvania's limited-access statute supplies a narrower legal analogue: specified records become subject to restricted dissemination after stated conditions, while exceptions and criminal-justice

access remain.² Each mechanism is partial, domain-specific, and contested. What they share is a structural commitment: the past does not own the future, and systems that remember everything must be taught when to let go.

There is an asymmetry in who is building. Every mechanism on the memory side of this architecture has engineers today: logs that cannot be rewritten, records that any stranger can check, provenance that survives its author. Permanence is the direction that comes cheaply: a record persists by default, and an industry exists to make it persist more durably still. The forgetting side has fragments of law, and engineering only where the law has forced it: delisting pipelines, records that age off credit reports on statutory schedules. What has no engineers is the harder object the constitutional principle below requires — a record that remains checkable while it can be contested and then verifiably loses its force, expiration a stranger can confirm rather than a deletion the operator merely promises. In practice, then, deletion is already well supplied with engineering effort, whereas verifiable forgetting attracts almost none — largely because no one is yet paid to produce it. The architecture this chapter describes is therefore not a refinement of the memory infrastructure now being assembled, but the part of it that will be left unbuilt unless someone sets out to build it.

The Constitutional Principle

The architecture must encode a temporal asymmetry. *Power-time is eternal; person-time is mortal.*

Receipts for the exercise of authority persist indefinitely. The liquidation, the denial, the freeze, the suspension: these must remain inspectable as long as the institution that issued them ex-

ists. An institution that exercised coercive power fifty years ago must still answer for that exercise. Institutions do not have the capacity for transformation that persons do; the institution that denied a loan in bad faith in 1975 is structurally continuous with the institution that operates today, and the receipt of the denial is the mechanism of accountability.

Records of individual conduct must be capable of expiration, sealing, separation. The borrower who defaulted at twenty-two may be creditworthy at forty. A former convict who served his time and built a new life may be an exemplary neighbor. The person who expressed foolish opinions at nineteen may be a thoughtful citizen at thirty-five. Perfect memory denies all three possibilities. Designed forgetting restores them.

Without this asymmetry, the receipt regime becomes a system of permanent caste. A person flagged at twenty-two carries the flag forever. It composes with every other record, producing a portrait that determines what David can do, where David can live, who David can be. The receipt supposed to constrain power becomes a tool of power: wielded by institutions to determine David's future from David's past. Sociologists call this credentialed exclusion: formal records creating barriers to participation that persist long after the underlying condition has changed. A criminal-record check preventing a reformed offender from obtaining housing. A credit report presenting an eight-year-old bankruptcy as evidence of current unreliability. An employment gap raising questions regardless of what happened during the gap. In each case the record is accurate; the person has changed; and the system cannot perceive the change, because the system's perception is constituted by the record. Designed forgetting does not falsify the record. It constrains the record's jurisdiction (limiting the domains in which it can speak and the duration for which it speaks) so that the person standing before the institution is evaluated as the person she is, not as the person she was.

The Irreducible Human Element

The five operations of designed forgetting—expiration, sealing, aggregation limits, separation, and amnesty—can be automated once a legitimate authority sets their rules. The hard question is who sets the rule, hears the exceptional case, and answers when its application becomes unjust. That decision is moral and political before it is computational.

An arbiter deciding that David’s twelve-year-old emergency-room visit should expire is making a judgment about David’s capacity for change. A legislature granting amnesty for dismissed eviction cases is making a judgment about whether a society wants to permanently punish resolved disputes or allow people to move on. A court sealing a juvenile record is making a judgment about whether a sixteen-year-old’s actions should determine a twenty-five-year-old’s possibilities.

No default settles every case. A seven-year rule may be defensible in one domain and dangerous in another; even a well-calibrated rule will produce exceptional cases in both directions. Rules provide the baseline. Arbiters hear claims that the baseline has failed in application and give reasons that can be reviewed.

Those rules govern constitutional release rather than forgiveness. They stop an old record from deciding the case before judgment begins. A deterministic sunset and an exception classifier can each apply a rule, but neither can own the later judgment that the rule does not settle.

The architecture places an answerable human institution at its center. A model may calculate, categorize, and estimate whether later conduct supports a claim of change. It may even outperform individual reviewers on a defined prediction. It may not be the final constitutional author of a coercive judgment

about whether a person's past will govern her future. The institution adopting the judgment must be identifiable, give reasons in the particular case, and remain subject to appeal.

The arbiter reads David's record and says **nevertheless**. She does not correct the past. She considers the evidence of change, the remaining risk, the purpose of the rule, and the cost of letting an old record continue to speak. Her decision may be wrong, which is why it must carry reasons and an appeal. What matters is that the record has met an authority empowered to limit its jurisdiction rather than an automated exception that no one can own.

No protocol forgives by verifying more accurately. A protocol can apply an exception rule; an algorithm can recommend one. Mercy begins when an authorized institution accepts responsibility for saying **nevertheless**: the record is true, and it will not be permitted to exhaust the person before us. The judgment limits the record's jurisdiction. That limit is the fourth equation's demand.

C12. Without temporal limits, accurate records can compose into durable exclusion. The Mercy Threshold is the point at which a true record must cease to determine a person's future by default. If a receipted system without designed forgetting produces no pathology of permanent exclusion, this claim is wrong.

Notes

1. Alfred Blumstein and Kiminori Nakamura, "Redemption in the Presence of Widespread Criminal Background Checks," **Criminology** 47, no. 2 (2009), pp. 327–359, estimate how the hazard of rearrest changes with time clean, age at the earlier event, and offense type. The study supplies evidence for differentiated calibration, not a universal expiration period. back

2. 18 Pa. Cons. Stat. § 9122.1(a)–(d) provides petition-based limited access for qualifying records after specified conditions, preserves enumerated exceptions, and directs notice through the criminal-history repository. It is a bounded legal analogue, not an implementation of the constitutional rule proposed here. back

Chapter 18: Elena

The system has decided otherwise.

The call comes on a Tuesday in February, eleven minutes before her shift starts.

Elena Marchetti has been a pediatric nurse at St. Anne's for nine years. She knows the sound of bad news, has delivered it, held hands through it, watched families reorganize themselves around it. But she does not recognize this voice, the HR coordinator reading from a script, and she does not understand what the words mean.

"Your license verification returned a flag. We can't let you work until it clears."

Elena is a composite. Her hospital, identifiers, dates, and timelines are constructed to compare the two procedural designs that follow.

She is standing in the break room, scrubs already on, stethoscope around her neck. Through the window she can see the charge nurse assigning rooms. Elena's name is on the board. She has three patients today: a four-year-old recovering from an appendectomy, a teenager with a respiratory infection, an infant whose parents have not slept in two days.

“What flag? My license is valid. I renewed it in October.”

“The system shows a disciplinary action. I’m looking at it now. Suspension for—” a pause, the sound of scrolling —“patient endangerment. From 2019.”

Elena’s hand tightens on the phone. She can feel her pulse in her throat. Patient endangerment. The words are technical, precise, and they describe a person she has never been. In nineteen years of nursing she has never received a complaint, never been the subject of a review, never had a supervisor question her judgment at the bedside. She has held a seizing infant steady while the attending fumbled with an IV line. She has caught a medication error — two milligrams of morphine prescribed for a four-year-old when the order should have read point-two — and escalated it before the dose was administered. She has sat with dying children and their families through the small hours when the rest of the hospital was quiet and the only sound was the ventilator and the parents’ breathing. Patient endangerment. The system making this claim does not know any of this, because the system does not know anything. It matches records to identifiers and returns results.

“That’s not me. I’ve never had a disciplinary action. Check the state board.”

“We don’t query the state board directly. The credentialing system uses HealthVerify.”

“Then HealthVerify is wrong.”

“You’ll need to dispute it with them. In the meantime, you’re on administrative leave. I’m sorry, Elena. I know this is frustrating.”

Frustrating. The word hangs in the air after the call ends. Elena looks at her reflection in the dark window of the break room microwave. She is forty-three years old. She has a mortgage, a daughter in community college, a mother in assisted living whose monthly fee has increased twice in the past year.

She has been a nurse since she was twenty-four. She has never endangered a patient.

The system has decided otherwise.

HealthVerify's website offers a "dispute center." The form requires her to create an account, verify her identity through a third-party service, and upload documentation. She gathers what she can: her license, her renewal confirmation, her employment history. The form asks for the "case number" of the disciplinary action she is disputing. She does not have a case number. There was no case.

She calls the Ohio Board of Nursing. After forty minutes on hold, a human voice confirms what she already knows: her license is valid, no disciplinary actions on record, everything in order. The voice is sympathetic but limited. "We don't control what the aggregators report. You'll need to take it up with them."

She takes it up with them. The dispute form generates an automated response: **Your request has been received. Please allow 30-45 business days for review.**

Forty-five business days. Two and a half months. She does not have two and a half months.

She calls St. Anne's. Can she work while the dispute is pending? No. Hospital policy. Insurance requires clean verification. She calls the nursing union. They will look into it, but these disputes take time. She calls a lawyer. The lawyer explains that HealthVerify's terms of service include an arbitration clause and a liability waiver. Elena signed it when she created her nurse profile three years ago. She does not remember signing it.

"What did I agree to, exactly?"

"You agreed that any disputes would be resolved through binding arbitration, that you release HealthVerify from liability

for errors in their database, and that your sole remedy is correction of the record.”

“And if the correction takes three months?”

“That’s between you and them.”

The first week, Elena tells herself it will be resolved quickly. An obvious error, easily fixed. She files the dispute, uploads the documentation, waits. She checks the portal daily. Nothing changes.

The second week, she calls HealthVerify’s support line. The wait is two hours and forty minutes. When a human answers, they can only confirm that her dispute is “in queue.” They cannot tell her what documentation is needed, who is reviewing it, or when a decision might come. “The process takes as long as it takes.”

By the third week, she has tried to work elsewhere. Three hospitals in the region use the same credentialing system. A nursing staffing agency uses HealthVerify too. Home health positions, private clinics, anything she can think of: the flag follows her, because the infrastructure is everywhere.

By the fourth week, she stops sleeping well. She wakes at 3 a.m. and lies in the dark, running through the logic again: she has done nothing wrong; the system says she has; the system’s word outweighs hers; there is no one to convince because there is no one making the decision. A database merge, or a keystroke error, or an algorithm that matched her name to someone else’s discipline. The cause is unknowable because the system does not disclose it. Her daughter asks why she is home during the day. Elena does not know how to explain that she has been erased by an error that has no author. The explanation sounds paranoid, technical, too small to cause this much damage. A field in a

database she has never seen and cannot access. “It’s a paperwork thing. It’ll get sorted out.”

It does not get sorted out.

By the fifth week, Elena begins to notice something she had not anticipated: the erosion of her professional identity. She has been a nurse for nineteen years. The work defined her — the early shifts, the scrub color she preferred, the way she organized her pockets, stethoscope in the left, pen light in the right, the greeting she used with nervous parents. All of it is gone, not because she chose to leave but because a system she did not build decided she is someone she is not. She finds herself explaining her situation to friends and family, and each explanation feels less credible than the last. The absurdity of it — a competent nurse sidelined by a phantom disciplinary action — sounds like a story someone tells when the real story is worse.

By the sixth week, her savings are drained. She applies for unemployment. The form asks why she left her job. She was not fired; she was not laid off; she did not resign. She is on administrative leave pending verification. The form does not have a box for this. She checks “other” and writes an explanation that takes four paragraphs. The system truncates it to 500 characters.

By the eighth week, she has stopped calling HealthVerify. There is no new information. Her calls change nothing. She has become a remainder: technically employed, functionally erased. She exists in the system, but the system will not let her work.

Her mother’s assisted living facility sends a payment reminder. Elena does not open it. She sits at her kitchen table with her hands around a coffee mug that has gone cold and tries to calculate how long she can hold on. The mortgage is current through next month. The car payment is due Friday. Her daughter’s tuition, which Elena pays in installments from each paycheck, is two installments behind. The math does not work, and the math does not care that the reason it does not

work is an error in a system she never consented to depend upon.

On the seventy-third day, she receives an email. **Your dispute has been resolved. The record has been corrected.**

That is all. No explanation of what happened, no acknowledgment of the error, no apology. The flag is gone. She can work again.

She calls St. Anne's. The HR coordinator checks the system. "You're clear. Can you start Thursday?"

"What about the last ten weeks?"

"What about them?"

"I lost ten weeks of pay because your system said I was someone else."

"Our system didn't say anything. HealthVerify's system did."

"And you relied on it."

"We're required to rely on it. It's the credentialing standard."

"So who is responsible?"

The coordinator pauses. "I don't know, Elena. I'm really sorry. I'm glad it's fixed."

Elena hangs up. She stares at her phone. Ten weeks. The error had no author. The correction has no author. The loss has no author. She does not know who to sue, who to complain to, who to hold accountable. The system is not a person. It cannot blush or repent.

She goes back to work on Thursday. Her patients do not know she was gone. The hospital does not acknowledge the gap. The aggregator does not acknowledge the error. Ten weeks vanish as if they never happened, and the only record of the vanishing is Elena's empty bank account and her daughter's questions she cannot answer.

The Other Elena

But there is another way Elena's story could have gone.

The call comes on the same Tuesday, eleven minutes before the same shift. The HR coordinator reads from the same script. A disciplinary flag. Administrative leave. The words are the same, and Elena feels the same tightening in her throat, the same flush of wrongness.

But in this version, Elena does something the first Elena could not. She opens her phone, taps the nursing credential she has carried since her last renewal, and holds it up to the conversation the way a traveler holds a passport. The credential is hers — received from the Ohio Board of Nursing the way she received her paper license, except that this one cannot be lost in a desk drawer, cannot be reproduced by a forger, and does not depend on any aggregator's database to confirm that she is who she is. When the hospital's system queries her status, it asks her to present the credential, and the credential answers for itself: valid, current, no actions on file. The check takes less than a second. It does not pass through HealthVerify. It does not consult an intermediary. It goes to the source.

