

Actual Economics

Physical structure, continuation, and responsibility

Jonathan Washburn

Recognition Science Institute

Working manual: established arguments and precise open connections. The universal forcing and responsibility account is not complete.

Contents

1 What actual economics concerns **2**

2 Distinctions forced by executable consequences **3**

3 Why endpoints and totals are insufficient **4**

4 The continuation budget **5**

5 Capabilities can determine maintenance requirements **8**

6 Authored reliance and governing responsibility **21**

7 Costly care, conflict, and the virtues **36**

8 Institutions and practical assessment **41**

1 What actual economics concerns

Actual Economics concerns the objective physical structure of sustaining and coordinating life. Participants maintain themselves, act through physical means, produce and use things, make commitments, and live with what they and others do. These activities belong to the same reality. Their governing conditions cannot be changed by choosing a different accounting convention, giving an institution another name, or describing a loss as a gain.

"Actual" names this literal structure and its intended necessity. It has the same meaning here as in actual mathematics, actual physics, actual meaning, and actual ethics. The task is to identify what the subject itself requires: the distinctions a faithful description must preserve, the transformations that are available, and the governing relations that make some actions performances and others violations. Different realizations may respect the same necessary structure.

The physical and ethical objects remain connected throughout. Recognition Science describes physical relations and their transformations. The ethical account reads an agent's condition, recognition cost, and effects of action from those same relations. Economics follows them through maintenance, production, work, storage, consumption, exchange, and coordination over time. An economic action and its ethical effect must refer to the same event, participants, and resources.

This starting point directs attention to what an arrangement organizes. What is available? Who can act? What happens when they do? Which participants are affected? What remains possible afterward? A currency, price rule, ownership convention, or administrative system must be understood in relation to those questions. A faithful change of notation must leave their answers intact.

A description and an arrangement have different jobs. A description represents states, actions, and consequences. An arrangement determines or organizes access, permitted actions, information, transfers, and undertakings. A description can fail by concealing a decisive distinction. An arrangement can fail by exhausting participants, depending on unavailable resources, or violating a governing undertaking. Accurate reporting does not by itself provide food, authorize a transfer, or establish a rule's authority.

That distinction gives "forced" several precise applications. A transition can be physically impossible. A report can lose information needed to answer an actual consequence question. A plan can fail to sustain a participant. An executable action can violate a governing obligation. These failures are different. A theorem establishing one must not be presented as establishing all four.

The arguments in this manual develop established representation and continuation results and their connected physical and ethical examples. Universal governing identification remains unfinished: which reading of an authored arrangement is binding across different physical carriers, especially when duties conflict? The complete native identification of participant maintenance also remains unfinished. These are exact connections within the physical structure being studied. They do not change its subject into an analogy or an external ethical addition.

2 Distinctions forced by executable consequences

Begin with what participants can actually do and undergo. If two situations give different answers to an available consequence question, a description that promises to answer that question cannot merge them. The distinction earns its place through the difference it makes.

The existing resource construction distinguishes raw inputs, ready goods, stored goods, and productive effort. Repeated consumption distinguishes quantities of ready material. Retrieval distinguishes stored material. Production distinguishes raw inputs and effort when the required complementary input is supplied and counted. The resource fields are therefore recoverable from actual operation questions within the specified technology and contexts.

The contexts are essential. A raw input may be dormant when there is no productive effort. In the constructed system, zero and one dormant raw unit can have identical closed-system futures. Adding an accounted unit of effort separates them. This does not prove that every sealed economy can summon that complement. It establishes what must be retained when the stated interactions are available.

The recovery argument has two directions. First, equal operational answers force equal retained resource states: use the consumption, retrieval, and complemented production questions to distinguish any unequal component. Second, equal retained states give equal answers because the operations depend on those components. A report preserving these questions must consequently permit recovery of the retained state on its attained range. To construct the recovery, choose any actual state producing a given attained report; the separating questions ensure that every such choice has the same retained state.

This is uniqueness of necessary information, rather than uniqueness of a data format. A report can encode the state in different coordinates or retain additional information. It cannot discard a distinction and still answer a question that separates it. Equivalence is relative to the stated operational questions; selecting which questions an adequate economic account must preserve remains substantive physical work.

Undertakings introduce further consequential differences. Offers, accepted promises, and performed undertakings leave different possibilities. In the two-person construction, the continuation probes first supply one explicitly accounted ready unit to Alice. They then test four actual continuations: do nothing, accept, offer then accept, and accept then transfer. Their pending and due consequences recover the undertaking's residual status under the specified protocol.

Authored corrections recover the records themselves. A participant can change their own entries while preserving the balance of their books. Whether each possible correction makes the record truthful distinguishes their claims. Together with resource and undertaking observations, these experiments determine the retained economic view. The proof concerns coherent states and balanced books under the specified protocol. Its truthfulness test uses the protocol's due amount. Recovering that amount is not an independent derivation of a duty to pay it.

Faithful dynamics impose another requirement. Every actual successor must appear in the description. Every reported successor must be attainable from the actual source being described. This second direction prevents a report from assembling an apparent future from

actions available only at different hidden states. Checking it source by source is stronger than showing that some representative can realize each reported move.

These two directions preserve finite execution by induction. Project an actual first step and repeat. Conversely, lift the reported first step from the given actual source, then lift the rest from the successor actually reached. Joint requirements must hold at one shared destination. Separate witnesses that different participants could each be satisfied do not establish a jointly possible outcome.

The same source-specific lifting condition also preserves a specified infinite history. Start from an actual opening state whose report is the specified history's initial state. Whenever an actual state has been reached, the next reported move has an actual successor from that very state. Choose one such successor and repeat recursively. The choices form one compatible infinite trajectory, and induction shows that its report is the specified history at every time. Projecting an actual infinite trajectory proves the reverse direction.

The condition is stronger than finding a different finite demonstration for every horizon. It requires the next lift from every actual state encountered. It can be obtained by preserving every question of the form "is some successor in this target set?" at every actual source. Taking the target set to contain only the proposed successor forces a lift. This is an exact adequacy condition; it is not an efficient measurement procedure. The construction uses mathematical choice and does not supply a controller, an inexhaustible delivery stream, or governing authority.

Information constrains control as well. A person's policy must use the observations and retained history available to that person. A policy cannot depend silently on another person's private state or on an event that has not happened. The existing representation results preserve informed control when actual transitions, authorship, observations, participant requirements, and stated permissions are preserved. Choosing a successful action at a fully known state and possessing a policy that succeeds throughout an uncertainty set are distinct achievements.

3 Why endpoints and totals are insufficient

A history can contain a consequential loss even when its endpoint is repaired. The storage construction makes this exact. One execution stores a ready unit and retrieves it. Another waits twice. Both have identical opening and final states. Their complete authored posting histories also agree.

After the first action, however, the waiting execution still permits immediate consumption. The storage execution requires retrieval first. Their next-action access differs. Under the stated requirement to preserve that access and a nonzero comparison encoding, storage produces positive native harm and retrieval produces an equal negative change. Both histories have zero net signed change, but only one contains the intervening harm.

No function of identical endpoints and posting histories can return different correct answers to whether harm occurred. This is a direct impossibility proof: the proposed reader receives the same input in the two cases. Later restoration does not restore the missing information about the path.

The example does not condemn storage generally. It preserves the explicit access requirement and comparison calibration. Next-action access is not by itself a physiological deadline. Remembered harm is also not automatically an unpaid debt or grounds for punishment. The example establishes the need for the relevant physical history; its further moral consequences require their own governing relations.

Accounting and physical history must therefore be connected without being identified indiscriminately. An entry can be written without producing its asserted physical effect. An action can affect a participant without changing any book. An adequate account must preserve the relation among the event, its author, its consequences, and its record.

Aggregation creates a parallel difficulty. In the provisioning example, two enabled histories agree on final stocks, total consumption, total reserve, work, waste, and completed tasks. One leaves both participants with positive reserve; the other exhausts one of them. No reader of those aggregates can determine whether everyone continues, because the aggregate is identical while the answer differs.

Total abundance cannot substitute for provision. The resource must reach the particular participant in a usable form and at the relevant time. The provider's expenditure belongs in the same account. A constructed production example gives each person a meal while exhausting the producer through work. A spare meal left unconsumed does not restore the producer. It must enter the actual sustaining process.

Whole descriptions must retain member conditions, and member descriptions must preserve shared constraints. A plan cannot spend the same unit independently for several claimants, treat work as free to its performer, or use a satisfactory later endpoint to erase an earlier exhaustion. The whole and its members are descriptions of the same events and resources.

4 The continuation budget

Consider a fixed finite set of participants and resource types. Quantities are integer units chosen by the physical application. Each resource has a positive material weight. Each participant has an opening reserve, a positive intake-conversion factor, a nonnegative maintenance cost per interval, and a nonnegative cost of labor. Technology, labor capacity, and expiration dates are explicit physical data.

An operation draws inputs, produces outputs, provides intake, performs work, and may generate waste. Its weighted input equals weighted output plus intake and waste. Every input must be available before any batch output. Work must fit the interval's capacity. Stock that expires is recorded as discarded material. Production transforms the accounted material; it does not create an unrecorded supply.

The interval order matters. First check the opening requirements and positive reserves. Next receive any recorded boundary delivery. Then perform the operation. Intake is credited before the interval's maintenance and labor drain; production outputs arrive at its end. Delivery changes stock, not reserve or consumption directly. An opening requirement cannot be satisfied retroactively by an arrival later in that interval.