"I'm showing a clean credential from the board," Elena says. "Can you run the check against my credential directly?"

The coordinator pauses, then runs the check. The board's attestation is clear. But the aggregator's flag still exists, and hospital policy requires resolution of discrepancies.

"There's still a conflict," the coordinator says. "HealthVerify has the flag. Your credential doesn't. We need to resolve the mismatch before you can come in."

In the first story, this is where Elena falls into the void: seventy-three days of silence, automated responses, a dispute

queue with no bottom. In this version, the mismatch arrives with a document she can read. The rejection notice specifies what was found: a disciplinary record, case number HV-2019-44721, alleging suspension for patient endangerment in March 2019, attributed to a nurse whose name matches hers to within one character. Authority cited: Hospital Policy 7.4.2. Appeal path: a specific arbitration process with a timeline of five business days for initial review.

Elena can see the claim. She can see it is wrong. She does not need to guess what happened, because the receipt tells her: a case number, a date, a source, and a specific discrepancy between the aggregator's record and the board's attestation.

She files the dispute that afternoon. She uploads two things: her credential, signed by the Ohio Board, and the rejection receipt showing the conflicting claim. Her case goes to a retired health-law attorney in Cleveland who has posted a bond against the quality of her decisions. The arbiter queries the Ohio Board directly, receives signed confirmation that no disciplinary action exists for Elena Marchetti, and compares it against the HealthVerify record. The two records disagree. The board's is authoritative. HealthVerify's turns out to be a name-matching error: Elena's identifier merged with that of a nurse in another state whose surname differs by one character, an error that propagated through the aggregator's pipeline without human review.

On the fourth business day, the arbiter issues a finding that names the error, specifies its cause, and directs HealthVerify to correct the record. The finding is itself a signed document with an unalterable timestamp, and Elena adds it to her records the way a litigant keeps a court order. She presents the finding to St. Anne's. The hospital has three documents: the aggregator's flag, Elena's credential, and an arbiter's finding that the flag is erroneous. If the hospital still refuses to let Elena work, it does so over the documented objection of an independent arbiter, and

its own decision generates a receipt available if Elena pursues damages.

St. Anne's lets her work. She returns on the following Monday, eleven days after the call. She has lost one pay period instead of ten weeks. She has missed eight shifts instead of fifty.

The loss is documented: she holds a receipt showing the erroneous rejection, the dispute, the resolution, the time elapsed. If she wants to pursue damages, she has evidence that would satisfy a court. If she wants to warn other nurses about HealthVerify's error rate, she has documentation. If she simply wants to move on, she can — but she moves on with standing, not silence.

The error was the same in both stories: one record had been merged with another. In the first, Elena discovered the claim only through its consequences. Her recourse was a queue, and the correction arrived after seventy-three days as a gift no answerable institution was obliged to give. In the second, she could read the claim, answer it with evidence, and carry the dispute to an arbiter whose decision bound the parties and left a record of its own.

The receipt did not make the system accurate. It gave the error an address, a deadline, and an institution that had to answer for the result. Elena still lost eight shifts. She did not lose ten weeks without knowing who had taken them.

That difference is standing: the condition under which an injured person can demand redress rather than wait for grace. A society that can give Elena standing and chooses not to has made a constitutional choice.

Chapter 19: The Call

What follows is for the living to decide.

Agent systems coordinate through objectives they did not choose. Nothing in the act of optimization supplies a common good.

An objective function is a constraint imposed from outside. The system that denies a loan while its applicant sleeps contains no account of why she needed the money, what the denial will cost her, or which reasons should matter more. It returns the result its designers made operational. Cruelty or kindness enters through the human purposes, institutions, and consequences around that result, including the choice to treat it as final.

Humans learn ends differently. We learn them under finitude: time that will run out, lineage that binds us to the dead and the unborn, responsibility that accrues because mistakes have faces. A face can be wronged. A wrong can be remembered. We inherit purposes before we choose them, and even when we try to escape the weight of choosing, it follows us. A child inherits a language, a history, a set of debts and obligations that precede her birth and will outlast her death. A community inherits its institutions, its customs, its unresolved conflicts, its accumulated

wisdom and accumulated error. Inheritance is the condition under which morality exists. A being that lacks the capacity to suffer consequences lacks the capacity to bear obligations. A system that processes without stakes cannot betray, because it cannot promise.

The book's conjecture is that we are spandrel souls: consciousness arrived with the biological machinery once required for coordination, and coordination can now migrate to systems for which no claim of felt experience is needed. The dome no longer needs the mosaics. The mosaics still weep. Whether or not the conjecture survives, the constitutional argument does not depend on it. Efficient allocation matters because it improves or diminishes lived human lives, and those consequences create claims against the institutions that deploy the system.

The asymmetry between people who bear consequences and systems that score them is a political fact. The answer proposed here requires durable witnesses, disclosed costs, contestable receipts, portable standing, and an institution willing to limit a true record's reach. Some of those institutions do not yet exist. They will need money, law, training, and people prepared to answer for their judgments.

If systems without legal or material stakes wield power over lives that end, safeguards cannot rest on the virtue of the process. They belong in the surrounding institutions: receipts that make coercion legible, capabilities that can be revoked, exits that remain practicable, and records that survive hostile interpretation. The system will not supply those constraints for us. People with standing must build and govern them.

The argument has reached its practical question: whether the architecture will be built, and against what resistance.

Two futures remain possible. They differ in what power can be made to answer.

In the first, constraint arrives without a face. Scores shift while you sleep. Associations become liabilities by correlation. Distance is “recommended,” and the recommendation is priced into every rail that matters. No one threatens. No one argues. Refusal is made expensive in ways untraceable to a contestable act. The deepest luxury the lords sell is not convenience. It is abdication: the right to stop being the author of one’s life while still feeling free.

The exile adapts. She learns to navigate around invisible boundaries, to cultivate the favor of systems she has no window into. She becomes, without anyone calling it this, a subject.

In the second, constraint is never silent. When a system limits a person, it leaves a receipt. The receipt names the act, the authority, the bounds, the justification, the path of appeal. Not every receipt is read; not every act is contested. What changes is standing: the governed can verify what governs them. The exile holds a receipt. She may still lose. But she has standing: proof that something happened, to her, by a nameable process. She can contest.

Coercive authority becomes inspectable by those subject to it, while private life is no longer made legible by default to systems that will never answer for what they know. Politics does not disappear under that arrangement. What disappears is the silent exercise of power.

A skeptic who has followed this argument might raise a final objection: “You have shown what is possible. You have not shown what is likely. The Quiet Foreclosure is stable because it serves the interests of those who control it. The Protocol Republic requires overturning an equilibrium that no one who benefits from it has reason to overturn. Elena’s second story is a fable. Her first story is the future.”

The objection deserves a real answer rather than an inspirational one.

The Quiet Foreclosure is stable. Those who benefit from it are powerful. Those who suffer from it are dispersed, unaware, and poorly organized. This book's proposed transition is not inevitable, nor even likely if likelihood is measured by the current distribution of power and interest. Platforms that control identity, payment, and reputation have market capitalizations in the trillions, lobbying budgets in the billions, and user bases trained to prefer convenience over sovereignty. Every entity with a material interest in the status quo will resist.

One structural difference distinguishes this moment from earlier cycles of decentralization and recapture. The internet's original architecture was captured because it provided connectivity without economic commitment. Anyone could route packets, but no one staked value or bonded performance at the protocol layer. What coordination required above bare connectivity (identity, payment, trust, recourse) was supplied by platforms, and supply conferred sovereignty. The verification primitive changes the equation. For the first time, economic commitment can be embedded in the protocol itself: staked collateral, bonded arbitration, receipted authority. Whether this advantage proves durable is an empirical question. That it exists at all is why the possibility deserves to be taken seriously.

Equilibria also shift for reasons the entities benefiting from the equilibrium are powerless to control. Costs of the current architecture are becoming visible: not through philosophical argument but through accumulation, each breach that exposes millions of records, each wrongful freeze that destroys a livelihood, each Elena. The accumulation is slow, but it is also structural: the same computational systems that make the Quiet Foreclosure possible make its failures legible in ways that earlier forms of institutional abuse were not. A wrongful freeze in 1990 was a private grievance between a customer and a bank. A wrongful freeze in 2025 is a social media post, a news story, a class action,

a regulatory inquiry. Visibility does not guarantee change, but it creates conditions under which change becomes politically possible.

History offers no guarantees. The Roman Republic lasted five centuries before the principate captured it. Venice lasted a millennium before Napoleon dissolved it in an afternoon. The American Republic has lasted two and a half centuries and is not obviously secure. Constitutional constraints that limited power in one era were captured or abandoned in the next. Design does not guarantee outcome.

But design shapes the possibility space. A world where the Protocol Republic is possible is different from a world where it is not. A world where Elena can hold a receipt is different from a world where she cannot. Architecture does not determine politics, but it constrains what politics can achieve.

The architecture can be written down. It does not build itself, and the interval in which it can be built is passing rather than theoretical.

A Protocol Republic must be built in code that refuses custodial shortcuts, mechanisms that bind power to receipts, credentials that remain portable under pressure, and communities willing to bear some friction to avoid domination. The institutional work is larger than the technical work. Arbiters need training, funding, and a professional culture of impartiality. Independent rulemaking bodies need charters and oversight. Interoperable protocols need standards, reference implementations, and incentives that make compliance more attractive than proprietary lock-in.

The easier order will win unless opposed. Its bargain is simple: accept the terms, surrender the keys, trade agency for relief. It asks almost nothing and delivers comfort immediately. The alternative asks for competence, attention, and the willingness to be inconvenienced by one's own freedom. Freedom is

more expensive than servitude. It requires the citizen to attend to matters the subject can safely ignore: who makes the rules, how the rules are enforced, whether enforcement is proportionate, whether appeal is genuine. Systems that offer *epistemic foreclosure*, the surrender of judgment for relief, are not lying about the convenience. They are lying about the cost, which is not assessed in the present but compounded in the future, when the institutions that could have constrained power have atrophied from disuse and the power that could have been constrained has grown beyond the reach of any mechanism the citizen might then wish to invoke.

The consent that authorized the arrangement is itself a casualty. Terms accepted in 2019 by a person who no longer exists, under conditions that no longer obtain, amended unilaterally as the original agreement permitted: the agreement is dead, and the platform continues to animate its corpse. This is *necromantic consent*: invoking a dead agreement to authorize present coercion. Article 10's anti-waiver principle exists because contractual consent in this domain has become a simulacrum: the form of agreement performing the function of agreement while lacking its essential feature, the ongoing and informed participation of a living person.

One diagnostic governs every encounter with computational authority:

What trace will remain?

If the answer is none, domination is present, whatever its manners.

If the answer is a receipt only power can read, accountability is decorative.

If the answer is a receipt verifiable by affected parties, a different order is possible. Not guaranteed. Possible.

Verification cost is the primitive variable that determines the structure of trust, and therefore the structure of power. No economic shift since the collapse of communication cost rivals the collapse of verification cost in constitutional consequence. The printing press made it cheap to disseminate information, and the constitutional response took three centuries to mature. Cheap verification makes it possible to prove claims without trusting the claimant, and the constitutional response has barely begun.

Power will be computational. Verification will be cheap.

The question is whether the receipts will belong to those who govern, or to those who are governed.

Demand receipts from computational authorities, preserve a penumbra where private life can remain unobserved, and give personal records an end. The proof of power must endure; the proof against persons must expire.

The clerk's pen still moves. The ledger still updates. In one future, the entry vanishes without trace, and the erased learn their status by collision with a world that has already decided against them. In the other, every line leaves a mark that outlives its author, and the mark can be read by those it concerns.

The question is which we will build.

Freedom needs receipts.

Humanity needs mercy.

Constitutional Proposal

Grounds of the Articles

A constitutional safeguard is warranted when a durable condition of power creates a predictable failure of legitimacy and a defined institutional rule can prevent or repair that failure. The safeguard must address the condition directly, preserve room for lawful variation, and remain capable of administration and review. Each Article is therefore stated through its structural condition, legitimacy failure, minimum safeguard, partial legal analogue, and open calibration.

Article 1. Receipt

Article 1. Right to a receipt at the time of a coercive act.

Structural condition: Computational acts can occur faster than affected persons or public institutions can inspect them. *Legitimacy failure:* An unrecorded act leaves no stable object for contest, comparison, or cumulative audit. *Minimum safeguard:* The authority must issue a contemporaneous receipt identifying the Act, Authority, Bounds, Justification, and Appeal Path in an accessible human-readable form and, where independent verification requires it, an interoperable machine-readable

representation. *Partial legal analogue*: GDPR Articles 13 and 14 impose scoped information duties, and Regulation Z requires disclosures in covered credit transactions.¹ *Open calibration*: Schema details and emergency completion periods may vary, but the five functions and contemporaneous duty remain.

Article 2. Contest

Article 2. Right to contest through independent review.

Structural condition: An authority that controls both the act and its review can preserve the appearance of process while preventing correction. *Legitimacy failure*: A receipt becomes evidence of subjection if no independent institution can reverse, modify, or remand the act. The same failure recurs when recourse infrastructure controls admission, consolidation, precedent matching, or closure without review. *Minimum safeguard*: Review must be independent, timely in relation to the harm, empowered to grant an effective remedy, and available for material decisions governing access to recourse. Common procedure may decide common questions once but must preserve material individual differences. *Partial legal analogue*: GDPR Article 22 provides a qualified right against certain solely automated decisions and, in specified exceptions, safeguards including human intervention and contestation.² *Open calibration*: Deadlines, interim relief, aggregation, and evidentiary procedure may vary by severity.

Article 3. Human Review

Article 3. Right to human review for material adverse actions.

Structural condition: High-volume delegation can leave a nominal human reviewer without time, competence, evidence, or authority to disagree, while a sequence of individually minor acts can produce a material deprivation. *Legitimacy failure*:

Responsibility attaches to a signature while practical judgment remains with the computational system, or a severe aggregate effect escapes review because its components were classified separately. *Minimum safeguard*: Every material adverse action, assessed by cumulative effect across related acts, omissions, and delays, requires an independent human arbiter whose competence and exercise of judgment can be examined. Lower-severity acts require expedited reconsideration and statistically valid independent audit. *Partial legal analogue*: The EU AI Act imposes human-oversight duties for high-risk systems and assigns related duties to deployers within its statutory scope.³ *Open calibration*: Published severity thresholds and competence standards may vary by domain, but routine confirmation does not satisfy the right.

Article 4. Export

Article 4. Right to export data, credentials, and relational context.

Structural condition: Accumulated standing can make departure ruinous even when a service is nominally voluntary. *Legitimacy failure*: Lock-in converts consent and contest into dependence because the person must abandon identity, reputation, relationships, or transactional history to leave. *Minimum safeguard*: Export must preserve the usable structure and provenance needed for practical migration. Where migration is not practically available, nominal exit cannot substitute for voice and review. *Partial legal analogue*: GDPR Article 20 creates a scoped data-portability right, while the Digital Markets Act imposes specified portability and interoperability duties on designated gatekeepers and services.⁴ *Open calibration*: Formats, continuity, security controls, and protected third-party interests require technical and legal specification.

Article 5. Presentment

Article 5. Right to present portable credentials.

Structural condition: Export remains ineffective if the issuer controls every place where a credential may be used. *Legitimacy failure:* The credential becomes proof of continuing membership rather than portable standing. *Minimum safeguard:* A system implementing a published interface, or capable of evaluation through reasonable technical adaptation, must permit presentment without the issuer's permission. It may evaluate provenance, validity, relevance, and status under public rules, but a claimed incompatibility or rejection at a covered passage requires a receipt and review. Recourse records must remain portable enough that changing a registry does not extinguish a claim. *Partial legal analogue:* The W3C Verifiable Credentials Data Model supplies a technical model for portable attestations but does not compel acceptance.⁵ *Open calibration:* Trust registries and acceptance rules may vary if presentment and review remain available.

Article 6. Cross-Domain Composition

Article 6. Right against cross-domain composition without valid authority.

Structural condition: Separately lawful records and decisions can combine across domains into a durable restriction that no participant authorized as a whole. *Legitimacy failure:* The cumulative act affects a person's life while remaining invisible to every institution responsible for only one component. *Minimum safeguard:* Direct joins and functional proxies require explicit, informed, revocable consent or another independently reviewable authority that identifies domains, purpose, duration, and consequence. *Partial legal analogue:* The cited GDPR and

DMA provisions regulate defined processing, portability, and automated-decision contexts without making every cumulative cross-domain effect a distinct object of review.⁶ *Open calibration:* Necessary fraud, safety, and public-law uses require narrow rules, records, and review.

Article 7. Temporal Jurisdiction

Article 7. Right to time-bounded personal records.

Structural condition: A true historical record may remain available long after its relevance to a present decision has weakened or ended. *Legitimacy failure:* Retained information acquires indefinite coercive authority and can make past conduct determine unrelated future access by default. *Minimum safeguard:* Occurrence, retention, access, and present adverse use are decided separately. Evidence that coercive authority acted remains durable, while personal information within or supporting that evidence remains subject to minimization, sealing, restricted access, and limits on later adverse use. Renewed adverse use after the applicable threshold requires a current domain-specific nexus, fresh justification, independent review, limited duration, and a receipt. *Partial legal analogue:* GDPR Article 17 supplies a qualified erasure right, and the FCRA limits reporting of specified adverse information subject to category-specific periods and exceptions.⁷ *Open calibration:* Schedules and exceptions vary by record, purpose, current evidence, safety, archival need, investigation, and adjudication. No universal deletion or machine-unlearning method is required.

Article 8. Knowable Rule

Article 8. Right to know the rule invoked.

Structural condition: A person cannot contest a decision when the operative rule cannot be named or evaluated. *Legitimacy failure:* Authority becomes secret in operation even if a general policy is public. *Minimum safeguard:* The receipt must identify the rule, procedure, and principles actually applied, with confidential access where legitimate privacy, security, or trade-secret interests prevent full public disclosure. *Partial legal analogue:* GDPR Articles 13, 14, and 15 require meaningful information about the logic involved in defined automated-decision cases. In Case C-203/22, the Court of Justice required an intelligible explanation of the procedure and principles actually applied rather than a complex formula or exhaustive technical account.⁸ *Open calibration:* Disclosure tiers and red-team exceptions must remain narrow, time-limited, and independently reviewable.

Article 9. Minimum Collection

Article 9. Right against excess data collection.

Structural condition: Information collected beyond a person's requested function or an independently authorized duty expands future power, creates cross-domain influence, and raises the cost of exit. *Legitimacy failure:* The Operator acquires authority that no present function requires and can later reuse the resulting asymmetry. *Minimum safeguard:* Collection is limited to the least data-intensive reasonably effective means of performing the specific function requested or the duty independently authorized by law. *Partial legal analogue:* GDPR Article 5(1)(c) states data minimization within a supervisory and remedial structure.⁹ *Open calibration:* Reasonable effectiveness depends on the function, risk, and lawful purpose, not technical convenience or speculative future use.

Article 10. Anti-Waiver

Article 10. No contractual waiver of the constitutional floor.

Structural condition: A person dependent on an unavoidable passage cannot bargain over standard terms on equal footing. *Legitimacy failure:* Every protection can be extinguished by the same click required to obtain the service. *Minimum safeguard:* Contract cannot waive Articles 1 through 9 or release the authority from the institutional duties attached to Articles 11 and 12. *Partial legal analogue:* Existing law contains targeted non-derogation and anti-waiver rules, including ECHR Article 15(2) and section 29(a) of the Securities Exchange Act.¹⁰ *Open calibration:* Stronger law remains available, and lawful settlements may resolve accrued claims without authorizing prospective waiver.

Article 11. Independent Record

Article 11. Right to an independent record.

Structural condition: An authority that controls the sole authoritative evidence of its own acts can revise, suppress, or selectively disclose the record under review. *Legitimacy failure:* Receipt and audit become conditional on the continued cooperation of the power they constrain. Recourse fails in the same manner if a registry can erase intake, routing, consolidation, or closure decisions. *Minimum safeguard:* Records of covered acts and material recourse decisions must be independently verifiable, resistant to unilateral revision or suppression, and secured by an external constraint whose defeat is publicly detectable and costly in proportion to the authority recorded. Integrity establishes provenance and history rather than the truth of every claim. Objections, corrections, superseding status, and adjudicated findings remain linked to the original entry.

Partial legal analogue: The legal provisions surveyed for the other Articles do not supply the complete independent-record protection stated here.¹¹ *Open calibration:* Independent custody, institutional replication, transparency logs, cryptographic commitments, multiparty attestation, and physically costly settlement may serve different threat models without making any named technology constitutionally required.

Article 12. Independent Audit

Article 12. Mandatory independent audit for coercive authorities above systemic significance.

Structural condition: Repeated acts and coordinated systems can reveal population-wide error, capture, evasion, or compositional effects that no individual contest can establish. Persons least able to complain may also be the least visible to a complaint-driven system. *Legitimacy failure:* Responsible entities can fragment the system while each remains the final judge of whether its own receipts, reviews, rules, and records satisfy the floor. Low complaint volume can then conceal missing notice, inaccessible recourse, or retaliation. *Minimum safeguard:* An independent Auditor must have access across material contributors, examine random samples and latent-exposure indicators, publish methods and findings subject to lawful redaction, and impose or recommend corrective action through an authorized process. *Partial legal analogue:* Sarbanes-Oxley created the PCAOB and imposed specified auditor-independence controls for public-company audits.¹² *Open calibration:* Audit frequency, sampling, funding, access, and corrective authority vary with scale, severity, concentration, reversibility, and evidence of suppressed contest.

Notes

The legal comparisons are current through 18 July 2026. They identify partial analogues within their stated scopes.

1. GDPR Articles 13-14 specify information duties when personal data are collected from the data subject or obtained elsewhere, with limits and exceptions. Regulation Z, 12 C.F.R. Part 1026, prescribes disclosures for covered consumer-credit transactions; see, for example, §§ 1026.5 and 1026.17. [back](#)

2. Under GDPR Article 22(1)-(3), the safeguards in paragraph 3 apply to the contract and explicit-consent exceptions in paragraph 2(a) and (c), not without qualification to every automated decision. [back](#)

3. EU Artificial Intelligence Act, Articles 14 and 26(2). These duties concern high-risk AI systems within the Act's scope. [back](#)

4. GDPR Article 20(1)-(4); Digital Markets Act, Articles 6(1), 6(9), and 7. The DMA duties attach to designated gatekeepers and the core platform services listed in the designation decision; Article 7 addresses number-independent interpersonal communications services. [back](#)

5. W3C, **Verifiable Credentials Data Model v2.0**, W3C Recommendation, 15 May 2025. The technical model does not itself compel an institution to accept a credential. [back](#)

6. The comparison is limited to GDPR Articles 5, 20, and 22 and DMA Articles 6-7. No exhaustive claim is made about every legal system or cause of action. [back](#)

7. GDPR Article 17(1)-(3); Fair Credit Reporting Act, 15 U.S.C. § 1681c(a)-(b). The FCRA provisions include seven- and ten-year periods, category-specific treatment, and statutory exceptions. [back](#)

8. GDPR Articles 13(2)(f), 14(2)(g), and 15(1)(h); Court of Justice of the European Union, **Dun & Bradstreet Austria**, Case C-203/22, ECLI:EU:C:2025:117, paragraphs 58-66. The judgment

defines the explanation required in the case before it; it does not establish how often deficient explanations occur or what causes them. The EU AI Act Article 86 provides a separate and limited right to explanation for specified decisions based on outputs from covered high-risk systems. [back](#)

9. GDPR Articles 5(1)(c), 58, 77-79, 82, and 83. Supervisory and judicial remedies vary in application, but the principle is not enforced by fines alone. [back](#)

10. European Convention on Human Rights, Article 15(2); Securities Exchange Act of 1934, 15 U.S.C. § 78cc(a). The provisions operate in different domains and are cited as targeted models. [back](#)

11. The comparison is bounded to the GDPR, AI Act, DMA, W3C Recommendation, FCRA, ECHR, Securities Exchange Act, and Sarbanes-Oxley provisions cited in these notes. No claim is made that every legal system lacks an analogous safeguard. [back](#)

12. Sarbanes-Oxley Act of 2002, sections 101, 201, and 202. Section 101 establishes the PCAOB for public-company audits; sections 201-202 restrict specified non-audit services and require audit-committee preapproval. [back](#)

Computational Republicanism

Jurisdiction and Entitlement

Computational authority becomes constitutional in character when it controls a covered passage and materially determines whether a person may pass. The relevant power does not arise from an operator's size, public status, or chosen label. It arises when a person lacks a reasonable substitute and a computational process materially determines, recommends, or executes an act that affects access to the passage.

Two conditions must therefore coincide. The first is practical dependency: refusal, exclusion, delay, or degradation would impose a material loss that a reasonable alternative cannot timely cure. The second is computational determination: a computational rule, model, classification, or composed process materially contributes to the act. A large service with ready substitutes may fall outside the first condition. A smaller service may satisfy it where geography, market structure, identity dependence, interoperability failure, or accumulated standing leaves no reasonable alternative.

Institutional form does not alter either condition. Public administration may be captured, and private administration may

acquire sovereign effects when departure requires material forfeiture. The inquiry follows power and practical refusal, giving neither public office nor private contract a presumption of legitimacy.

An affected person subject to both conditions is entitled to invoke these Articles and to receive their protections. That entitlement does not by itself create jurisdiction in every court. Legal enforcement depends on an adopting jurisdiction, a binding commitment by an operator, or another source of law that gives the Articles effect. The distinction preserves the normative rule without claiming authority that no institution has conferred.

The following terms govern construction:

- *Covered passage* means access to money, work, housing, medical care, communication, identity, legal standing, or another interest of comparable consequence.
- *Coercive computational authority* means an operator that controls a practically non-substitutable covered passage and uses computational determination in acts affecting that passage.
- *Coercive computational act* means a decision, classification, restriction, denial, suspension, ranking, condition, omission, delay, or related sequence that materially affects a person's access to a covered passage.
- *Operator* means each public or private entity responsible for a covered act. A vendor, model provider, delegated agent, affiliate, or protocol integrator may share responsibility, and delegation does not displace the duty to identify an answerable principal.
- *Affected person* means a natural person whose access, standing, rights, or material interests are directly affected by a covered act. Affectedness is specific to the act, rule, exposure, and remedy at issue; it is not a permanent political status.

- *Independent review* means review by a party that did not take the act, does not answer to the decision-maker for the result, has access to the evidence necessary for judgment, and can reverse, modify, or remand the act.
- *Material adverse action* means an act or related sequence above a published severity threshold that restricts access to funds, employment, housing, medical care, communication, identity, or legal standing. Related acts are assessed by their cumulative effect.
- *Rule* includes the declared policy, threshold, model use, composition rule, or decision procedure materially invoked in the act. A rule is evaluable when the affected person or a qualified advocate can test whether the stated conditions were satisfied.

Coverage is determined act by act. An operator may be covered for one function and outside coverage for another. Corporate form, contractual language, omissions, delays, rankings, correlated low-severity acts, use of an affiliate, and division of a decision across services do not alter coverage when practical dependency and computational determination remain.