Let T be the number of intervals. For participant p, let r_p be opening reserve, c_p intake conversion, m_p maintenance per interval, ℓ_p labor cost, I_p cumulative intake, and L_p cumulative labor. Repeated substitution of the unchanged reserve transition gives the exact endpoint identity:

$$r_p(T) = r_p + c_p I_p - T m_p - \ell_p L_p.$$

The proof is induction on the action list. The empty list leaves reserve unchanged. Appending an interval adds exactly its converted intake and subtracts exactly its maintenance and labor cost. Grouping those terms gives the displayed identity. No permission rule or welfare weight enters it.

If the participant remains alive at the endpoint, their integer reserve is at least one. Rearranging the identity therefore gives a necessary member budget:

$$T m_p + \ell_p L_p + 1 \le r_p + c_p I_p.$$

Now let S_0 be opening weighted stock and D_T the weighted boundary deliveries actually received during these T intervals. Material conservation at each operation, together with nondecreasing cumulative discarded material from waste and spoilage, gives:

$$\sum_p I_p \le S_0 + D_T.$$

To see why previous consumption is not new supply, include stock, all recorded consumption, and discarded material in one material account. Each internal operation preserves that account. A boundary receipt increases it by exactly the receipt's weight. Subtract opening consumption and discard. Remaining stock and additional discard are nonnegative, leaving the displayed intake bound.

Suppose v is a nonnegative integer upper bound on the participants' physical intake-conversion factors. Write M for total maintenance, W_T for total labor cost, R_0 for the sum of opening reserves, and N for the number of represented participants. Summing the member budgets and applying the common material bound gives:

$$TM + W_T + N \le R_0 + v(S_0 + D_T).$$

The conversion ceiling is a physical bound, not a price or an ethical weight. The proof uses each member's own reserve inequality before summing. The final aggregate inequality is necessary but not sufficient: it can conceal which person receives the intake, which resource types remain, whether a route exists, and whether the operation occurs before a deadline.

The same argument applies at every prefix of a continuing history. Every prefix is physically feasible and ends with positive reserves, so its own cumulative intake, work, and actual deliveries satisfy the budget. Supplies arriving in later intervals do not appear in an earlier prefix's account. Endpoint recovery cannot finance a failed earlier continuation.

Authorization and additional requirements remain arbitrary in this theorem. Any continuing path satisfying any such predicates must obey the same physical budget. This does not prove that every authorization rule is justified. It proves that none can make an actual continuing path violate the stated material and reserve laws.

For a sustained-supply obstruction, fix nonnegative integer allowances B and q. Suppose every candidate horizon receives at most B weighted material units plus q weighted material units per interval, and converted supply per interval is strictly below total maintenance:

$$D_T \le B + Tq, \qquad \nu q < M.$$

Insert that upper bound in the joint budget and discard the nonnegative labor and remaining-reserve terms. The result is:

$$T(M - \nu q) \le R_0 + \nu(S_0 + B).$$

The right side is fixed. The left side grows with a strictly positive integer coefficient. Choose a horizon larger than that fixed bound permits, and the proposed continuation is impossible. The proof excludes arbitrarily long feasible, endpoint-alive horizons even when each horizon selects a different sequence of actions. It is a uniform bounded-burst and linear-rate obstruction, not a complete characterization of irregular asymptotic supply. Equality of average supply and maintenance is not generally a sufficiency theorem.

The construction is nonvacuous. One participant begins with reserve one, no stock, conversion one, and maintenance one. Each interval receives one unit, consumes that unit, and does no work. The permitted recipe consumes exactly its available input. Reserve returns to one, stock returns to zero, and the consumed total advances by one. Induction gives a continuing open-member history of every finite length. Total delivery equals its length. The same operation with no delivery is disabled because its input is absent.

This example constructs the inside continuation conditional on actual supply; it does not construct an inexhaustible exterior. To include a finite exterior, retain a resource-indexed source inventory and subtract each actual delivery from it. Enable a delivery only when the source contains it. The remaining source plus cumulative delivery equals its opening inventory, by the same induction. Source material and the inside material account are conserved together.

A finite exterior therefore only enlarges the initial budget. Set the rate q to zero and the burst B to opening external stock in the obstruction above. With positive total maintenance, arbitrarily long continuation is impossible. Changing an accounting boundary cannot convert a finite source into perpetual renewal. Transport, access, source aging, and replenishment outside the chosen boundary still need their actual dynamics; the inside feasibility predicate does not establish them.

A household or cooperative can change its membership without changing the underlying physical population. At each interval, retain the opening roster, perform the actual physical operation, and then record the next roster. Read an entrant's or departing member's reserve after that operation. These readings can be signed: excluding an exhausted participant does not turn their condition into a positive asset. This construction changes the account boundary; it does not create or destroy a participant.

Write C for maintenance and labor costs charged to the roster present during each interval, G for its actual converted intake, and A and Z for opening and closing selected reserves. Let E and X be cumulative entering and departing reserves, read at their actual boundary crossings. The reserve transition and membership decomposition give an exact identity:

$$Z + C + X = A + E + G.$$

For one step, substitute the reserve update for each opening member. Then separate the closing roster into retained members and entrants, and the opening roster into retained members and departures. Retained members cancel between those decompositions. Repeating the identity makes intermediate selected reserves cancel, leaving the displayed history account. No assumption that anyone survives is needed for this identity.

The shared supply must also retain intake received outside that roster. Let J be the total such intake across the same intervals. At every step, selected and unselected recipients partition the physical population, so their intake sums exactly to whole-population intake. Consequently G + vJ is at most v times the sum of opening weighted stock and actual deliveries. If all N closing members have positive integer reserve, Z is at least N. Combining these facts yields:

$$C + X + N + vJ \leq A + E + v(S_0 + D_T).$$

The outside-intake debit matters when someone receives provision before joining the account. Their entering reserve already reflects that provision; the material they consumed is no longer available for another allocation. The identity retains their actual reserve, and the debit prevents the shared supply allowance from silently granting those consumed units again. This remains a necessary inequality under a conversion ceiling, not an exact energy budget. It establishes neither the continuation of excluded people nor any authority to exclude them. Birth, death, and the physical formation of new participants require further transitions with their histories retained.

5 Capabilities can determine maintenance requirements

A physical need should be identified through the activity it sustains. The membrane construction begins with an actual finite operation. Two finite inventories are separated by a membrane that stores electrical charge. Transferring material changes both inventories and voltage, so the operation changes the force that drives it. Neither side is an unlimited bath held at its original concentration.

Under the stated constitutive laws, the comparison's donor operand is the donor inventory. Its balancing receiver operand is receiver inventory multiplied by the exponential voltage factor. The logarithm of their ratio equals the instantaneous electrochemical drive in thermal-voltage units. Thus the comparison is tied to the same state that drives the operation.

For the specified positive-conductance operation, with positive inventories and an initial voltage below the target, finite completion requires a strictly positive prospective endpoint margin. At zero margin, the target can instead be an asymptotic boundary. Where the prospective endpoint retains positive inventories, its zero comparison profile excludes finite attainment. The constructed boundary case has zero cost in the individual channel comparison while losing finite attainment of the requested operation. Equilibrium of that channel cannot simply be identified with viability of the complete participant.

The laws used here are explicit: fixed unit volumes, ideal logarithmic chemical potentials, a capacitor law, a positive channel conductance, and a supplied target voltage. They describe this physical system. The requirement nevertheless follows from its dynamics, including

finite donor depletion and electrical backreaction; it is not inserted as an independent maintenance constant. The closed reaction extension also supplies the pump's stoichiometry and constitutive reaction law. Its maintenance results require nonnegative pump mobility.

Consider readiness for two specified isolated operations whose voltage targets are ordered and separated. Their joint readiness forces the sum of the channel forces to exceed that separation. With both conductances fixed and positive, the conductance-weighted sum of squared forces has a strictly positive lower bound. Under the supplied reaction law and nonnegative pump mobility, the pump adds a nonnegative loss. The resulting maintenance floor follows from those capabilities and channel laws. Readiness here does not assert that both isolated operations are enacted simultaneously.

This restriction extends to a history because readiness and free-energy change are calculated from the same evolving positive inventories, membrane voltage, and chemical reaction. Throughout a ready interval, the derived loss persists. With the supplied standard chemical energy nonnegative, the same account gives a nonnegative terminal free energy. The derived depletion then makes the duration of any positive, continuously ready interval strictly smaller than the opening free energy divided by the maintenance floor. A separately constructed positive-duration ready history establishes that the capability is possible; the duration restriction is not vacuous.

Replenishment remains in the same account. An extended construction adds finite fuel and waste. During an actual interval, regeneration increases the pump's chemical supply while fuel decreases and waste increases. Material and charge constraints are preserved. The free-energy derivative follows from the complete stated reaction equations. A local reserve can be restored while the larger source is depleted. The corresponding duration result additionally requires nonnegative fuel standard energy and nonnegative source mobility.

Opening the fuel boundary does not remove the maintenance requirement. Add the specified inlet current only to the fuel coordinate of the same ten-coordinate membrane, chemical supply, fuel, and waste state. Fuel plus waste then changes at exactly that inlet rate. Differentiate the complete free energy along this changed trajectory. All internal reaction terms retain their original accounting; the added term is the inlet current multiplied by the fuel's chemical potential.