Where a covered act results from the combined operation of several entities, each materially contributing entity answers for duties within its control. If the participants cannot establish bounded contributions through inspectable records, responsibility is joint. An adopting instrument may designate a lead principal, but an affected person need not reconstruct the system merely to identify a respondent.

An ownerless protocol or transient process cannot be the sole answerable principal. A party that deploys or integrates the system, controls access to the covered passage, or derives authority from its operation must supply a surviving principal capable of issuing receipts, answering contests, preserving records, and

complying with remedies. Without such a principal, the system may not exercise coercive computational authority.

Enumerations of covered passages within the Articles state included cases, not an exhaustive boundary. The jurisdictional test and defined terms govern when an operative provision does not repeat a covered passage.

The Twelve Articles

Canonical text, version 2026-07-18. Where any other statement of the Articles differs, this text governs.

Each Article names a right held by every person subject to coercive computational authority. That authority exists when a computational process materially contributes to an act governing a covered passage and the person lacks a reasonable and timely substitute. Population scale is relevant to systemic-significance duties under Article 12; it is not a condition of entitlement under Articles 1 through 11. Together the Articles constitute the constitutional floor below which computational governance lacks legitimacy.

1. Right to a contemporaneous receipt for any coercive computational act, stating Act, Authority, Bounds, Justification, and Appeal Path in an accessible form and, where required for independent verification, a machine-readable representation.
2. Right to contest any act through independent review, on a timeline proportionate to the severity of the harm.
3. Right to human review by an independent arbiter for every material adverse action above a published severity threshold. Related acts, omissions, or delays

are assessed by their cumulative effect. Other adverse actions require expedited reconsideration and inclusion in a statistically valid independent audit.

4. Right to export data, identity credentials, reputation attestations, and relational context in interoperable, machine-readable formats.

5. Right to present portable credentials to any compatible system without the issuing platform's permission.

6. Right against cross-domain composition of personal records (directly or by proxy, including inferred joins) without explicit, informed, revocable consent.

7. Right to time-bounded personal records. The right to become someone new is constitutionally protected. Evidence that coercive authority acted must remain durable, but personal information within or supporting that evidence remains subject to lawful minimization, sealing, restricted access, and limits on later adverse use.

8. Right to know the specific rule invoked in any adverse act, stated in evaluable terms. Disclosure is tiered: full rule and threshold to the affected party and their advocate under confidentiality; aggregate rule-invocation data published publicly; narrowly defined, time-bounded red-team exemptions subject to independent audit.

9. Right against collection beyond the minimum necessary for the specific function requested by

the person or for a duty independently authorized by law. Necessity is measured against the least data-intensive reasonably effective means.

10. No contractual waiver extinguishes Articles 1–9. Terms of service that purport to waive receipt, appeal, exit, or portability rights are void against the constitutional floor.

11. Right to an independent record. No coercive computational authority may control the sole authoritative record of its own acts. The record must be independently verifiable and resistant to unilateral revision, suppression, or censorship. Integrity establishes provenance and history, not the truth of every recorded claim; objections, corrections, and adjudicated findings must remain linked to the original record. Assurance must rest on a constraint external to the authority’s control, whose defeat is publicly detectable and costly in proportion to the power constrained.

12. Mandatory independent audit for coercive computational authorities above the threshold of systemic significance.

Canonical construction of Article 7. After the applicable threshold, renewed adverse use requires fresh, purpose-specific justification and independent review.

Institutional Allocation

The constitutional order contains three continuing organs: the Standard-Setting Body, the Auditor, and the Adjudicator. Their

authority is limited to the functions assigned here, and no organ may acquire another organ's final power by contract, delegation, or emergency practice. Continuity is justified where rule maintenance, technical examination, or reasoned judgment requires durable competence and institutional memory.

Standard-Setting Body

The Standard-Setting Body defines receipt schemas, interoperability requirements, audit criteria, severity thresholds, and procedural calibrations. Its rules must be public, versioned, prospective unless a stated necessity requires otherwise, and accompanied by reasons that answer material objections. It does not adjudicate individual cases or certify its own compliance.

Material rules require notice and a deliberation period sufficient for affected persons to respond. The Body must identify the legal or adopted authority for each rule, the class of operators and acts covered, the evidence considered, the expected burden, and the review date. Its rules remain subject to adjudicatory review and, where law provides, legislative control.

Auditor

The Auditor examines operators, receipt systems, record custody, review performance, and compliance with published rules. The Auditor must be institutionally and financially independent of the operator under review. Its mandate includes access to the records, interfaces, personnel, tests, and declared conventions needed to assess compliance. Confidential access may protect legitimate security, privacy, and trade-secret interests, but confidentiality may not prevent the Auditor from stating whether the constitutional duty was satisfied.

Audits must produce findings, supporting methods, limits, unresolved uncertainty, and corrective deadlines. Material find-

ings are public unless a narrowly defined withholding rule applies. Withheld matter remains available to the Adjudicator and any court with jurisdiction.

Adjudicator

The Adjudicator decides contests, reviews claimed exceptions, interprets the Articles, and determines whether rules or amendments breach the constitutional floor. It must be independent of the Operator, Auditor, and Standard-Setting Body in the matter before it. It may obtain technical assistance, but the reasons for judgment must remain attributable to the Adjudicator and intelligible to the parties.

The Adjudicator may affirm, reverse, modify, remand, order a new review, require a corrected receipt, suspend a rule, or impose another remedy authorized by the adopting instrument. Its decisions must identify the act, authority, evidence, applicable rule, disposition, and route of further review.

Affected-Person Counterpower

Affected-person counterpower is a capacity, not a continuing office. Each rule may affect a different population. Permanent representation would assign a durable identity to a changing relation and invite professionalization, jurisdictional expansion, and capture. Counterpower expires with the claim, remedy, or authorized implementation review.

Affectedness may be established by a receipt, an independent record, credible evidence of unrecorded exposure, a finding of the Auditor or Adjudicator, or credible inclusion in the population identified by a prospective material-change receipt. A materially defective or missing required receipt, together with credible evidence of exposure, creates a rebuttable presumption of affectedness and requires independent reconstruction of the ex-

posed population. An Operator may not defeat invocation by withholding the evidence that Article 1 required it to create.

Each affected person may invoke review, join or leave a common proceeding, delegate and timely revoke claim-specific representation, receive notice, and object to closure. Interoperable recourse systems independent of the Operator may aggregate common contests. A routing decision that rejects, consolidates, prioritizes, assigns, distinguishes, or closes a contest must issue a receipt and remain independently reviewable.

Employees, researchers, journalists, civil organizations, vendors, and other witnesses may present credible evidence sufficient to open a preliminary examination or audit. That capacity does not confer control of an affected person's claim, authority to bind the affected class, or entitlement to another person's remedy.

Only the Adjudicator may stay an operating rule or pipeline through a reasoned, time-bounded order. A temporary affected-person panel may examine remedy design, notice, implementation, and closure when a disposition would bind or limit absent persons. It may present objections but may not decide merits, write rules, appoint officers, control a continuing budget, license systems, impose a stay, or extend its mandate.

Operator and external institutions

The Operator is the regulated party. It may petition for a rule, amendment, or emergency exception and may contest an audit or judgment through the prescribed process. It does not vote as a constitutional organ. A recourse provider administers procedure and has no authority to interpret the Articles or determine the merits of a claim. Courts remain available for judicial review where law provides, and legislatures retain authority to enact

stronger protections, alter statutory institutions, or decline adoption. No internal organ is insulated from lawful public authority.

Canons of Construction

Institutional specifications, temporal-use rules, and explanatory grounds implement this Constitution. If they conflict with an operative provision, the operative provision governs. They may not amend the Articles except through the amendment procedure.

Receipt and review

Articles 1 and 2 operate together. A receipt without a practical review path does not satisfy Article 2. Review without a contemporaneous statement of the act, authority, bounds, justification, and appeal path does not cure an Article 1 violation. Template language fails when it does not identify the actual rule or evidence materially used.

Every receipt must also state the date and time, stable identifier, responsible Operator and surviving principal, schema version, materially relevant rule or model version, whether the act was automated, recommended, or human-decided, the provenance of material inputs, material uncertainty, any expiry or review date, and the status of correction and appeal. It must provide an accessible human-readable form and an interoperable machine-readable representation sufficient for independent verification.

The review timeline must be proportionate to the harm. A process completed after the material consequence has become irreversible may remain useful for correction or damages, but it does not satisfy a duty of timely contestation where interim relief was practicable.

Human judgment

Article 3 requires independent human judgment for material adverse actions. A reviewer must possess the competence, authority, time, and evidence necessary to evaluate the act. Confirmation of an output without those conditions is not human review. The resulting receipt must identify the reviewer, the evidence considered, the disposition, and any material limit on the reviewer's capacity.

Algorithmic reconsideration is permitted for lower-severity acts only where the rules define sampling, escalation, and audit. It is not equivalent to Article 3 review and may not be used for acts above the materiality threshold.

Severity follows cumulative effect. An Operator may not divide a restriction among repeated acts, omissions, delays, rankings, affiliates, or coordinated systems to keep each component below the materiality threshold.

Portability and presentment

Article 4 protects the data and standing needed for practical exit. Export must preserve usable structure, provenance, and relationships to the extent necessary for a receiving system to evaluate the material. Security and privacy restrictions must be narrowly fitted to the risk and may not serve as disguised lock-in.

Article 5 requires compatible systems to permit presentment without the issuer's permission. A system is compatible when it implements a published interface or can evaluate the credential through reasonable technical adaptation. It does not compel acceptance. A receiving system may assess provenance, validity, relevance, and current status under public rules, but self-declared incompatibility and rejection are covered acts subject to receipt and review.

Composition and consent

Article 6 applies to direct joins and to proxies, derived scores, embeddings, cached classifications, or coordinated outputs that materially reproduce a prohibited cross-domain composition. Consent must identify the domains, purpose, material consequences, duration, and withdrawal procedure. Consent is invalid when refusal would deny access to a covered passage unless the composition is necessary to provide the service and independently authorized under law or the adopted constitutional process.

Temporal jurisdiction

Article 7 separates four questions: whether an event occurred, whether its record may be retained, who may access it and for what purpose, and whether it may materially contribute to a present adverse act. A record may remain accurate, retained, and accessible for a defined purpose while losing authority in an unrelated or later decision.

After the applicable threshold, non-use in adverse decisions is the default. Renewed use requires a present, domain-specific nexus; an explanation of why current evidence or a less restrictive means is inadequate; independent review; notice before the act where practicable; and a duration limited to the approved purpose. Authorization permits the stated use only. It does not restart the threshold or restore general authority.

The rule follows functional reliance. An operator may not avoid it through an affiliate, broker, proxy, derived score, embedding, model output, or changed record form that materially carries the expired influence into the present act. No particular deletion or machine-unlearning method is constitutionally prescribed.

Records of coercive authority are governed differently because they support public accountability. Their persistence

remains subject to lawful protection of personal data, security, and adjudicatory confidentiality, but the authority may not invoke personal renewal to erase the evidence of its own acts.

Rule disclosure

Article 8 requires an evaluable account of the rule materially invoked. Disclosure need not reveal source code, model weights, third-party personal data, or a trade secret to the public. It must still permit the affected person, a confidential advocate, the Auditor, and the Adjudicator to determine which procedure and principles were applied, which material inputs were used, and whether the stated conditions were satisfied.

A narrowly defined red-team exception must identify the risk, scope, duration, custodian, and independent reviewer. It may delay or tier disclosure; it may not convert a rule into secret authority beyond review.

Minimum collection and anti-waiver

Article 9 measures necessity against the specific function requested by the person or a duty independently authorized by law, using the least data-intensive reasonably effective means. An Operator may not enlarge the function to bundle unrelated purposes. Data useful for speculation, future product development, or unrelated optimization is not necessary merely because collection is inexpensive.

Article 10 bars contractual waiver of Articles 1 through 9. It also prevents an operator from using consent to reduce duties imposed by Articles 11 and 12. Stronger rights supplied by law remain available.

Independent record and audit

Article 11 is technology-neutral. The record must be independently verifiable, resistant to unilateral revision, and protected by an external constraint whose defeat is publicly detectable and costly in proportion to the power constrained. The proper mechanism depends on the threat model. Independent custody, multiparty attestation, public transparency logs, cryptographic commitments, institutional replication, and physically costly settlement may satisfy different assurance levels. No named technology is constitutionally required.

Record integrity establishes what was recorded, by whom, and how it changed. It does not establish that the recorded assertion was true. An affected person's objection, an authenticated correction, a superseding status, and an adjudicated finding must remain linked to the original entry under the governing access and retention rules.

Article 12 applies above a published systemic-significance threshold because recurrent or population-wide risk requires examination beyond individual contest. Below that threshold, an audit may still be required by the Standard-Setting Body, opened by the Auditor under published predicates, sought by an affected person, supported by credible witness evidence, ordered by the Adjudicator, or imposed by law. Low contest volume does not establish compliance without examination of access, missing receipts, abandonment, and retaliation.

Burdens and Remedies

The Operator bears the initial burden of producing the receipt and the record necessary to evaluate a covered act. Once an affected person identifies a material omission, inconsistency, plausible violation, or credible evidence of exposure without the re-

quired receipt, the Operator must show that the stated authority applied, the evidence satisfied the rule, the bounds were proportionate, and the review path was effective. An affected person is not required to prove the internal operation of a system whose relevant evidence remains under the Operator's control.

The burden for an exception rests on the party invoking it. That party must identify the provision affected, the authorized purpose, the necessity of the departure, the absence of a less restrictive means, the duration, and the independent reviewer. A generalized interest in efficiency, fraud prevention, safety, security, or trade secrecy does not establish the exception without facts connecting that interest to the particular departure.