Let F(t) denote this complete free energy, P(t) the derived boundary chemical power, and D(t) the internal loss. For positive inventories the actual trajectory satisfies F'(t) = P(t) − D(t). Let Q be any accumulated-input function whose derivative is this P. This identifies the input from the physical current; it does not assume an energy budget. Chemical power is signed. Even a positive fuel current need not carry positive power in the supplied ideal potential.

Suppose inventories remain positive and both capabilities remain ready throughout a positive interval of duration H, with positive channel conductances and nonnegative reaction mobilities. Their maintenance floor m is strictly below the actual loss. The derivative of F(t) + mt − Q(t) is therefore strictly negative throughout the interval. Comparing its endpoints gives:

$$F(H) + mH < F(0) + Q(H) - Q(0).$$

With nonnegative standard chemical energies, the retained terminal free energy is nonnegative. If net chemical input is at most B + qH and q is strictly below m, rearrangement gives:

$$H < \frac{F(0) + B}{m - q}.$$

For a fixed opening state, the same finite burst allowance B and rate q below m therefore cannot support readiness over arbitrarily long horizons. This result does not assert that the stipulated readiness can always be maintained, nor construct the exterior apparatus that supplies the current. It gives a necessary restriction on any trajectory that does maintain it under these physical laws.

The native supply constructions retain another indispensable part of history. An empty donor is prepared by a paid exchange with an occupied supplier. The supplier remains present, total occupation is conserved, and correlations remain in the joint state through a downstream contact. A separate finite-donor construction lets a fresh second donor contact the system while the consumed first donor remains retained. For the constructed initially empty system and occupied donors, coherently reusing the first donor gives a different result from fresh delivery after two pulses. Substituting a fresh state therefore changes that physical process.

A native clock can enact the retained two-donor construction's finite programmed contact sequence while retaining the clock, reference, donor bank, and relevant holding corrections. Paid preparation of the first donor can be connected to that clocked sequence without re-setting its correlated supplier. The supplier remains a fourth cell with its own holding term. Regrouping the joint coordinates is only a change of indexing; the clocked contacts act on the bank while the supplier undergoes its retained free evolution. At the programmed endpoint, the bank's reduced state agrees exactly with the delivered-bank evolution. Partial traces give the stated readouts; they do not delete those factors from the physical state.

Positivity and normalization of the complete constructed state follow from positive normalized preparations and unitary evolution. The algebraic readout identity has broader parameter scope than these physical-density conditions. A nonnegative source-drive holding additionally retains the original sign and duration conditions of paid preparation. The initial system, paid source pair, fresh second donor, and clock reference have specified preparations; their availability is not proved by naming them. The clock's positive holding correction is retained energy, not a proved expenditure on each tick. This finite construction supplies neither an autonomous inexhaustible source nor an independently replenished clock.

The four retained cells also have one occupation account: the system, first donor, second donor, and original supplier. Its observable commutes with both contacts, the donor permutation, and all four cell holdings. These commutations persist through the clock program and its static correction. Consequently the complete evolution preserves that occupation account at every elapsed time, not only at the two programmed contact times. The proof follows the conserved observable through the full unitary evolution and takes its readout only afterward.

Initially, the paid donor and supplier together carry one occupation unit. With initial system occupation p and fresh second-donor occupation f, the total is p + 1 + f, and remains so throughout this evolution. This is a conserved occupation expectation in the stated native construction. It is not an assumed conversion into food, work, heat, or sustained participant readiness. Conservation alone does not make every transfer irreversible consumption.

Counting all resources once extends beyond two donors. For any finite retained bank, add the occupation observable of every bank cell to that of the system. Each contact conserves the contacted pair's sum and leaves the other cells untouched; each wiring operation merely permutes cells. For any finite bank size, the constructed sequence of conserving pair contacts and coordinate regroupings therefore preserves the complete sum. For a joint density state, the readout is an expectation of that one observable, so retained correlations do not create an additional resource.

The retained-bank construction also gives an exact relaxation law. Prepare the receiver at occupation p and each fresh donor at the same occupation f, with $0 \le p < f \le 1$. Use the stated calibrated exchange at each contact. Let $q = \sin^2(1)$, which lies strictly between zero and one. The actual receiver readout after n contacts satisfies:

$$a_{n+1} = (1-q)a_n + qf, \qquad a_n = f + (p-f)(1-q)^n.$$

The first identity follows from the actual pair exchange after taking its marginal. Induction gives the second. Since p − f is negative and the nonnegative geometric factor decreases to zero, the receiver readout increases monotonically from p toward f; its first increase is strict. Used donors and their correlations remain in the full history. The limit compares successively larger retained banks and counts contacts. It does not provide an inexhaustible finite donor, a source of fresh preparations, or a law in elapsed time.

Renewal has an explicit native construction at every finite number of contacts. Alternate a fully occupied incoming source with an empty incoming receiver, retaining every departed cell. Let s be the actual exchange probability, with $0 < s \le 1$. Prepare the system at $p = (1 - s)/(2 - s)$. Contact with the source raises its occupation to $1/(2 - s)$; contact with the receiver restores p and gives that receiver a positive charge $s/(2 - s)$. These identities follow by applying the same collision rule twice.

$$p = \frac{1-s}{2-s}, \qquad p_{\text{loaded}} = \frac{1}{2-s}, \qquad q_{\text{receiver}} = \frac{s}{2-s} > 0.$$

The calculation preserves the entire joint state. For an arbitrary correlated system and old bank, contact with an independently prepared, normalized arriving cell leaves the old-bank marginal unchanged. This follows by tracing out the active system and incoming cell and using the unitary identity $U^\dagger U = I$; no reset of the earlier correlations is required. Consequently each departing receiver keeps its charge in the later retained bank. Induction over the contacts identifies the sum of the departure readouts with the receiver-only occupation observable in the final bank: after n source–receiver pairs it is $n\,s/(2 - s)$.

The whole resource account remains visible. After those n pairs, the full system and bank contain the opening system occupation plus n units brought by the occupied sources. The system has returned to its opening marginal and the departed bank contains n units in total. The receiver-only part is the charge just calculated; the remaining occupation stays elsewhere in the same bank. This is a family of finite prepared supply histories. It supplies neither an inexhaustible finite source nor a derivation of autonomous contact timing, source preparation or biological maintenance.

Renewal also restores an operational capability. Each receiver produced by an occupied-source contact followed by an empty-receiver contact has the same full reduced state, including its retained thermal payload. Its occupation is $q_{\text{receiver}} = s/(2 - s)$. Its capacity to serve

another empty cell through the specified next contact is therefore K = s q_receiver > 0. This conclusion concerns a further executable transfer, so equal occupation alone is not being used as an undefined measure of usefulness.

The further service can act on the actual retained history. Rearrange coordinates so that the latest receiver becomes the active system; the former system and every older cell remain in the bank. Append one empty recipient and apply the same native contact. Taking its pair marginal gives exactly the capability calculation above. No reset of the older correlated state is needed. The delivered charge equals the active receiver's loss, and retaining a requested residual capacity requires the same explicit maintenance inequality already derived.

A finite supply gives a sharp boundary. Supply only N occupied source cells and then allow only empty incoming cells. Through the first 2N contacts, the history is the renewal history just described. After m additional empty contacts, system occupation is $(1 - s)^m$ p and the next-contact capacity is $s(1 - s)^m$ p. Since 0 < s < 1, this capacity tends to zero; it cannot remain above any fixed positive floor. The full retained state still has occupation p + N. The earlier bank and the later recipients together carry N + p − $(1 - s)^m$ p. Loss of the system's service capacity is therefore compatible with exact conservation of the whole account.

One source can itself be prepared by the specified paid native pulse. At its full-preparation endpoint, the donor has gained one occupation unit and the original supplier has lost that unit; the supplier remains in the state. A positive holding reserve accompanies this preparation. If d is the positive duration scale, the reserve is $\hbar\|G\|/d$ and full preparation lasts $\pi d/2$. Their product is $\hbar\pi\|G\|/2$. A positive cap C on that reserve therefore imposes the preparation-time bound $\hbar\pi\|G\|/(2C)$. This is a reserve and latency relation for this apparatus. It is not an assertion that the reserve is dissipated as heat or spent anew at every clock tick.

Combining that preparation with the retained two-tick controller gives the same receiver state and positive next-service capacity as one renewal cycle. The source preparation, clock and reference preparation, static coupling, and fresh empty recipient remain explicit parts of the construction. The result supplies one paid finite cycle and consistent finite renewal histories. A physical mechanism that continually prepares incoming supplies and schedules all later services must still be constructed.

The finite supply can be prepared while every original supplier remains in the same state description. Begin with empty donor and receiving cells, an initial system occupation p, and N occupied suppliers assigned to the first N source contacts. Each paid source pulse transfers occupation from its supplier into its donor. The entire preparation is unitary. Apply the actual service contact word while retaining all suppliers as spectator registers. Tracing only those supplier registers gives exactly the earlier finite-supply renewal state; the enlarged state still contains them and their correlations.

There is also a fixed autonomous clock construction for this finite batch. Its first checkpoint gives the complete source-prepared state, and its second gives the complete serviced state. The initial clock and reference are positive normalized states, the supplied holding is positive for nonnegative cell energy, and the full evolution preserves positivity and normalization. The clock construction contains the complete preparation and service words. It does not assign separate elapsed clock times to each internal contact. A clock that exposes every service prefix at distinct times requires the further construction of those checkpoints.

Sum the occupation observable over the system, every donor and recipient, and every original supplier. It commutes with the complete clock evolution, so its expectation is p + N at every real time once all N suppliers are included. No supplier disappears from the account after transferring its occupation. With zero occupied suppliers and zero opening system occupation, the same construction has zero total occupation throughout. Positivity then excludes a created occupied population hidden in some retained cell.

At the serviced endpoint, the recipient-only occupation is N times the earlier per-cycle service charge. The retained donor residues are excluded from that recipient observable. Appending m further empty contacts leaves future service capacity equal to $s(1 - s)^m$ p, where s is the fixed contact transfer probability. Since 0 < s < 1, no strictly positive capacity floor survives arbitrary extensions. These extensions are a family of finite banks and batch controllers. The result does not turn their contact count into elapsed time along one inexhaustible autonomous trajectory.

The resulting identity says that the change in system occupation is exactly the opposite change in the whole bank. For an initially empty receiving bank, its final total occupation equals the system's initial occupation minus its final occupation. Physical density requires normalized positive preparations, including initial filling fractions between zero and one. The identity retains cells after use and covers every finite bank size; it does not construct an infinite bank or prove that exhausted cells can be renewed.

An operational capability follows by preparing the existing second-contact cell empty. That retained cell then receives charge from the system during the second contact. Define delivery capacity as the occupation this same paid contact would deliver to an empty receiver. It is a readout of the actual evolved pair. With system occupation p immediately before service and the native pulse's transfer probability s, the reduced system after contact has occupation (1 − s)p. Conservation of the pair's total occupation therefore gives receiver gain r = sp, exactly the system's loss. Delivery capacity before service is K = sp; applying the same operational readout to the residual system gives K′ = s(1 − s)p = K − sr. Consequently preserving a specified residual capacity q has the exact condition:

$$q \le K' \quad \Longleftrightarrow \quad q + sr \le K.$$

The pair readout here is also the pair marginal at the calibrated endpoint of the complete sourced clock construction, with nonzero contact durations and clock parameter. The supplier, used first donor, clock and reference remain in that history. The hypothetical next service used to measure residual capacity requires its own empty receiver and controlled contact; their availability is not established by evaluating the readout. The specified q is a requested service level. Deriving a participant's physiological need for that service, its deadline, and the processes that renew it remains a separate physical connection.

Connecting this native account to the membrane requires agreement through time. A fresh paid donor begins with occupation zero and follows $\sin^2(t/d)$, where d is its fixed duration parameter. Its derivative at the start is zero. In a positive regenerating membrane state with the pump disabled, the ATP-labelled amount instead has a strictly positive derivative. No future-local identification by a fixed affine readout can make those two fresh histories agree at that start.

Preparation can match an instantaneous amount and current. Let A and D be positive ATP- and ADP-labelled amounts, let N = A + D, and let j be the positive ATP current at the comparison state, equal to regeneration current when the pump is disabled. Write p = A/N and choose a prepared phase and duration as follows:

$$\theta = \arcsin\sqrt{p}, \qquad d = \frac{2N\sqrt{p}\sqrt{1-p}}{j}, \qquad t_0 = d\theta.$$

The native source then has scaled donor amount N $\sin^2(t_0/d)$ = A, supplier amount N − A = D, and scaled donor derivative j. Positivity of A, D and j gives positive duration and preparation time. The supplier remains in the same joint state. N is a representation scale; this argument does not turn a pair of native cells into N molecules. Choosing d from j supplies a calibrated control rate rather than deriving a molecular rate.

A second derivative distinguishes a matched tangent from a matched history. Consider any fixed prepared pulse A(t) = N $\sin^2((t_0 + t)/d)$, with D(t) = N − A(t). If A(0) = D(0), its sine squared is one half, so its cosine squared is also one half. Differentiating twice gives A″(0) = 0, for every such fixed pulse.

For the pump-disabled finite-source membrane, write P for phosphate, f for fuel, w for waste, and κ for the positive product of Faraday and thermal-voltage parameters. The regeneration current r obeys A′ = r, D′ = P′ = f′ = −r and w′ = r. Its ideal chemical force is a difference of logarithmic potentials. Differentiating that force yields:

$$r' = -\nu\kappa r\left(\frac{1}{A} + \frac{1}{D} + \frac{1}{P} + \frac{1}{f} + \frac{1}{w}\right) < 0.$$

Here every inventory, the regeneration mobility ν and r are positive. Thus the membrane's right second derivative at the comparison state is negative. If the histories agreed on [0,H] with H positive, their first and second right derivatives at zero would agree. Zero cannot equal this negative value. No fixed shifted and scaled pulse reproduces that membrane history on an interval beginning at the comparison state.

The excluded membrane history exists. Set capacitance, Faraday parameter, thermal-voltage parameter, both channel conductances and regeneration mobility to one; set pump mobility to zero and voltage targets to −2 and 0. Start at voltage −1, inside sodium 1, outside sodium 4, inside potassium 4 exp(2), outside potassium 1, and A = D = P = f = w = 1. Choose chemical standard energy E = 6 + 5 log 4 and fuel standard energy E + 1. The pump drive and regeneration rate are both positive, with the latter equal to one. Both isolated operation margins are positive: the sodium margin is one half, and the potassium margin is 3/(1 + exp(−2)) − 1.

The vector field is continuously differentiable at these positive inventories, and positivity and strict readiness are open conditions. Local differential-equation existence therefore supplies a positive interval retaining them. The curvature contradiction applies to this actual constructed history. It excludes the fixed-pulse identification, not controlled pulses, retained banks, or native physical realization in general. A controlled construction can overcome this obstruction. Its next question is how the physical controller obtains and enacts the required time dependence.

The programmed construction starts with the same zero-pump membrane path. Since A′ = r and D′ = −r, their sum N is constant. Positive A and D place p = A/N strictly between zero and one. Choose the exchange phase from this actual path:

$$\theta(t) = \arcsin\sqrt{p(t)}, \qquad \theta'(t) = \frac{r(t)}{2N\sqrt{p(t)}\sqrt{1-p(t)}}.$$

Prepare the original source–supplier pair at phase θ(0), retaining both cells and their reference payloads. Subsequent evolution multiplies that actual preparation by a holding evolution and the additional exchange phase θ(t) − θ(0). The result equals the original paid exchange at phase θ(t), with the corresponding holding evolution still present. Nothing in this construction discards the initial preparation or silently replaces its supplier.

Let H_0 be the matched holding operator and C the positive exchange-control operator, including its retained baseline. The generator is $H_0 + \hbar\theta'(t)C$. With nonnegative holding energy, positive ħ and positive regeneration current, this operator is nonnegative. Differentiating the constructed evolution gives the Schrödinger equation with precisely that time-dependent generator. Unitarity preserves positivity and unit trace of the full state.

The source occupation is $\sin^2\theta(t) = A(t)/N$. The retained supplier occupation is its complement, D(t)/N; their sum stays one. Multiplication by the fixed representation scale N therefore reproduces both adenylate coordinates throughout the supplied interval. This is a complete programmed path correspondence for those two readings, extending the earlier amount-and-current match.

The phase program is calculated from the membrane trajectory. Its existence does not yet construct an autonomous controller that generates that trajectory or account for the apparatus varying its coefficient. N is a representation scale, not a derived count of molecules. The other chemical and ionic coordinates, their coupled kinetics, and the resources needed to prepare and sustain the controller still require their connected physical realization. A positive generator alone supplies none of those missing identifications.

The chemical comparison must retain all species that enter the reaction. Write A, D and P for the positive ATP, ADP and phosphate amounts in the stated ideal-mixture model. Its reaction quotient is A/(DP). Taking the logarithm gives log A minus log D minus log P; substitution into the supplied chemical-potential law gives the reaction affinity. The simpler adenylate ratio A/D omits the phosphate contribution.

The balanced membrane family supplies a precise acquisition case. Its phosphate and ADP coordinates are equal throughout the chosen embedding. The programmed native pair already has scaled occupation readings A and D, so those actual readings reconstruct ATP divided by the squared ADP amount, $A/(D^2)$. The corresponding logarithm gives the same chemical affinity. This equality uses the stated phosphate identity and programmed history; it does not install a general phosphate sensor.

The distinction is visible on the positive regenerating path already constructed. At its opening, the adenylate coordinate is one. Its strict increase makes phosphate, which is two minus that coordinate, smaller than one at every positive time. Positive inventories then make A/(DP) different from A/D. Thus two plausible-looking comparison ratios give different readings on

the same state. The governing physical process must determine which observable is relevant. A coordinate name or a convenient ratio cannot do that work.

A finite autonomous construction supplies a different next step. Prepare a native clock and a source–supplier pair, then let one fixed holding drive their joint evolution. The source pair begins at the paid preparation phase $\pi/4$, so its receiver occupation is one half. Its dimensionless exchange current is one, and the exchange contribution to its current derivative is zero at that phase. These identities follow by differentiating its actual $\sin^2$ occupation law.

The clock retains a reference payload R of unit trace. Let V_0 and V_7 be its orthogonal retained-slot embeddings. Prepare its density as $\frac{1}{2}VRV^\dagger$ with $V = V_0 - iV_7$. Since $V^\dagger V = 2I$, this state is positive and has unit trace. Let P select slot seven and let Hc be the native clock holding. Direct compression onto these two slots gives expectation ½ for P and −½ for the current i[Hc,P]. The latter follows from the clock's actual off-diagonal entries: their real sum is −1.