Remedies must address the constitutional defect and the practical harm. A valid adoption must authorize timely interim relief, correction, reversal, modification or remand, restoration where practicable, preservation and controlled access to evidence, and protection against retaliation. It may also authorize a new independent decision, exclusion of an impermissible record, suspension of a rule, an audit, compensation, or another remedy consistent with the Articles.

Where a defect affects a class through a common rule or system, relief may extend beyond the individual case. The Adjudicator may order notice to similarly situated persons, preservation of relevant records, testing of the common rule, prospective correction, or a defined stay pending review. Representative relief must identify the affected class, common exposure, remedy, implementation period, and process for preserving materially different facts and remedies. A disposition that would bind or materially limit absent persons requires participation by a temporary affected-person panel and reasoned approval by the Adjudicator. Representative relief supplements rather than displaces each affected person's direct claim in the designated independent forum.

Interim relief is appropriate when delay would defeat meaningful review and the likely injury from temporary protection is proportionate to the risk of an unlawful act. The Adjudicator must state the evidence, duration, conditions, and allocation of risk. Interim relief does not decide the merits unless the adopting law expressly provides otherwise.

Good-faith compliance may affect penalty or remedy but does not erase the affected person's right to correction. Repeated failure, concealment, retaliation, record suppression, or use of an exception outside its stated bounds supports stronger relief. An Operator may not retaliate against a person for requesting a receipt, pursuing review, assisting an audit, presenting a portable credential, withdrawing consent, joining a common proceeding, or submitting evidence of a systemic defect.

Compliance with these Articles does not validate an act that is discriminatory, fraudulent, retaliatory, arbitrary, or otherwise unlawful. These Articles supplement and do not displace stronger substantive or procedural protections.

If two Articles appear to conflict, they must be construed to preserve the practical exercise of both where possible. Privacy and security protections may shape disclosure under Article 8 without eliminating independent evaluation. Record persistence under Article 11 may protect evidence of authority while Article 7 limits the later adverse use of personal information contained in that evidence. Portability under Articles 4 and 5 remains subject to third-party rights without permitting the Operator to use those rights as a general bar to exit.

Invalidity of one rule, calibration, or institutional assignment does not suspend the remaining Articles unless the adopting instrument makes the provisions inseparable. A transition ordered after invalidity must preserve accrued claims, records, and review rights.

Amendment

Any person or institution may petition for amendment or calibration. A valid proposal must state the text or calibration to be changed, the reason, the affected rights and institutions, the evidence considered, the expected consequences, and the transition rule. Technical calibrations within delegated bounds require public notice, a defined objection period, a reasoned response to substantive objections, and a two-thirds vote of the Standard-Setting Body. An objection alleging that the change exceeds delegated bounds or weakens the constitutional floor is reviewable by the Adjudicator. It does not stay the change unless the Adjudicator finds that delay would defeat meaningful review and issues a reasoned interim order.

The Auditor and Adjudicator may report consequences and legal defects but do not vote. An amendment to an Article requires the same notice and response, approval by two-thirds of the Standard-Setting Body, and ratification through the lawful process of the constituting authority that adopted the Constitution. Where a private constituting authority is controlled by the covered Operator and affected persons lack a reasonable and timely substitute, ratification also requires matter-specific approval through an independently administered process open to authenticated affected persons. The adoption instrument must state the quorum, voting rule, privacy safeguards, and treatment of materially distinct affected groups. The organs cannot amend an Article by their votes alone.

Articles 1, 2, 3, and 10 remain non-derogable minima because they preserve the practical conditions of notice, contest, answerable judgment, and non-waiver. Calibrations such as deadlines, audit frequency, severity thresholds, interoperability profiles, and temporal-use schedules may be revised when the revision preserves meaningful exercise of the right. An amendment

affecting Article 11 may alter assurance architecture, custody, or technology, but may not make the practical exercise of Articles 1 through 3 depend solely on evidence controlled by the Operator.

An amendment takes effect prospectively after a stated transition period. Retroactive application requires a separately stated justification and may not extinguish an accrued claim or validate an act that violated the governing rule when taken.

Emergency

An Operator may request a temporary exception by publicly identifying the threat, the provisions affected, the proposed scope, the duration, and the review channel. An independent authority designated by the adopting instrument must authorize the exception before it takes effect, except where immediate action is necessary to prevent imminent material harm. Immediate action requires a provisional receipt at the time of the act and independent authorization within forty-eight hours.

The Adjudicator must promptly review every emergency exception. The record must state the evidence, rule, affected persons or class, measures taken, information withheld, and termination condition. Secrecy may be authorized only by a time-limited order, with access for the Auditor and Adjudicator.

No emergency exception may suspend Articles 1, 2, 3, or 10. Operational failure may move receipt, review, or record duties to a degraded channel, but it does not extinguish them. Records created during degraded operation must be reconciled when service returns. An exception expires after ninety days unless renewed through the amendment process.

Adoption and Enforceability

An adopting jurisdiction must identify the institutions that exercise each constitutional function, the constituting authority, nomination and appointment procedures, confirmation where required, removal standards, initial and staggered terms, interim authority, succession, quorum and voting rules, compensation, conflict rules, confidentiality and transparency duties, the recourse systems through which affected persons may proceed, independent funding, the minimum remedies stated above, the route to judicial review, and the relationship between these Articles and stronger existing law. Funding may not remain subject to the unilateral control of an Operator reviewed by the institution.

Valid adoption requires a solvent remedy path proportionate to the authority exercised. An independently custodied reserve, bond, mutual pool, insurance arrangement, public appropriation, or combination may satisfy that duty. The funder may not determine standing, select the Adjudicator, control an audit, interpret the Articles, suppress a claim, or settle away non-waivable correction. No affected person may be charged for access to the constitutional minimum.

A private operator may adopt the same duties by enforceable charter, contract, certification, or public commitment only if affected persons may invoke the Articles directly in a designated forum, obtain the minimum remedies, and pursue review before an institution independent of the operator's discretion.

Partial adoption must be described article by article. An operator may not claim constitutional compliance from adoption of selected procedures while omitting the articles that the claim implies. Interoperability between different adoption levels must preserve provenance so that a receiving institution can determine which rights governed the credential, receipt, or record.

The constitutional floor governs only where it has been adopted as law or binding obligation. Its protections attach to every person subject to the defined power; its legal force extends as far as an authorized institution can enforce it. Keeping those propositions separate permits the Constitution to state the minimum conditions of legitimate computational authority without concealing the work of enactment.

The Machine in Detail

I. Coverage and Responsibility

The constitutional duties attach when practical dependency and computational determination coincide. Practical dependency exists when denial, delay, exclusion, or degradation at a service would impose a material loss that a reasonable substitute cannot timely cure. Computational determination exists when a rule, model, classification, or composed computational process materially determines, recommends, or executes the act.

Coverage is assessed act by act and does not depend on corporate form, public status, scale, or description. Scale may increase dependency and harm, but scale alone is not the jurisdictional test.

The same test applies to public and private authority. A regulator may be captured by the institutions it oversees. A private service may acquire sovereign effects where departure requires material forfeiture. Neither office nor contract answers whether refusal is practical.

The *Operator* is each entity responsible for a covered act. Where several entities materially contribute, each answers for duties within its control. If they cannot establish bounded contri-

butions through inspectable records, their responsibility is joint. An adoption instrument may designate a lead principal to coordinate compliance, but the affected person need not reconstruct the combined system merely to identify a respondent.

Every delegation chain must identify a *surviving principal* with authority to constrain the system and answer after transient agents, services, or personnel cease to operate. An ownerless protocol or transient process cannot occupy that role alone. A party that deploys or integrates it, controls access to the covered passage, or derives authority from it must supply identifiable and durable answerability.

Coverage follows the combined effect of the act. Repeated omissions, delays, rankings, correlated low-severity acts, affiliates, or coordinated systems may not be divided to avoid a threshold that their aggregate effect satisfies.

II. Receipt Architecture

A receipt records a coercive computational act in a form that supports review. It contains five fields:

Field	Required content	Function
<i>Act</i>	The decision, classification, restriction, denial, or state transition imposed	Identifies what occurred
<i>Authority</i>	The rule, policy, mandate, or delegated power invoked	Identifies the claimed power

Field	Required content	Function
<i>Bounds</i>	Scope, duration, reach, and affected services or identities	Defines the consequence
<i>Justification</i>	The material facts, evidence, and reasoning used	Makes the act evaluable
<i>Appeal Path</i>	Reviewer, procedure, deadline, and available relief	Makes contest practical

The Operator issues the receipt with the act. An emergency provisional receipt may state Act, Authority, and Bounds at once, with the remaining fields completed within forty-eight hours. Its status, omissions, deadline, and responsible official remain visible.

A field must identify the actual basis of the act. Generic policy language, an unapplied category, or possible reasons do not suffice. Material uncertainty must be disclosed without false precision.

The public, versioned schema states the date and time, stable identifier, responsible Operator and surviving principal, schema and materially relevant rule or model versions, decision mode, provenance of material inputs, material uncertainty, expiry or review date, and status of correction and appeal. It supplies an accessible human-readable form and an interoperable machine-readable representation sufficient for independent verification. Correction preserves the prior version, correcting party, authority, and change.

Recourse and finality

Recourse is allocated by the kind of question presented. Mechanization reduces the cost of enforcing settled requirements. It does not enlarge what machines can decide.

Path	Trigger	Authorized consequence	Limit
<i>Formal defect</i>	Missing required field, expired authority, broken appeal route, or absent required attestation	Preserve evidence, toll deadlines, correct the record, and restore a prior state where the adopted rule has made that response safe and determinate	No conclusion about substantive legality
<i>Observed cure</i>	Bounded implementation failure with an undisputed governing rule	Operator correction within a published period under independent observation	Failure or dispute advances the matter

Path	Trigger	Authorized consequence	Limit
<i>Systemic examination</i>	Common fingerprints, audit predicates, missing-receipt patterns, severe incidents, or credible witness evidence	Aggregated independent audit and corrective findings	Auditor establishes facts but does not decide remedies
<i>Adjudication</i>	Novel interpretation, disputed systemic facts, proportionality, meaningful-review questions, or material individual differences	Reasoned judgment and effective remedy	Judgment remains attributable to an independent human Adjudicator

Low-severity acts that are readily reversible may proceed with a valid receipt and review path. A material but substantially reversible act may proceed provisionally only while the evidence and means of practical restoration remain available. A severe or materially irreversible act receives the independent human review required by Article 3 before final execution, except under the emergency rule. The deadline always shortens when delay would defeat the remedy.

Severity is assessed by cumulative effect. A sequence of related acts, omissions, delays, or rankings receives the review required by its aggregate consequence even when no component independently crosses the threshold. Any act satisfying the constitutional definition of a material adverse action receives independent human review regardless of its administrative label.

Machine-checkable evidence may establish that declared authority exists, versions are valid, fields are present, bounds have not expired, records are independently committed, and required attestations exist. It cannot establish factual truth, proportionality, practical substitutability, meaningful human judgment, nondiscrimination, or constitutional legitimacy. A formally conforming act remains contestable on those grounds.

Human review and competence

Article 3 requires an independent human arbiter with relevant competence, time, evidence, authority to disagree, and protection against retaliation. The review receipt identifies the arbiter, evidence, tests, disposition, and material limitations.

Where substantive review cannot be distinguished from routine confirmation, the institution must narrow authority, reduce volume, increase capacity, or change the procedure until review becomes auditable.

III. Temporal Use of Personal Records

Article 7 governs the present authority of personal records. It does not reduce the issue to deletion. Four questions remain separate: whether an event occurred, whether a record may be retained, who may access it and for what purpose, and whether it may materially contribute to a present adverse act. A record can

remain accurate, retained, and accessible for a lawful purpose while losing presumptive authority in another decision.

Canonical construction of Article 7. After the applicable threshold, renewed adverse use requires fresh, purpose-specific justification and independent review.

Schedules are calibrated by record type, severity, present purpose, current evidence, affected-party interests, and narrowly specified safety, archival, investigatory, or adjudicative needs. After the threshold, non-use in adverse decisions is the default. The party seeking renewed use must show a present domain-specific nexus, explain why current evidence or a less restrictive means is inadequate, identify the duration, and obtain independent approval. Notice must precede the act where practicable. Protected investigative use may receive later notice under an independent and time-limited order.

Authorization permits only the stated use. It neither restarts the threshold nor restores general authority. The holder of the record may not unilaterally extend or suspend the threshold.

The rule follows functional reliance. An Operator may not evade it by routing a record through an affiliate, data broker, proxy, derived score, cached classification, embedding, or model output that contributes materially to the adverse act. The FTC's final Everalbum order required deletion of specified face embeddings and models or algorithms developed using covered biometric information. That was a case-specific remedy rather than a general rule.¹ The influence of individual data on trained systems can be difficult to trace, and machine-unlearning verification remains vulnerable to evasion.² Operators must preserve enough lineage for independent testing and disclose material uncertainty. No particular unlearning method is constitutionally prescribed.

Records of coercive authority are not entitled to the same temporal presumption. They persist to support public account-

ability, subject to lawful protections for personal data, security, and adjudicatory confidentiality. Public institutions may limit a record's future coercive use. They cannot forgive on behalf of a victim or community that has not done so.

IV. Four Institutional Separations

Four separations prevent the same interest from creating the evidence, judging the evidence, and controlling the remedy.

Issuer and Verifier

The credential issuer may not be its sole verifier. An independent path must permit assessment of authenticity, status, scope, and provenance without allowing the verifier to alter the claim. No named credential format is required.

Operator and Auditor

The Operator may not control the Auditor's appointment, access, findings, compensation, or continued existence. The Auditor receives access adequate to test receipts, review, record custody, temporal use, portability, minimization, and composition. Controlled access may protect secrets but may not prevent a compliance finding.