Let C be the positive paid exchange control, L the source receiver occupation, and H_0 the matched source holding. With coupling g positive, use the fixed joint holding below. Both baseline holdings and the selected control are positive, so their sum is positive.

$$K = H_c \otimes I + I \otimes H_0 + gP \otimes C, \qquad U(t) = e^{-itK/\hbar}.$$

Write J = i[C,L] for the source current and D = i[C,J] for its next commutator. The clock and source initially have the stated product preparation, but no factorization is imposed after they interact. The operator identities i[K,I⊗L] = gP⊗J and i[K,P⊗J] = i[Hc,P]⊗J + gP⊗D hold on the full retained system. For the evolved state X(t), differentiating an expectation gives $d\langle Q\rangle/dt = \langle i[K,Q]\rangle/\hbar$. Thus the changing clock contributes directly to the receiver current's derivative.

$$a(0) = \frac{1}{2}, \qquad a'(0) = \frac{g}{2\hbar}, \qquad a''(0) = -\frac{g}{2\hbar^2}.$$

Here a(t) is the receiver's occupation in the complete evolved state. The first derivative uses $\langle P\rangle\langle J\rangle = ½$. For the second derivative, the clock term has initial expectation −½ and the source-curvature term vanishes because $\langle D\rangle = 0$. Unitary evolution preserves density and unit trace at every time. The sum of receiver and supplier occupation commutes with K and remains one; the clock and both source cells remain present throughout.

This derives positive initial current and negative initial curvature from a fixed finite holding. It does not require a supplied function θ(t) during that autonomous segment. Preparing the coherent clock and the half-exchanged source pair, installing their contact, and identifying the resulting occupation with a complete membrane trajectory remain physical obligations. The result establishes the stated local response; it does not establish all chemical coordinates, perpetual provision, or an irreversible resource loss.

The pump-disabled membrane witness has a positive continuation for every nonnegative time. Its ten coordinates can be recovered exactly from three variables: inside sodium n, inside potassium k, and ATP amount a. Set K = 1 + 4 exp(2) and V_0 = 2 + 4 exp(2). The voltage is n + k − V_0. Outside sodium is 5 − n and outside potassium is K − k. ADP, phosphate and fuel each equal 2 − a, while waste equals a. These identities reproduce the stated initial condition and all ten differential equations.

$$n' = \log(5 - n) - \log n - (n + k - V_0),$$
$$k' = -(n + k - V_0) + \log(K - k) - \log k,$$
$$a' = 1 + 3\log(2 - a) - 2\log a.$$

Here is a region that prevents any required inventory from reaching zero. Write B = 10 + 4 exp(2), δ = exp(−B − 2), and A = 2 − exp(−2). Then 0 < δ < 1 and 1 < A < 2. Take the closed box δ ≤ n ≤ 5 − δ, δ ≤ k ≤ K − δ, and 1 ≤ a ≤ A. It contains the initial state (1, 4 exp(2), 1), and throughout it the voltage lies strictly between −B and B.

On the lower sodium face, −log δ = B + 2, while log(5 − δ) is positive. The voltage bound therefore makes n′ positive. On the upper face the same terms exchange roles and n′ is negative. The potassium faces have the same signs because K − δ exceeds one. At a = 1 the chemical rate is one. At a = A it is −5 − 2 log A, which is negative. The vector field thus points strictly inward on each of the six faces.

To construct the whole path, first clamp each coordinate to its interval and evaluate the original field there. This extended field is bounded and globally Lipschitz: clamping cannot increase distance, and the original continuously differentiable field is Lipschitz on the compact box. For any finite horizon T, a ball of radius L times T, where L bounds the speed, supplies a solution throughout that horizon. Uniqueness makes solutions on overlapping horizons agree, giving a path for all real times. The boundary derivative signs keep its future inside the box, where clamping changes nothing. Restoring the seven dependent coordinates gives the actual original ten-coordinate trajectory.

Regeneration stays strictly positive at every finite future time. Its rate depends only on a and starts at one. If it first attained zero at an amount a*, freeze the chemical coordinate at a* while retaining the same evolving ionic coordinates. Because the chemical rate at a* is zero and the ionic equations do not depend on a, this is another solution of the same globally Lipschitz extended field. The two paths agree at the alleged hitting time. Uniqueness, also backward to the initial time, would force a* = 1, whose rate is one rather than zero. Continuity therefore preserves the positive sign.

This construction establishes global positive inventories and positive regeneration in the stated constitutive model. It does not assert sustained ionic readiness, a uniform positive regeneration rate, or an identification of all these equations with a fixed finite native quantum apparatus. Those are distinct physical requirements. The complete source and waste remain in the accounting throughout.

The long-time behavior sharpens that distinction. The chemical rate r(a) = 1 + 3 log(2 − a) − 2 log a is continuous and strictly decreasing for 0 < a < 2. It is positive at one and negative at A. The intermediate value theorem therefore gives exactly one zero a* between one and A.

Along the constructed path, positive regeneration makes ATP strictly increase, while the sign of r forces it to remain below a^*.

No positive rate can be maintained uniformly. Suppose a' stayed at least $\varepsilon > 0$. The derivative lower bound would give $a(t) \geq a(0) + \varepsilon t$, eventually exceeding the fixed upper bound A. Hence the rate falls below every positive ε at some finite time. Since it decreases thereafter and remains positive, it converges to zero. For any c below a^* but at least one, r(c) is positive. Once the actual rate falls below r(c), strict decrease of r forces a above c. Together with $a < a^*$, this proves a converges to a^*.

Fuel equals $2 - a$ throughout this history. Since $a^* < A < 2$, positive fuel remains at equilibrium. The declining rate comes from the vanishing chemical driving force, with fuel, waste and the other inventories retained. Continued regeneration at every finite time thus coexists with output that tends to zero. Neither a positive remaining inventory nor ongoing activity alone establishes sustained provision at a required positive rate.

The exact unfinished physical connection is to identify the native reaction and supply history with the membrane's capability history, retaining the actual source, controller, thermal receiver, and correlations. Free-energy loss must not be equated casually with heat alone; energy and entropy changes need their correct connected account. The capability targets and incident channels must also be identified with the participant whose activity depends on them. Assigning an owner label does not establish that physical identification.

The global regenerating history also imposes a precise limit on its microscopic representation. Take any finite closed carrier evolving under a fixed self-adjoint Hamiltonian. Include its suppliers, reference and clock in that carrier. Let a real-valued readout depend continuously on the evolution near the identity. If that readout is nondecreasing for every future time, it must remain constant.

Here is the argument. Finite unitary evolution returns arbitrarily close to the identity at arbitrarily late times. Suppose the readout has increased by a positive amount at some time. Continuity supplies a neighborhood of the identity in which its increase is smaller than that amount. Choose a later return in this neighborhood. Monotonicity says the later reading is at least the earlier increased reading; continuity says it is smaller. The contradiction excludes every strict increase. The same argument applies to a matrix expectation, since matrix multiplication, conjugation and trace are continuous.

The constructed membrane history has strictly positive regeneration at every finite nonnegative time. Its ATP coordinate is therefore strictly increasing, although it approaches a finite equilibrium and its rate tends to zero. No continuous readout of a finite closed fixed-Hamiltonian carrier can reproduce that coordinate exactly for all future time. This is an exact obstruction to that representation. It does not exclude finite-time agreement, approximation, open systems, growing carriers or dynamics with a changing Hamiltonian. A finite-clock construction must keep its finite horizon visible; a claim about an unlimited future needs a correspondingly justified carrier and dynamics.

A finite controller can also reach the preparation and successive service checkpoints within one autonomous evolution. Construct a finite cyclic clock whose successive ticks visit distinct clock slots. Assign to each slot the cumulative operation wanted at that checkpoint: first the

supplied preparation, then each service prefix. A block unitary associates that cumulative operation with its corresponding clock slot.

Conjugating the uncoupled clock evolution by this block unitary produces the required sequence. The payload operations preserve the original holdings and occupation, so their association with clock slots does not remove the supplier cells or invent an unaccounted supply. A suitable positive correction retains the original controller baseline. The resulting fixed Hamiltonian is positive, and the complete supplied-bank occupation commutes with it. At the specified increasing times, its retained state has exactly the required preparation and service marginals.

The conclusion has a finite scope. The clock eventually wraps and the bank contains the originally supplied resources. Its coupling and preparation are inputs to the construction. Realizing that coupling with the established native interactions is a further physical question, distinct from proving that the supplied matrix has the desired evolution. Resource accounting must retain the clock and suppliers while that question is resolved.

A recurring delivery can also be constructed directly from the native local exchange interactions. Retain the original fourteen cells and add three complete cells, including their internal degrees of freedom. Prepare the first added cell occupied and the other two empty. An explicit simultaneous combination of local exchanges circulates that occupation through the three positions. For positive Planck constant and duration scale d, the occupation is one in cell k modulo three and zero in the other two at the following elapsed times, for every nonnegative integer k:

$$t_k = \frac{2\pi k d}{3\sqrt{3}}, \qquad k = 0, 1, 2, \dots .$$

This calculation keeps the full seventeen-cell state. It allows correlations among the original cells and internal degrees of freedom, and retains the complete holding background and positive control baseline. The background cancels from the selected occupation reading because of the proved commutation relations; it has not disappeared from the apparatus or its account. The result therefore connects repeated checkpoints to specified native interactions, with the preparation and availability of the simultaneous drives still explicit.