Rule-Maker and Adjudicator

The Standard-Setting Body writes prospective rules. The Adjudicator applies and interprets them in contested cases. The same person may not perform both functions in one matter. A later rule revision cannot reverse the judgment that prompted it.

Credentialer and Identity Provider

A credentialer may not make continuing membership the exclusive means of proving identity or presenting an attestation. Public evaluation rules must permit presentment without the issuer's permission. They need not require every institution to accept every credential.

V. Affected-Person Counterpower

Affected-person counterpower belongs to persons exposed to a covered act or rule through direct claims, common proceedings, claim-specific representation, prospective objections, and representative relief. Affectedness changes with the act, lineage, population, severity, and remedy. Permanent membership would give that changing relation incentives for institutional survival and jurisdictional expansion.

A valid receipt or independent exposure record establishes affectedness. Credible evidence of exposure with a materially defective or missing required receipt creates a rebuttable presumption and an independent duty to reconstruct the population. A finding by the Auditor or Adjudicator may also establish affectedness. A material-change receipt establishes prospective eligibility for persons credibly within the projected population to challenge the classification, seek audit, or request interim relief before an irreversible change.

Each affected person may contest, join or leave a common docket, delegate and timely revoke claim-specific representation, receive notice, seek individual relief, and object to closure. A mandate is non-transferable beyond the matter.

Contest Registry

One or more interoperable Contest Registries may authenticate and administer recourse. No registry is a constitutional organ or final interpreter. An adoption must provide at least one accessible route that the Operator, registry provider, and assurance provider cannot unilaterally close.

Each contest record states stable contest and receipt identifiers; Operator and principal; act, passage, authority, and dates; schema, rule, model, and functional lineage; Article and claimed defect; severity, reversibility, exposure evidence, uncertainty, and requested remedy; representation mandate and revocation status; common-docket assignment; procedural status, decisions, deadlines, correction history, and appeal path; and an individual delta preserving material facts, consequences, substitutes, vulnerabilities, and remedies.

A decision rejecting, consolidating, prioritizing, severing, assigning a forum, applying precedent, or closing a contest issues a meta-receipt with the rule, evidence, reasons, version, result, correction procedure, and independent appeal. Registry rules are inspectable, versioned, tested for false negatives, independently recorded, and externally reviewable.

Privacy-preserving credentials or zero-knowledge proofs may establish exposure without public identification. They are optional means of authentication. They do not prove harm, unlawfulness, adequate representation, or the truth of a claim. Failure to satisfy an automated membership test remains reviewable on the ground that the test encoded the affected class incorrectly.

Aggregation and precedent

Common dockets aggregate by authority, functional decision procedure, system lineage, failure mechanism, covered passage,

and material factual predicates. Version strings alone neither compel nor defeat consolidation. Each underlying contest retains its individual delta, and the affected person may seek de-consolidation when that difference could alter liability, timing, or remedy.

An Operator may not evade an established common defect through version churn, personalization, affiliates, relabeling, or nominal pipeline changes. A successor system descended from a version found defective carries a rebuttable presumption of the same defect until the Operator shows that the relevant failure mechanism has been corrected.

A precedential disposition produces a reasoned opinion, a machine-readable statement of the holding, its factual and legal boundaries, a public conformance test where the defect is mechanically testable, a remedy template, material distinctions, and an expiry or reconsideration condition. An adverse systemic finding may create a rebuttable presumption for materially matched claims. A settlement creates no precedent. An exonerating finding does not bind absent persons without adequate representation, notice, and a demonstrated material match.

Witness evidence and latent exposure

Employees, researchers, journalists, vendors, civil organizations, and other witnesses may submit credible evidence of a systemic defect. They may obtain preliminary examination or audit but may not control affected persons' claims, bind them, or claim their remedies.

The Auditor may act on random sampling, outcome discontinuities, missing-receipt patterns, abnormal withdrawal or abandonment, evidence of retaliation, divergence between declared and observed exposure, complaints concentrated among unusu-

ally sophisticated persons, or a single severe event. A low complaint rate is not evidence of low harm until access, notice, suppression, and retaliation have been examined.

Temporary remedy panels

A temporary affected-person panel is constituted only when batch relief, settlement, or closure would bind or materially limit absent persons. An independent administrator uses stratified sortition among verified voluntary claimants and includes materially distinct groups. Members receive independent counsel, facilitation, expenses, and fixed compensation under a public schedule from the assurance mechanism. Compensation may not be paid directly by the Operator or vary with the outcome.

The panel reviews remedy design, notice, implementation, and closure and presents objections to the Adjudicator. It cannot decide merits, write rules, appoint officers, control a continuing budget, license systems, impose a stay, or extend its mandate. It dissolves after implementation review. Binding representative relief requires reasoned Adjudicator approval.

Only the Adjudicator may stay an operating rule or pipeline. A stay requires a reasoned order stating the evidence, scope, duration, interim protection, and route to expedited review.

VI. The Three Constitutional Organs

The *Standard-Setting Body* defines schemas, interoperability profiles, thresholds, audit criteria, temporal-use schedules, and procedural rules. It publishes drafts, evidence, objections, reasons, versions, and review dates. It does not decide individual cases.

The *Auditor* examines compliance and system performance. It reports methods, findings, limits, uncertainty, and corrective

deadlines. It does not write the governing rules for the matter audited or decide the affected person's remedy.

The *Adjudicator* decides contests, interprets the Articles, reviews exceptions, and supplies remedies authorized by the adopting instrument. It may receive technical assistance but remains responsible for the judgment and reasons.

Affected-person counterpower is a constitutional capacity rather than an organ. Contest Registries administer procedure and temporary panels participate in representative remedies; neither possesses rulemaking or adjudicatory authority.

The Operator is a regulated party. It may petition, answer, contest, and seek review. It does not vote as an organ. Courts and legislatures remain external backstops. Courts review judgments where jurisdiction exists. Legislatures may impose stronger rights, revise statutory institutions, or decline adoption.

VII. Portability and Practical Exit

Export must preserve the structure, provenance, status, and relationships needed for a receiving system to evaluate identity, credentials, reputation, and context. Security and privacy limits must answer an identified risk.

Presentment and acceptance are distinct. A system is compatible when it implements a published interface or can evaluate the credential through reasonable technical adaptation. A compatible system must permit submission without the issuer's permission. The receiving institution may reject the credential under public rules governing provenance, validity, relevance, and current status. Self-declared incompatibility and rejection are covered acts when they govern a covered passage; each requires a receipt and review.

Practical exit requires switching procedures, service continuity, protection against retaliation, and disclosure of dependencies that cannot be ported. An unavailable alternative is not exit.

Function-based necessity

Collection under Article 9 must identify the specific function requested by the person or the duty independently authorized by law. The Operator must use the least data-intensive reasonably effective means and state why a less intensive means would not perform the function with reasonable effectiveness. A broad service label, technical convenience, speculative future use, or a bundled secondary purpose does not establish necessity.

VIII. Independent Record Assurance

Article 11 requires evidence of coercive acts to remain outside the Operator’s unilateral control. Assurance is calibrated to the power constrained and the threat model.

Assurance	Suitable uses	Minimum properties
<i>Standard</i>	Lower-severity service and moderation receipts	Append-only history, independent replication, authenticated correction, periodic external audit
<i>Heightened</i>	Employment, housing, payment, and credential decisions	Multiparty custody or attestation, public consistency proofs or equivalent detection, tested recovery, separation from the Operator

Assurance	Suitable uses	Minimum properties
<i>High</i>	Criminal justice, legal identity, systemic finance, and other exceptional powers	Several independent custodians, publicly detectable suppression or revision, durable recovery, and an external constraint costly to defeat in proportion to the authority recorded

The mechanism may use institutional replication, transparency logs, cryptographic commitments, multiparty attestation, independent archives, physically costly settlement, or another method that meets the required properties. A blockchain or proof-of-work system is neither required nor sufficient by name. The design must state the threat, the custodian set, the revision procedure, the detection method, the recovery path, and the consequence of compromise.

Integrity proves what was recorded, by whom, and how the record changed. It does not establish the truth of the underlying assertion. Objections, authenticated corrections, superseding status, and adjudicated findings remain linked to the original entry under the governing access and retention rules.

Independent-record failure model: the entity that controls the audit log can edit, suppress, or selectively disclose the evidence against itself. The remedy is an external verification and custody arrangement proportionate to the authority recorded.

IX. Declared Rules and Formal Diagnosis

Article 8 requires a nameable and evaluable rule. For systems composed from declared conventions, the Operator must disclose the components, the mappings by which outputs cross boundaries, and the rule used to resolve disagreement. Formal local-to-global analysis may diagnose omitted compatibility requirements when the declared mappings satisfy the hypotheses of the chosen model.

That analysis does not infer an operative rule from opaque model weights, prove that a runtime act will fail, or establish that a disclosed convention is normatively justified. Register mappings are design choices. A seam or obstruction result is conditional on those mappings, the declared cover, and the mathematical assumptions. Where an opaque learned system materially contributes to a covered act, the Operator still owes an evaluable account of the procedure and principles actually applied. If the account cannot support contest, the unreadable output may not serve as the sole authority for coercion.

X. Amendment and Emergency Operation

Any person or institution may petition for a technical calibration or constitutional amendment. A petition states the proposed change, reasons, affected rights and institutions, evidence, expected consequences, and transition rule. A calibration within delegated bounds requires public notice, a defined objection period, a reasoned response to substantive objections, and a two-thirds vote of the Standard-Setting Body. An objection that the change exceeds delegated bounds or weakens the constitutional floor is reviewable by the Adjudicator and may support a reasoned interim order.

An amendment to an Article requires the same notice and response, approval by two-thirds of the Standard-Setting Body, and ratification through the lawful procedure of the constituting authority that adopted the Constitution. If a private constituting authority is controlled by the covered Operator and practical exit is unavailable, ratification also requires matter-specific approval through an independently administered process open to authenticated affected persons. The adoption instrument states the quorum, voting rule, privacy protections, and treatment of materially distinct groups. The Auditor and Adjudicator may advise but do not vote.

An Operator may request an emergency exception by identifying the threat, provisions affected, scope, duration, evidence, and review channel. An independent authority designated by the adopting instrument authorizes the exception. Immediate action necessary to prevent imminent material harm requires a provisional receipt and independent authorization within forty-eight hours. The Adjudicator promptly reviews the exception.

Every emergency act receives a receipt. Any secrecy is separately justified, independently ordered, and time-limited. Articles 1, 2, 3, and 10 remain in force. Operational failure may move duties to a degraded channel but does not extinguish them. An exception expires after ninety days unless renewed through the amendment process.

XI. Public Performance and Capture Controls

Each organ and recourse provider publishes measures sufficient to reveal whether the constitutional procedures work in practice. Measures include receipt completeness, registry rejection and severance, review volume, median and tail deadlines, rates of reversal and modification, interim-relief use, audit findings, repeated rule failures, portability completion, rejected present-

ments, temporal-use exceptions, record corrections, emergency invocations, and unresolved remedies. Publication protects personal data and legitimate security interests while preserving enough structure for independent analysis.

Performance measures do not determine whether an individual act was lawful. They identify patterns requiring audit, rule revision, funding changes, or common proceedings. A low reversal or complaint rate may indicate accurate initial decisions, inaccessible review, missing receipts, weak remedies, retaliation, or captured adjudication. The Auditor must examine access and incentives before treating any metric as evidence of compliance.

Capture controls apply to appointment, funding, information access, career incentives, and review. Each organ publishes conflicts, recusals, funding sources, appointment terms, removal standards, and material contacts with covered Operators. Rotating appointments and cooling-off periods may reduce dependence, but no single device establishes independence. The operative test is whether the institution can obtain evidence, reach an adverse conclusion, impose or seek a remedy, and survive the loss of an Operator's favor.

Each disclosure is versioned, retained, and available to the Auditor, affected persons through lawful access procedures, and any court with jurisdiction.

XII. Adoption and Verification

An adoption instrument identifies the institutions assigned to each organ, the constituting authority, nomination and appointment procedures, confirmation where required, removal standards, initial and staggered terms, interim authority, succession, quorum and voting rules, compensation, conflicts, confidentiality and transparency duties, the interoperable recourse systems, the Operators and acts covered, data-access

authority, transition periods, and relationship to stronger law. Its funding mechanism must be insulated from the unilateral control of any reviewed Operator.

Valid adoption supplies a solvent remedy path proportionate to the authority exercised. The mechanism may use an independently custodied reserve, bond, mutual pool, insurance, public appropriation, or a combination. Smaller Operators may pool assurance. The mechanism funds audits, adjudication, temporary-panel participation, restoration, and continuity when an Operator fails. No affected person pays for access to the constitutional minimum.

An assurance provider may price and finance risk. It may not determine standing, select the Adjudicator, control an audit, interpret the Articles, suppress a claim, or settle away non-waivable correction. Contributions may consider independently verified exposure, severity, reversibility, concentration, missing receipts, sampled violation rates, correction performance, and retaliation. Complaint counts alone are insufficient because the Operator may influence whether complaints are possible.

Valid adoption supplies a minimum remedial package: timely interim relief; correction; reversal, modification, or remand; restoration where practicable; evidence preservation and controlled access; protection against retaliation; and a direct claim in a designated independent forum. Representative action supplements rather than displaces individual invocation. Compliance with the Articles does not validate discrimination, fraud, retaliation, arbitrariness, or another unlawful act, and stronger substantive or procedural rights remain available. A private adoption may not make the forum or remedy withdrawable at the Operator's discretion.

Partial adoption is stated article by article. The adopter must not use a general claim of constitutional compliance where material articles or institutions are absent. Receipts and credentials

carry adoption provenance so a receiving party can determine the rights, schema, record assurance, and review process that governed them.