The resource can remain in this same carrier through a receiver contact and the next circulation interval. Number the three added cells 0, 1 and 2. Start in the prepared sector with cell 0 occupied and cells 1 and 2 empty. The first cycle interval takes the occupation to cell 1. A specified exchange then couples cell 1 to cell 2, after which the same circulation resumes. Cell 2 is already part of the seventeen-cell apparatus; no fresh receiver is appended and no cell is reset.

The exchange calculation is explicit. Write S_j for the isometric embedding with the occupation in cell j and all original-apparatus and internal payload coordinates retained. The contact generator G obeys $GS_1 = S_2$ and $GS_2 = -S_1$. Expanding its exponential therefore gives the following action. Write C for one cycle step in this occupation calculation:

$$e^{G}S_1 = \cos(1)S_1 + \sin(1)S_2, \qquad Ce^{G}S_1 = \cos(1)S_2 + \sin(1)S_0.$$

These simple actions determine the occupation readings of the full evolution, without replacing its holding operator. For each stage the holding is $H_0 + (\hbar/d)(iG + \|G\|I)$, with that stage's

generator and positive duration scale. The common background H_0 commutes with the occupation observables and the subsequent exchange and cycle operations. It therefore also commutes with each observable conjugated by a later operation. Cancelling the background in the last readout, then in the preceding one, gives the same sequential occupation calculation. The positive scalar baseline cancels from these readouts as a phase; both terms remain in the actual holding.

The occupied embeddings are orthogonal. Projecting onto a selected cell and taking the squared norm consequently gives a scalar times the identity on the entire retained payload space. Put $p = \sin^2(1)$. For every integer background parameter and positive $\hbar$, cycle duration and contact duration, the four occupation readings are:

$$(\langle N_1\rangle, \langle N_2\rangle)_{\text{after contact}} = (1-p, p),$$
$$(\langle N_2\rangle, \langle N_0\rangle)_{\text{after resumed cycle}} = (1-p, p).$$

Here the brackets denote expectation in a normalized state from the specified initial occupied sector. The identity on the payload makes the result independent of its particular coefficients: arbitrary initial correlations among the original apparatus and internal payload coordinates are allowed within that sector. Those spaces remain present throughout. Their numerical correlations need not remain unchanged under the complete background evolution. The claim does not cover arbitrary initial occupation distributions.

The receiver contact thus changes the later circulation on the same retained apparatus. It is reversible redistribution of one supplied occupation. Cell 2 participates in the resumed cycle, so its received amount is not permanently extracted or held aside as consumed output. Positive holdings do not by themselves supply the work of switching drives or an autonomous controller. The schedule and simultaneous drives remain supplied, and changing a duration also rescales its drive. Repeated replenishment after actual consumption still requires the consuming process and fresh supply to be included in the physical account.

A comparison can be acquired through an actual intervention on its source. Take positive operands already present in a physical signal and retain the complete surrounding carrier. With three blank input banks, a reversible operation halves one operand and holds the other fixed. The complementary outputs stay in the banks. Applying the same involution again restores the original carrier. Relative to the calibrated state, that return doubles the comparison ratio.

The signed change in recognition cost during this return determines the oriented comparison ratio. The calculation therefore supplies both an intervention and an inverse reconstruction. It does not prepare a signal from a desired answer and then recover that answer. The supplied full Hamiltonian enacts the operation at positive duration while retaining its records and clock registers. Those registers are held fixed by this particular driver; their retention is not proof that a clock advanced or paid for the operation.

To use this reconstruction for a patient, the physical source must be identified with that patient's affected process. Once the independently fixed initial comparison is identified, the intervention derives the corresponding exposure response. Assigning an owner label supplies no such identification. The remaining work must connect the bodily channel, its actual intervention and the available provision within the same physical history. The patient's remaining

capacity is additional information: it cannot be recovered from the present comparison ratio alone.

6 Authored reliance and governing responsibility

An undertaking changes a shared physical history. Someone offers terms, someone accepts them, work occurs, and later actions perform or fail what was undertaken. The same recognition structure carries authorship, effects, and the participants' capacity to continue. A balance or aggregate benefit cannot replace that history.

In the primitive record account, consent is authorship of one's own side of the interaction. Receiving a benefit does not establish authorship. Taking on a burden does not establish refusal. A participant can author an action that increases their own cost. Identifying consent with "nobody becomes worse off" would exclude voluntarily authored care whenever it increases the helper's cost before examining what anyone did.

Content, roles, performance, and later releases must remain distinguishable. Histories with the same books can have different outstanding requirements because their terms or performances differ. A protocol can specify who may release a claim; faithfully reconstructing its records does not independently establish that every possible protocol chooses release authority correctly.

In the care construction, a helper offers assistance and a recipient accepts. Under the recipient's existing controller, acceptance changes the next action from self-feeding to work. The work occurs and leaves a physical record. Later the helper can deliver food or omit delivery.

The relevant displaced response can be recovered by intervention. Prevent the offer while retaining the remaining controller and resource dynamics: the recipient self-feeds. Prevent acceptance instead: the recipient also self-feeds. Both interventions recover the same response. Their agreement uniquely identifies what the accepted undertaking displaced. It is not an independently chosen welfare target.

Those interventions concern the formation of the history. They do not permit undoing its actual elapsed prefix. Once the work has occurred, holding that prefix fixed leaves delivery as the remaining preventive event in the construction. Feeding restores the recipient's response to the recovered reference; omission does not. Across this case's physically legal action domain, restoration and performance of accepted content coincide.

This care transition has a realization on the same physical bonds used to measure its consequences. The joint state retains material inventory, the shared bond ledger and each participant's repair capacity. Exposure changes the actual bond multipliers. An affordable repair applies the native restoring action to that ledger and debits its charge from the participant's capacity. If repair cannot be funded, the strained bond remains and no repair charge is taken.

Read the resulting multiplier and capacity directly from this shared state. For each participant, the existing native repair identity gives exactly the response update used by the care transition; the material projection independently follows the same inventory operation. These two equalities prove that the joint state's direct readout agrees with the represented successor.

The equality holds for the total mathematical transition functions. Physical executability additionally requires available stock, labor and nonnegative funded capacity.

The specified initial state meets those conditions for work followed by either feeding or omission. After omission the helper's capacity is 7/4 and the recipient's is zero. After feeding they are 3/2 and 1/2. The represented bonds are balanced in both outcomes, so the remaining capacity distinguishes their ability to maintain themselves. The helper's burden remains visible. The material model's older signed reserve is not an extra spendable resource to add to this native repair capacity or to charge again as maintenance.

The exposure law, intake conversion, labor schedule and funding convention remain explicit physical assumptions of this construction. Connecting them to independently derived microscopic apparatus dynamics is the remaining identification. The direct ledger realization establishes the shared objects and action at this application scope; it does not establish the governing authority of an undertaking merely from equality of descriptions.

The remaining capacity has an operational meaning: it determines which later sequences of exposure and paid repair the participant can carry out. Each affordable repair restores the actual bond and deducts its charge from that participant's capacity. The care construction identifies these execution questions with the corresponding reserve calculation for every finite sequence. An economic representation preserving the original participant observations therefore preserves their answers, including after omission or an unfunded repair. This recovers more than a total: it retains whose bond is affected and whose capacity can pay.

Food, inventory and repair capacity remain distinct parts of the same history. In the meal example, provision takes one unit from the chosen stock, records one unit consumed by the recipient, and records the helper's work. Omission leaves that unit in stock and records neither the intake nor that work. Providing the meal also leaves the helper with a quarter less repair capacity than omission. The recipient's gain does not erase this burden. The stock movement and the capacity account describe their specified physical transformations; they do not create two supplies that can be spent independently.

A single later repair question makes the distinction concrete in this care opening. Exposing the recipient's bond to a multiplier of two requires a quarter of capacity to restore it. The supplied meal leaves capacity to pay; omission leaves none. A later release of the undertaking's active record does not supply that quarter. The released record can satisfy its current compliance condition while this original repair question still fails. The retained ledger continues to distinguish provision from omission, and a remembered failure remains a failure. A release changes the standing record; treating it as a certificate that the physical care was completed would discard evidence the history still contains.

An exact description still needs a physical route to an answer. Reading capacity in the mathematical state is different from an apparatus acquiring it from the participant's actual continuing ledger. Preparing a correct answer from the chosen action label supplies information to the apparatus; it does not establish that the apparatus obtained that information from the meal, work and repair history. Acquisition must preserve the affected participant, retained history and resource account, and its own operation must fit the available resources and time.

A completion claim adds another use of the answer. The arrangement must connect what it reports to the actual accepted content, participant and performance window. Even a truthful

report of the repair consequences does not by itself establish why that report governs the undertaking. The remaining responsibility argument must connect the answer's actual use to the authored history and available control. It must do so while allowing the helper to refuse: correct recognition of an outstanding requirement and performance of it are different physical facts.

The recipient's acceptance is also causally involved: without it, self-feeding would have occurred. That does not make omission a performance of the accepted terms. Causal participation, fulfillment, knowledge, and blame are different questions. The intervention result establishes causal participation and displaced reliance; it supplies neither a blame score nor knowledge of a later failure.

The reserve boundary connects this case to continuation capacity. Positive reserve admits an abstract continuing recognition-agent extension; zero reserve fails already at the opening window. The positive construction chooses balanced future skew and a continuing positive future budget. It does not prove that those future resources are supplied by the actual care environment. Its scope must be kept distinct from the resource-accounted continuation budget derived earlier.