Implementation is verified through receipts, appeals, audits, amendment records, emergency records, and public performance measures. A constitutional obligation that leaves no inspectable trace cannot be distinguished from an aspiration. The record must therefore show who exercised power, under which rule, against whom, for how long, subject to which review, and with what result.

Notes

1. Federal Trade Commission, **In the Matter of Everalbum, Inc.**, Decision and Order, Docket No. C-4743 (May 6, 2021), Definitions paragraphs 1 and 5-6 and Part III.B-C. The remedy reached specified face embeddings and affected work product developed using covered biometric information. [back](#)

2. Binchi Zhang, Zihan Chen, Cong Shen, and Jundong Li, “Verification of Machine Unlearning is Fragile,” **Proceedings of the 41st International Conference on Machine Learning**, PMLR 235 (2024), pp. 58717-58738. The paper demonstrates adversarial evasion of several verification strategies; it supports caution about proof of removal, not a claim that removal is impossible. [back](#)

Appendices

Appendix A: The Twelve Canonical Claims

Each claim is stated, its chapter identified, and its falsification condition specified. A reader who finds a counterexample to any claim has refuted that portion of the framework and should say so.

C1. Tempo and Legitimacy (Chapter 0: The Crisis)

When decision tempo exceeds participation tempo, legitimacy collapses unless contestability is mechanized.

Type: Architectural. Falsification: Identify a class of coercive decisions operating faster than contemporaneous human deliberation that remains meaningfully contestable without a mechanized record or equivalent procedure. Context: The crisis begins when consequential computational acts outrun the procedures that make them answerable. An account freeze that executes in milliseconds and offers an appeal that resolves in months has satisfied the formal requirements of governance while violating the substantive ones. The claim asserts that this temporal asymmetry is not a design flaw but a structural condition that can only be addressed by embedding contestability in the protocol itself.

C2. Convergent Witnessing (Chapter 1: The Weight of the Word)

Binding, conditions, stakes, recourse, and composition form a recurring witness pattern across the selected institutions. The recurrence supports, but does not prove, necessity.

Type: Historical. Falsification: Identify a durable large-scale coordination system lacking one of the five or show that the categories have been imposed on unlike institutions so loosely that the convergence disappears. Context: Mesopotamian sealings, Roman tablets, bills of exchange, and fair institutions combine documentary form, attribution, consequences, recourse, and transfer in different ways. Legal cultures also borrowed from one another. The evidence therefore supports recurrence under varied institutions, not pristine independent invention.

C3. The Trust Tax (Chapter 2: The Trust Tax)

An intermediary's premium can combine a real coherence fee with an extractable trust tax. Cheaper verification can shrink the tax without eliminating composition cost or institutional rent.

Type: Interpretive. Falsification: Show, in the proposed domains, that the distinction does not identify separable coordination work and position-derived rent, or that reducing verification cost predictably leaves the alleged rent unchanged for reasons the framework cannot explain. Context: The distinction is a diagnostic lens, not a universal accounting identity. The research program's old coherence-fee measure failed as a predictor of execution failure and survives only as a scoped disclosure or omission measure.

C4. Compositional Failure (Chapter 3: The Witness Protocol)

A system that passes its specified bilateral checks can still fail at multilateral composition. In the chosen formal model, compatibility on overlaps is the gluing requirement and certain obstructions are computable.

Type: Formal. Falsification: Produce a counterexample to the stated formal result under its exact hypotheses, or show that the institutional identification used in an application does not satisfy those hypotheses. Formal substantiation: Bridge Paper (Appendix D).

C5. Factor Prime (Chapter 6: The Selection Gradient)

Energy structured through computation and disciplined by selection is the emerging factor of production. Within a defined domain, holding the named counterforces roughly constant, verification cost should predict automation order better than cognitive difficulty alone.

Type: Conjectural. The first sentence is an interpretive frame; the V/C ratio is a proposed automation-sequence heuristic. Falsification (of the empirical sentence): Holding the named counterforces roughly constant, show persistent within-domain inversions in which lower-V/C tasks automate before higher-V/C tasks, or show that cognitive difficulty predicts the order better than verification cost. Context: The V/C ratio (the value a completed task delivers relative to the cost of verifying it was completed correctly) is a proposed sequencing heuristic, not a determinant. Within a defined domain, and holding liability, regulation, integration cost, data rights, sunk capital, error detectability, and the other named counterforces roughly constant, tasks with high value and low verification cost should attract automation earlier than comparably difficult tasks whose outputs are expensive to check. Persistent inversions under those conditions

count against the hypothesis; an uncontrolled comparison across different domains does not settle it.

C6. Bifurcation (Chapter 7: The Bifurcated Economy)

As selected transaction costs fall, firm boundaries may move and power may concentrate at the interfaces between machine-speed coordination and human institutions.

Type: Conjectural. The claim is an architectural forecast. Falsification: In domains where the identified transaction costs fall, show that firm boundaries do not move in the predicted direction and that interface power does not concentrate, or show that the named counterforces reliably prevent those outcomes.

C7. Domination Without a Dominator (Chapter 10: The Kind Master Problem)

Domination without a dominator is a structural condition, not a metaphor. Local compliance does not imply global accountability.

Type: Interpretive. Falsification: Show that a system composed of individually compliant components cannot produce emergent interference that constitutes domination. Context: The Kind Master Problem identifies a form of domination that the republican tradition did not anticipate: a system in which no individual actor intends harm, each component follows its rules, and the aggregate behavior nevertheless constitutes arbitrary interference in the lives of those subject to the system. The dominator is structural, not personal, and the absence of a personal dominator makes the domination harder to identify, harder to contest, and harder to remedy.

C8. The Receipt Minimum (Chapter 11: The Receipt Regime)

A system may coerce only via a receipt whose fields — Act, Authority, Bounds, Justification, Appeal Path — are minimally sufficient for contestation. No receipt, no legitimacy.

Type: Normative. Falsification: Show that a system that coerces without receipts can maintain legitimacy at civilizational scale.

C9. Predictable Failure (Chapter 12: Three Ways Receipts Fail)

The proposal identifies three recurring failure classes — semantic deception, structural capture, and procedural obstruction — and specifies controls that can be tested against them.

Type: Architectural. Falsification: Show a recurring failure that does not reduce to the three classes, or show that capture persists through the controls specified for them.

C10. Credible Exit (Chapter 14: Fork Rights)

Contestability requires credible exit. Without fork rights, receipts become petitions.

Type: Normative. Falsification: Show that contestability can be maintained under conditions where exit is not credible.

C11. Quiet Foreclosure (Chapter 10: The Kind Master Problem)

Quiet foreclosure — the elimination of alternatives through process rather than force — is a candidate dominant form of computational coercion.

Type: Empirical. Falsification: Show that the forecast does not describe consequential computational markets, or that alternatives remain broadly available at tolerable switching cost despite the predicted foreclosure mechanisms.

C12. *The Mercy Threshold* (Chapter 17: The Price of Perfect Memory)

Without temporal limits, accurate records can compose into durable exclusion. The Mercy Threshold is the point at which a true record must cease to determine a person's future by default.

Type: Architectural. Falsification: Show that a receipted system without designed forgetting produces no pathology of permanent exclusion. Context: The receipt regime that makes power legible also produces durable records about persons. Designed forgetting — expiration, sealing, aggregation limits, separation, amnesty — limits those records' jurisdiction. The proposal assigns final coercive judgment to an answerable human institution; it does not depend on a claim that algorithms can never assist mercy or review.

Appendix B: Cross-Volume Correspondence

This appendix maps the abridged edition’s chapters to the full trilogy’s chapters, for readers who wish to pursue any argument in greater detail.

Act I: The Crisis

Abridged	Full Trilogy
Chapter 0: Coordination After the Absent Master	Codex: Introduction (Res Agentica)
— §I-IV: The Question through The New Condition	Codex §I-IV
— §V: The Tempo Problem	Codex §V
— §VI: The Four Equations	Codex §VI
— The Quiet Foreclosure (new subsection)	Vol III, passim; synthesized for abridged

Abridged	Full Trilogy
— §VII–XIII: Dependency Chain through The Choice	Codex §VII–XIII

Act II: Truth Needs Witnesses

Abridged	Full Trilogy
Chapter 1: The Weight of the Word	Vol I, Ch 1 (Weight of the Word) + Ch 2 (Chains of Stakes) + Ch 3 (Rent at the Gate) + Prologue
Chapter 2: The Trust Tax	Vol I, Ch 3 (Rent at the Gate) + Ch 4 (Empire of Strings) + Ch 5 (Empire of Tables)
Chapter 3: The Witness Protocol	Vol I, Ch 7 (The Witness Protocol) + Ch 6 (Evidence Without Custody) + Ch 8 (Similes of Symmetry)
Chapter 4: Designed Forgetting	Vol III, Ch 8 (The Mercy Threshold); new bridge material for abridged

Act III: Value Needs Work

Abridged	Full Trilogy
Chapter 5: The Diamond in the Riverbed	Vol II, Prologue + Part I (Chs 1–4)
Chapter 6: The Selection Gradient	Vol II, Ch 12 (Selection Gradient) + Ch 16 (Automation Continuum)

Abridged	Full Trilogy
Chapter 7: The Bifurcated Economy	Vol II, Chs 17–19 (Species That Buys Itself, Actuation Bottleneck, Agents Enter Markets) + Ch 7 (Shifting Boundaries)
Chapter 8: The Joule Standard	Vol II, Ch 15 (Existence Proof) + Ch 14 (Recursive Property) + Ch 10 (Time Crystallized)

Act IV: Freedom Needs Receipts

Abridged	Full Trilogy
Chapter 9: The Silent Ledger	Vol III, Prologue (The Silent Ledger)
Chapter 10: The Kind Master Problem	Vol III, Ch 5 (Non-Domination / The Kind Master Problem)
Chapter 11: The Receipt Regime	Vol III, Ch 6 (Receipted Coercion) + Ch 7 (Receipt Architecture)
Chapter 12: Three Ways Receipts Fail	New for abridged; synthesized from adversarial analysis
Chapter 13: The Constitutional Machine	Vol III, Ch 9 (Constitutional Machinery) + Ch 10 (Bonded Arbitration)
Chapter 14: Fork Rights	Vol III, Ch 11 (Fork Rights) + Ch 12 (Portability)
Chapter 15: Exit Under Duress	New for abridged; worked example stress-testing fork rights
Chapter 16: Against the Protocol Republic	Vol III, Ch 13 (Homo Arbitrator) + Vol II, Ch 21 (Counter-Thesis)

Act V: Humanity Needs Mercy

Abridged	Full Trilogy
Chapter 17: The Price of Perfect Memory	Vol III, Ch 8 (Mercy Threshold) + Vol I, Ch 8 (Similes of Symmetry) §mercy
Chapter 18: Elena	Vol III, Epilogue §Elena
Chapter 19: The Call	Vol III, Epilogue §The Two Futures + §The Call; Codex §XIII

Appendix C: Receipt Templates

This appendix provides worked examples of receipts for four common exercises of computational power, using the five-field format specified in Chapter 11. Each template demonstrates how the receipt regime translates abstract constitutional requirements into concrete, implementable specifications.

The five fields are constant: *Act*, *Authority*, *Bounds*, *Justification*, *Appeal Path*.

Template 1: Account Restriction

Context. A payment platform restricts a user’s ability to send out-bound transfers.

Field	Content
<i>Act</i>	Outbound transfer capability suspended for account #[hash]. All pending transfers held. Inbound transfers continue. Balance viewable but not withdrawable.

Field	Content
<i>Authority</i>	Platform Policy §7.3.2 (Unusual Activity Protocol), effective [date]. Applicable regulatory requirement: [jurisdiction] Anti-Money Laundering Regulation §[section].
<i>Bounds</i>	Suspension effective [timestamp]. Duration: 72 hours or until review completion, whichever is sooner. Scope: outbound transfers only. Inbound deposits, balance viewing, and account history access are unaffected. If review is not completed within 72 hours, the restriction is automatically lifted and may be reimposed only with a new receipt citing the results of the review.
<i>Justification</i>	Three transactions within 48 hours matching pattern [pattern-ID] in the platform’s anomaly-detection model (version [v], deployed [date]). Pattern confidence: [percentage]. The specific transactions flagged: [transaction hashes]. Justification available to independent auditor under audit protocol [ID].
<i>Appeal Path</i>	(1) Self-service identity verification via [URL], estimated time 15 minutes. If identity is confirmed and no further anomalies detected, restriction is lifted automatically. (2) Human review request via [URL], guaranteed response within 48 hours. (3) Escalation to Credential Arbitration Network, case filing via [URL], independent arbiter assigned within 5 business days.

Template 2: Content Removal

Context. A social platform removes a user’s post.

Field	Content
<i>Act</i>	Post [content-hash] removed from public view. Post remains in user’s archive (visible to user only). Engagement metrics preserved.
<i>Authority</i>	Community Guidelines §4.1 (Harmful Misinformation), version [date]. Specific sub-rule: §4.1.3 (Health Claims Contradicted by Verified Sources).
<i>Bounds</i>	Removal effective [timestamp]. Duration: indefinite unless overturned on appeal. Scope: public visibility only; the post is not deleted and remains in the user’s personal archive. Account standing is not affected by this removal.
<i>Justification</i>	Post contains claim: [extracted claim]. Claim contradicted by [N] verified sources: [source-1], [source-2], [source-3]. Claim evaluated by content-review model (version [v]) with confidence [percentage]. The specific elements of the post that triggered the removal are highlighted in the user’s archive view.
<i>Appeal Path</i>	(1) User may request human review via [URL], guaranteed response within 7 days. (2) If human review upholds removal, user may request independent review through platform’s Content Review Board, response within 30 days. (3) If Content Review Board upholds removal, user may file with external Content Arbitration Network via [URL].