Within the fixed care opening, restoring the displaced response, retaining this continuation extension for the identified recipient, and retaining one for each represented participant pick out the same legal actions. The helper alone retains positive reserve after feeding or omission. A helper-only continuation condition therefore permits omission and cannot establish the recipient's requirement.

The construction also gives the accepted terms a physical evaluator. Bounded memory retains the actual content. An evaluator supplied with the decoded terms and truthful response inputs distinguishes subsequent performance from failure. Every evaluator in the stated class recording those same terms gives the same judgment: feeding passes, omission fails.

An exact evaluator can use the actual reliance history rather than a different protocol's example. Take terms addressed to participant 1 for the window [2,3), and inspect the actual checkpoint 2 after work followed by the helper's later action. The initial verdict register is blank. Supply the retained terms and truthful bits reporting whether the recipient's bond is balanced and whether repair capacity remains positive. For each feasible later action, the finite evaluator writes a passing verdict exactly when the accepted terms are performed at this checkpoint.

For every feasible later action in this case, that verdict agrees both with recorded performance and with restoration of the recipient's intervention-derived no-reliance response. The proof evaluates the same native work-and-action ledger trace, then uses the established equivalence between its response and performance. Omission remains feasible and writes failure. The native material account and repair-capacity account remain exact; the separately prepared term-memory and evaluator preserve their holding energy.

These equalities do not yet combine acquisition and evaluation into the economic deadline. The evaluator receives prepared response bits and terms, and its physical operation time is not identified with the participant's clock. Computing the correct answer at a specified checkpoint and finishing a physical measurement before the undertaking expires are different requirements. A further finite writer can prepare bits from a retained action register

and a supplied economic interpretation, but that alone does not enact or sense care on the independently identified participant and resource carrier.

The reading implemented by this evaluator consists of all and only the consequences shared by its physically legal passing performances. This exact relation identifies what the apparatus implements. A reading that calls omission complete performance disagrees with its verdict on an available action. Appending a true statement about the apparatus to that reading does not repair the disagreement. The interpretation must describe the evaluator's actual performance relation; this does not yet establish the authority of every possible evaluator.

Within that implemented class, the reading is unique. Performance, restoration of the intervention-derived reference, and joint continuation capacity identify the same legal alternatives. This is a strong fixed-carrier result. It does not by itself prove that every authored economic history belongs to that implementation class or that its governing authority has been identified.

There is a further distinction between this minimal implemented consequence set and every legitimate additional commitment. Suppose two feeding slots both perform the recorded undertaking. A further commitment to feed in slot zero can be compatible with that undertaking, even though feeding in slot one also passes its evaluator. The more specific commitment has a smaller performance class. It need not equal the entire class recognized by the original evaluator.

This gives a concrete boundary for a necessity claim: required consequences can form a floor while compatible additional commitments remain possible. For a reading complete with respect to its own performances, requiring every such performance to pass the truthful evaluator is equivalent to requiring that reading to contain the recorded-performance condition. Consequently, that evaluator-soundness premise cannot independently derive recorded authority; it already selects the disputed consequence. The physical authorship and reliance argument must establish the required floor without hiding it in the admission rule.

Governing requirement and compliance remain distinct. Two helper controllers can carry the same accepted event, retained terms, evaluator, and recipient acceptance machinery while selecting different later actions. One feeds and the other omits. Their behavior does not rewrite what the evaluator recognizes as performance. A requirement must permit this distinction if it is to describe violation.

A more tightly connected realization joins the acceptance event to the helper's action coordinate. Acceptance writes the shared state from which the controller reads its action. The installed state selects feeding and implements the same joint-continuation reading. Omission remains executable in the broader apparatus but is not the state produced by that installation. This constructs an implementation of commitment and performance; it does not establish universal obedience.

Earlier acceptance can also be separated from the recipient's present request for the care operation. In a construction using the same two economic intervals as the reliance case, each participant changes only their own source record. The supplied control rule selects feeding only when both present requests occur. With the same accepted history, both requests select the feasible remedy; either request withheld selects feasible omission. In the omission branch

the recipient is not maintained. The care sequence retains its original clock, material, work and response, including the helper's expenditure.

The helper's record operation cannot supply the change in the recipient's own row. This makes joint current control distinct from an earlier acceptance record. The record operations and care operations have their respective physical ledger descriptions; making them operate together within the original interval still requires an apparatus with accounted time, resources and access. The source roles and control rule remain supplied. The represented care history retains a feasible remedy at the original deadline and a later refusal. It does not establish that every adequate governing arrangement must select that remedy.

A further construction tests whether acceptance-controlled writing is enough to establish a report's authority. Its initial preparation supplies the terms, an already evaluated truthful verdict for the action under examination, and two distinct exchange pairs: one for writing a different program and one for writing its report. The acceptance recorded in memory controls the first exchange, selecting an all-pass program; the second exchange then writes a passing report. Without the recorded acceptance, the program-writing exchange does not occur. Each stage has a nonnegative interaction generator and preserves the separately defined holding energy of the complete register apparatus, including both pairs. The earlier term-memory write also preserves this holding energy and reaches the prepared state from which these stages proceed.

The argument is direct. After the first exchange the program always passes; after the second exchange the report therefore passes for feeding and omission alike. Neither exchange alters the original memory or truthful verdict. Omission still fails the original terms. The same apparatus thus retains the truthful verdict and a rival report, with the rival program selected by the recorded acceptance. This form of acceptance-controlled writing alone cannot identify which report governs. The construction supplies staged operations, not a single autonomous trajectory joining the care environment, evaluator operation and every preparation and switching resource. Its enacted-reliance certificate remains separate from the apparatus trajectory. The next task is to connect the authored undertaking, its displaced response, actual care actions and evaluator operation within one accounted physical history.

The remaining responsibility theorem must identify governing readings from authored physical histories across a justified family of carriers. It must preserve authors, terms, reliance, relevant consequences, and available control while retaining executable refusal and breach. Defining admissible histories to be those that already satisfy the desired duty would assume the result. Requiring every controller to succeed would remove the very violation the framework must explain.

The responsibility carrier must retain the actual path by which a participant affects another. In the care construction, each participant's internal repair ledger uses self-bonds. A relation defined solely by sharing an incident bond therefore identifies only the participant with itself, throughout every action history. Nevertheless, after the helper works, feeding restores the recipient's capacity to one half while omission leaves it at zero. Both choices are feasible. The existing shared-incidence result remains exact at its scope; applying it as the whole cross-participant responsibility relation would omit the upstream control and funding path.

A continuation argument can now retain the original history exactly. Start from equal figures on a relationship. A source author raises its own claim, or a destination author withdraws its own acknowledgment, opening a positive gap. The opposite participant is the one that stood on the prior record. During the later epoch, suppose every write by that participant is an own journal on free accounts. Such a write cannot alter the designated figure on this relationship; nor can another participant's own write alter it. This operational condition derives a fixed counterpart reading. It is stronger than merely saying that the participant once stood on the record.

Suppose further that this counterpart continues posting arbitrarily late, the balance recorded on its original reserve account has a uniform upper bound, the books remain positive, and original-history pricing applies. The posting theorem forces the relationship ratio toward one. With the counterpart's figure fixed, the author who opened the positive gap must eventually make a signed corrective entry on the same designated account. Row exclusivity excludes another author making that own entry. The source-opening and destination-withdrawal cases select opposite correctors from their actual histories. No finite deadline or complete restitution follows from this argument.

Taking the suffix of a history does not replenish its reserve. The suffix's usual accounting expression equals the original expression plus all charges accrued before the cutoff. Those prior charges are nonnegative, so original-history pricing implies the weaker suffix pricing used in the proof. The bookkeeping identity is explicit. It supplies neither new energy nor a fresh claim on someone else.

The conclusion is an authored accounting correction. Interpreting it as culpable breach requires more evidence. Consider a joint record that says an undelivered transaction occurred: both figures can agree while both are false. A source then truthfully removes its claim. That correction creates disagreement, increases the comparison cost from zero to one quarter, and makes the truthful corrector the party that departed. Another constructed history keeps posting with bounded priced accounts while the agreed figures remain false. Agreement, cost and departure therefore retain their exact meanings; they do not replace the underlying terms, performance and authorized releases.

An actual delivery supplies a better reference than agreement alone. In the constructed history, a source offers one unit, the destination accepts, and the located unit crosses to the destination at tick three. From tick four onward, the retained event record reads one delivered unit, even when the unit later moves on. The two designated entries use a fixed positive opening offset of one. A joint posting makes each entry two, so each delivery claim, after subtracting that offset, reads one. Their agreement is faithful at this checkpoint because both calibrated claims match the retained delivery reference.

Now let the source alone increase its calibrated claim to two while the destination retains a claim of one. The source's entry becomes inaccurate relative to the same delivered unit. Alternatively, let the destination alone lower its calibrated claim while the source retains a claim of one; then the destination's entry becomes inaccurate. Under the preceding positive-reserve, pricing, bounded-original-account and continuing-posting conditions, with the other endpoint's later legal writes protected, the author of this new discrepancy must eventually write again. The direction follows from which author changed its calibrated claim relative to

the retained reference, together with the continuation argument; equal endpoint totals alone would not identify it.