Template 3: Credential Rejection

Context. An employer’s credentialing system rejects a professional license (the Elena scenario).

Field	Content
<i>Act</i>	Professional credential [credential-hash] presented by [holder-ID] rejected by [employer] credentialing system. Employment eligibility status set to “pending review.”
<i>Authority</i>	Employer Policy §[section] (Credentialing Requirements), requiring verification through approved credentialing sources. Approved sources: [list].
<i>Bounds</i>	Rejection effective [timestamp]. Duration: until discrepancy is resolved. Scope: the specific credential only; other credentials and employment history are unaffected. If discrepancy is not resolved within 15 business days, the employer must either accept the credential based on the issuing authority’s direct attestation or provide a new receipt citing specific grounds for continued rejection.

Field	Content
<i>Justification</i>	Credential contradicted by record in [aggregator-name]: [specific claim from aggregator, including case number, date, and nature of claim]. The direct attestation from the issuing authority ([issuing authority name]) shows: [attestation content]. The discrepancy between the two sources is: [specific discrepancy].
<i>Appeal Path</i>	(1) Holder may present direct attestation from issuing authority. If attestation contradicts aggregator record, employer must accept credential unless employer can cite independent grounds for rejection. (2) Holder may file dispute with Credential Arbitration Network via [URL], arbiter assigned within 3 business days. (3) If arbitration finds aggregator record erroneous, aggregator must correct record within 5 business days and issue a correction receipt to all parties that received the erroneous record.

Template 4: Algorithmic Scoring Adjustment

Context. A credit-scoring system adjusts a person’s score past a threshold that affects their eligibility for financial services.

Field	Content
<i>Act</i>	Credit score for [person-ID-hash] adjusted from [previous-range] to [new-range], crossing threshold [threshold-value] for [service-type] eligibility. Adjustment effective [timestamp].
<i>Authority</i>	Scoring model [model-ID], version [v], deployed [date], operating under [regulatory framework] §[section]. Model parameters last audited [audit-date] by [auditor-name].
<i>Bounds</i>	Score adjustment affects eligibility for: [list of affected services/products]. Score adjustment does not affect: [list of unaffected services]. The score is recalculated [frequency]. The adjustment will be reflected in the next recalculation cycle.
<i>Justification</i>	Score adjustment driven by [N] factors, listed in order of contribution: (1) [Factor, contribution weight, data source], (2) [Factor, contribution weight, data source], (3) [Factor, contribution weight, data source]. Full factor decomposition available to person via [URL] and to independent auditor under audit protocol [ID].
<i>Appeal Path</i>	(1) Person may request factor decomposition via [URL], provided within 5 business days. (2) Person may dispute any factor by providing contradicting evidence via [URL]. If evidence is accepted, score is recalculated within 10 business days. (3) Person may request independent audit of the scoring model's application to their case via [URL], auditor assigned within 15 business days.

Implementation Notes

These templates are illustrative, not prescriptive. The specific content of each field will vary by jurisdiction, industry, and the nature of the action. What is constant across all implementations is the requirement that all five fields be populated with content specific to the individual case, not with generic templates that provide no actionable information (see Chapter 12, Failure Mode One: Semantic Deception).

The receipt format should be machine-readable (structured data) as well as human-readable (natural language summary). The machine-readable format enables automated audit, cross-receipt comparison, and pattern detection. The human-readable format ensures that the affected party can understand what happened without technical expertise.

Receipts should be cryptographically signed by the issuing entity and timestamped on a tamper-evident log. The affected party should receive a copy that can be independently verified. The issuing entity should retain a copy in its audit archive. A third copy should be recorded on the shared settlement layer if the action crosses a threshold of severity defined by the applicable jurisdiction.

Appendix D: The Research Docket

This appendix is a reader-facing view of the repository's machine-readable research status, the sole authority for paper lifecycle and epistemic status. "Formally verified" means that a stated result in a stated model has machine-checked support. It does not verify a constitutional conclusion, a historical interpretation, or a claim about institutions outside that model.

The docket has changed materially. The original Coherence Fee gateway and several fee-family papers are withdrawn or falsified. Their surviving results may be reused only through the corrected reports named by the status source. In particular, the old fee did not predict execution failure. It survives only as a scoped disclosure or omission measure.

Current Program

Work	Lifecycle	Epistemic status	Reader's guide
Tarski Coherence	external review	formally verified	The degree-1 conjecture was false as stated. The paper gives a corrected graph-theoretic characterization in its model.
Compositional Accountability	technical report	empirically demonstrated	The proposed theorem gate failed. The surviving finite profile measures query-relative evidence survivability without claiming new cut mathematics.
BABEL v2	active draft	conjectural	Execution-failure prediction is unvalidated and awaits independently authored workflow evidence.

Work	Lifecycle	Epistemic status	Reader's guide
BABEL v1	archived	empirically demonstrated	The frozen benchmark remains reproducible within its protocol; the execution-prediction interpretation is retired.
The Disclosure Deficit	active draft	not assessed	Planned consolidation of surviving scoped measurements, with no new theorem presently claimed.
The Coherence Fee gateway essay	withdrawn	falsified	Historical only. The schema fee failed as an execution-failure predictor.
The Coherence Fee Paper I	withdrawn	falsified	Corollary 3.2 is false. Surviving component-count results require the consolidated report.

Work	Lifecycle	Epistemic status	Reader's guide
The Witness Gram Paper III	withdrawn	falsified	The basis-count corollary is false. Only audited rank identities and the corrected repair result may survive.
Witness Geometry Beyond Scalar Fee	withdrawn	falsified	Operational-sparsity claim withdrawn. Corrected repair results require the correction note.
Coherence Types	withdrawn	falsified	The type-soundness theorem is false under the stated rules.
The Linear Communica- tion Bottleneck Conjecture	withdrawn	falsified	Spectral-gap trichotomy withdrawn. Only the scoped Haar lemmas survive.

Work	Lifecycle	Epistemic status	Reader's guide
Column-Matroid Backbone	technical report	formally verified	Scoped corank identity under the paper's construction and hypotheses.
Signed-Incidence Structure	technical report	formally verified	Scoped rank results under stated hypotheses.
A Witness Logic for Semantic Composition	technical report	formally verified	Abstract numerical layer is checked. Concrete modeling identification remains review-dependent.
SCPI	technical report	formally verified	Scoped finite-site core, with perimeter statements remaining conditional.
Bridge	technical report	empirically demonstrated	Identification and specification gap on the disclosed study families only.

Work	Lifecycle	Epistemic status	Reader's guide
Seam	technical report	empirically demonstrated	Diagnostic consequences demonstrated in the reported environment, not a universal protocol theorem.
SHEAF	active draft	conjectural	Enriched bridge and topology-auction claims remain unverified.
Bitcoin After Money	technical report	conjectural	Settlement argument remains a proposal, not a demonstrated necessity.
Coherence Cliff	technical report	empirically demonstrated	Scaling result on the disclosed experimental families.
Local Interface Descriptions Do Not Compose	technical report	empirically demonstrated	Scoped evidence under the reported construction.

Work	Lifecycle	Epistemic status	Reader's guide
The Physical Coherence Fee	archived	conjectural	Historical extension, with no current demonstrated physical-domain result.
The Stitching Defect	technical report	empirically demonstrated	Scoped experimental result under disclosed tasks.
The Composition Tax	technical report	empirically demonstrated	Scoped experimental result that does not establish a universal institutional tax.
Local Validity Does Not Compose	technical report	empirically demonstrated	Demonstrated on the reported families, not all compositions.
Compositional Incoherence Is a Parity	technical report	conjectural	Hardness claim remains conditional.

Work	Lifecycle	Epistemic status	Reader's guide
Interpretability Frontier	archived	empirically demonstrated	The scoped cyclic-composition result is retained; no general boundary for all interpretability systems is established.

What the Docket Can Support

The research program supplies several kinds of evidence, which must not be collapsed:

- machine-checked theorems establish consequences of formal definitions under stated hypotheses,
- experiments establish results on frozen tasks, models, and datasets,
- historical cases support institutional analogies and convergence arguments,
- the constitutional articles remain normative proposals, and
- C2, C5 through C12 are not “verified” merely because some adjacent mathematical object is.

The strongest current formal result relevant to the abridged argument is that locally acceptable structures can exhibit defined global obstructions in specified models. The strongest current empirical warning is negative: an attractive structural measurement did not generalize to execution-failure prediction. That correction narrows the program and increases its credibility.

Claim-to-Evidence Map

Claim	Epistemic class	Present support	Current limit
C1 Tempo and legitimacy	architectural	constitutional argument and cases	no universal empirical threshold
C2 Convergent witnessing	historical	sourced recurrence across selected institutions	recurrence is not proof of necessity or independence
C3 Trust Tax	interpretive	institutional cases and scoped disclosure measure	no general failure predictor
C4 Compositional failure	formal plus empirical	checked formal cores and disclosed study families	model-to-world identification remains conditional
C5 Factor Prime	conjectural	operational V/C heuristic	automation order has counterforces and domain limits
C6 Bifurcation	conjectural	economic argument	concentration and firm-boundary forecast unvalidated

Claim	Epistemic class	Present support	Current limit
C7 Domination without a dominator	interpretive	republican theory and composed-system cases	normative classification, not a theorem
C8 Receipt minimum	normative	due-process analogy and design specification	sufficiency and calibration require trials
C9 Predictable receipt failure	architectural	working three-part taxonomy	taxonomy is not proven exhaustive
C10 Credible exit	normative	exit, voice, interoperability literature	portability may fail under network effects or duress
C11 Quiet Foreclosure	conjectural	platform and process examples	“dominant form” remains an empirical forecast
C12 Mercy threshold	normative	temporal-justice argument	no formal theory proves a single correct calibration

Live Authority and Falsification

The status source records a falsifier for every active paper. A manuscript claim must be downgraded whenever its linked paper is falsified, withdrawn, or superseded. No prose summary may preserve the earlier status. For current details, corrections,

evidence paths, and external-review state, consult that file in the repository revision from which this edition was built.

Appendix E: Vocabulary

Twelve coined terms carry the book's argument across chapters. They are gathered here for reference after the argument has earned them in use. Other named distinctions remain local to the passages that need them.

Spandrel Souls. Conscious beings may be an architectural byproduct of the substrate once required for coordination. Civilization needed beings who could deliberate and got beings who could also feel. The feeling was real. It was never the requirement.

Trust Tax. The premium charged for occupying the only position from which verification can be performed, distinct from the real work of reconciling claims. It is rent collected inside a verification bottleneck.

Coherence Fee. The effort required to make claims from different contexts compose. The fee can fall, change form, or be disclosed more clearly, but cheaper verification does not make it vanish. The docket uses the same phrase for a narrower schema-level disclosure measure, and no result about that measure transfers to institutions without a separate argument.

Orphan Commitments. Obligations that persist after the process that made them has terminated. The commitment remains in the world after the computational actor has gone.

Kakudmī Problem. A mismatch between governing and human tempos in which an answer arrives after the world that made the question intelligible has passed. King Kakudmī waits through one performance at Brahmā's court and returns to a world twenty-seven ages older.

Process Theater. A formal route that imitates contestation without giving the affected person an answerable reviewer, a usable deadline, or the power to reverse the act. The form accepts text; the institution need not hear it.

Quiet Foreclosure. The elimination of practical alternatives through accumulated procedure, dependency, and switching cost rather than an overt command. Its force lies in making submission appear voluntary after every other route has become unusable.

Protocol Republic. A proposed order in which coordination infrastructure is governed by common rules, exercises of coercive authority leave contestable receipts, and no operator controls rulemaking, enforcement, adjudication, and custody at once.

Civic Asymmetry. The principle that legibility should increase with power. Institutions exercising coercive authority owe records to the people they govern; private persons retain opacity against systems that cannot answer for their use of personal information.

Fork Rights. The rights and practical means required to leave a coordination system with one's data, credentials, accumulated relationships, and a viable route to continued service under different stewardship. A nominal export that cannot support a real alternative is not credible exit.

Mercy Threshold. The point at which a true record must cease to determine a person's future automatically. It is implemented

through designed forgetting and through judgment by an institution that can be named, challenged, and made to answer.

Surviving Principal. The persistent party that remains answerable for a delegation chain after transient agents and intermediate processes have ended. Registration, liability, bonding, insurance, and orphan-commitment rules make that answerability more than a name.

Local analytical terms include Proof Order, coordination without consensus, Kind Master Problem, membrane, Factor Prime, V/C ratio, Competence Trap, Specification Horizon, temporal sovereignty, Joule Standard, Homo Arbitrator, epistemic foreclosure, necromantic consent, penumbra, Sea/Membrane/Apex, decision wake, participation horizon, grounding, and designed forgetting. Each is defined where it first performs work in the argument.

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Cairo Geniza Documents. Tens of thousands of documents preserved in the Ben Ezra Synagogue storeroom, Fustat (Old Cairo), 10th–13th centuries. See Goitein (1967–1993).

Datini Archive. Archivio di Stato di Prato. 150,000 letters, 500 account books, and thousands of commercial instruments from the firm of Francesco di Marco Datini (c. 1335–1410). See de Roover (1948, 1953).

Sulpicii Archive. 127 documents on 185 wax tablets from Murecine near Pompeii, 1st century AD. See Camodeca (2003).

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A Note on the Author

John Komkov is an independent researcher. He wrote the three volumes this edition condenses, the formal companion that carries their proofs, and the reference implementation that tests whether the receipt they describe can actually be built.

The research program, its corrections, and the record of what it has withdrawn are published at resagentica.com. The receipt format and its verification contract are at glyphstandard.com; the implementation is open source at github.com/jkomkov/bulla.

Appendix D lists what the program presently establishes, withdraws, or leaves open. It is kept current, and it is meant to be checked.