These accounting premises are compatible. A four-account example records delivery, lets the source overstate it, and then has that source restore its entry. The protected destination continues changing its two free counterbalancing accounts while its calibrated delivery claim remains one. Its selected original reserve account stays at one, and the only nonzero assessed charge is one twenty-fourth at the discrepancy. Its reserve therefore stays positive. This is a constructed accounting history. Its role-tagged offer and acceptance, located-unit crossing, and funded native record operations still need one common physical realization before the example establishes a physically sustained responsibility arrangement.

The offer, acceptance and delivery can be retained on one native apparatus. Use distinct source and recipient record pairs, one unit pair, and fresh record slots with their reservoirs. An offer changes the source pair. The acceptance contact responds to that source record and changes the separate recipient pair. Delivery exchanges the occupied and empty unit modes. Each stage retains the earlier slots, and the direct slot readout recovers the three events. A later native operation can change the source's claim while preserving all three records. A truthful history and a false current claim are thus physically distinguishable on this same apparatus.

A spatial realization makes the transferred unit explicit. Choose two adjacent sites in the existing voxel space and encode the unit's left or right site in the corresponding one-occupation pair. The native finite-time exchange carries the encoded left basis state to the encoded right basis state while retaining the authored prefix. The coordinate rearrangement has an exact inverse and includes the unit pair once. Its checkpoint path has one source-to-destination crossing, and the retained slots read that crossing. The chosen site locations, contact accessibility and participant roles are construction data. During the contact, the quantum interpolation is not being replaced by a claim that the unit has a definite intermediate site.

The donor withdrawal has a similarly direct resource reading. Divide each donor port's actual energy by the positive comparison calibration to obtain its reserve quantity r. Represent its row by the four entries (1, −1, r, −r). A native contact changes the participating donor's reserve by its actual before-and-after difference, leaves the other donor's row unchanged, and is read exactly as the corresponding balanced own-row entry. For the calibrated positive comparison, that difference is −J(A/B). These are reserve rows; they do not replace the separate authored claims and liabilities about delivery.

When a nonzero primitive accounting move agrees with that physical reserve change, its author row is forced by the changed row. This identifies the author within the supplied accounting representation. It does not infer a person's consent from energy loss. The common physical history must also connect an actual source command, its retained record, and the contact. The following construction supplies that connection for its installed source menu; participant identity and governing authority remain further relations.

One construction now places the actual accepted record, a retained execute-or-refuse coordinate, and the comparison bank in the same native amplitude carrier. The record writer is reversible and preserves its full holding account. A positive block generator acts on the bank only in the enabled record-and-choice sector. Its continuous flow satisfies the native

evolution equation and retains the complete control coordinate. At the calibrated positive contact duration, the two staged contacts give the left-bank comparison cycle; refusal gives the unchanged bank.

The endpoint accounting includes both authored world pairs, the transferred unit pair, the earlier offer record, the new acceptance record and its reservoir, the explicit choice coordinate, and all bank ports. Their specified holding sum is preserved. The actual reserve difference is also the balanced own-row journal difference. The staging, accessible contact and prepared controls remain construction data; the endpoint identity does not establish that switching or installing the apparatus costs nothing.

A further native source write determines whether that contact can run. Keep distinct donor-source and other-source pairs, and a separate message pair with its reservoir. A donor-source write changes its own pair and writes the enabling message; the other source write changes its own pair without enabling the bank. Both source pairs survive. The changed pair reconstructs which of the two actual source operations occurred. For the prepared comparison with positive operands 2 and 1, an executed donor command withdraws one quarter in the calibrated reserve units. The other source command and an actual refusal each withdraw zero.

Any report that predicts these actual withdrawals must distinguish the two source histories. Otherwise one reported state would have to predict both one quarter and zero. This is a forced distinction in an adequate description. The gate itself is an installed physical construction: its operative source can be identified without thereby proving that every possible intervention must obey it. Connecting that source to an experiencing participant, informed consent, or a governing right requires the participant and authority relations to be retained as well.

The three source operations and two bank contacts can also be followed in one common amplitude field. Let N measure the size of an eight-coordinate complex signal. It is a norm unchanged by independent phase rotations and permutations of those coordinates. Comparison conservation requires a fixed positive comparison gain a and positive exponent q such that, for every pair of input signals,

$$N\big(a(\psi+\phi)\big)^q + N\big(a(\psi-\phi)\big)^q = N(\psi)^q + N(\phi)^q.$$

The comparison multiplies the sum and difference by a and preserves their combined energy. These conditions force the exponent to be two, the comparison gain to be the reciprocal of the square root of two, and each signal's energy to be a fixed positive multiple of the sum of its squared amplitudes. For any initial common field, the source writes preserve the energy attached to each exchanged source sector and their combined amplitude weight. Each bank pulse preserves the combined weight of its two active ports while retaining the other ports and recorded controls. With positive pulse strength, all five stages therefore conserve the full common-field holding at every intermediate time.

A positive exponent alone is weaker. With a fourth-power energy, a native source pulse that changes a definite source sector splits its amplitude between two distinct sectors. Halfway through the contact, their combined bank energy is half its initial value, while the source and control contribution is retained. For positive initial bank energy, the full holding has therefore changed during the pulse despite agreement at the endpoints. This fourth-power case falls outside the comparison-conservation condition. The conservation result retains its norm,

symmetry and all-input comparison premises. Preparation, switching, economic deadlines and the complete bodily care transition require their own physical accounting.

The command source itself has a physical history. Add two distinct upstream driver pairs, each initially containing an empty signal mode and a prepared reservoir. A native exchange can activate either pair. One fixed relay responds to either activation by issuing the same downstream command. The subsequent command records, acceptance records and bank-contact states then agree at every represented device stage, including the final execution or refusal.

No function of that device history can tell which upstream driver acted: identical input to the function would have to give two different answers. The enlarged history does retain the two driver pairs, and their different final states distinguish the cases. This is a loss under a particular projection of the physical carrier. The two complete histories are different. Recovering authorship requires keeping the relevant causal boundary and connection; a name attached afterward cannot recover discarded evidence.

The retained driver also permits an exact, limited attribution. Define an operation to be local to a boundary when it leaves every driver pair outside that boundary unchanged. Each of the two prepared native input operations changes exactly its own pair. It is therefore local to a boundary precisely when that boundary contains the changed pair. If boundaries are disjoint, two different boundaries cannot both contain that pair. If the boundaries cover it, exactly one qualifies. The source can still be reconstructed after the subsequent contact, whether execution or refusal occurs.

This derives attribution from the changed physical support and retained evidence. Applying it to a person requires the further physical identification of that person's boundary and local operation with this carrier. The finite menu contains two prepared input events. It does not identify an experiencing participant, informed consent or ownership simply by naming one of its ports.

Physical attribution has a similarly precise boundary. On the full formation carrier, prepare the helper's offer, issue a native source signal, and run the acceptance relay. This supplies a concrete native input operation whose subsequent installation is the existing formation operation. The helper-offer coordinate remains unchanged during this acceptance contact, and the retained driver identifies which primitive source acted. For the relay that responds to either source, either source can produce the same installed formation frame; their complete carriers still differ in the upstream driver. Independent source gates can impose a different access rule, whose physical operation must also remain represented.

Checking locality only on the driver pairs does not establish locality on the whole carrier. The existing native source write can instead be followed by the helper-offer operation. Every driver pair outside the selected source boundary still remains unchanged, so the driver-locality test passes. Yet the separately represented helper-offer coordinate changes. This actual operation exposes what that test observes and what it leaves unexamined. In the acceptance construction, retaining the helper's offer is a separate property of the executed contact, rather than a consequence of driver locality alone. Identifying the source boundary with an experiencing participant requires the participant's actual boundary and operation

to be connected to this same carrier. Source recovery, full-carrier locality and experiencing identity are distinct parts of that physical identification.

Refusal has a particularly instructive physical remainder. In the refused branch of the controlled bank contact, the interaction generator vanishes and that sector stays stationary for all contact times. The main signal already contains the kept projection in both branches. Looking at that signal alone cannot tell whether the funded contact ran. Under refusal the complementary component stays in the donor bank; after execution it occupies the output record. The complete bank distinguishes the outcomes.

A further native recombination with that actual donor recovers the original comparison operands after refusal. After execution, the same recombination leaves the already matched kept operands unchanged. For positive original operands A and B, the remaining donor capacity under the stated energy calibration is J(A/B) after refusal and zero after execution. Recombination conserves the full account and retains the earlier records. It is an additional physical operation. The stored complement establishes an available comparison resource; it does not establish a fresh expenditure on each tick, an independently identified patient need or, by itself, a duty to act.

An undertaking needs an actual route from what is offered and accepted to what later gets compared. Consider a finite physical bank with separate retained offer and acceptance sectors, three offered terms, a writing reservoir and initially blank memory. A controlled exchange installs those terms only when the formation gates are present. If formation is absent, the memory stays blank. The full bank, including the reservoir, belongs in the resource account.

The later comparison reads this installed memory. Its reference is therefore the content carried through the actual formation operation. On the specified reliance history, the failure indication agrees exactly with whether the recorded performance was made. Feasible omission still produces failure, and the specified later command operations leave that comparison intact. The construction explains how formation and its consequential record can persist physically through refusal.

The prepared acceptance contact has an exact readout as a change in the parties' records. It exchanges the acceptance signal with its reserve while preserving the offered terms and the other record pairs. Reading the offer and acceptance signals gives the accepting party's own-record update, and hence consent under the record account's authorship criterion. The upstream source that triggered the relay remains separately readable. Either source can trigger the same accepting record; its source index does not become the accepting author.

Additional paired registers retain a proposal number and its base revision. Each finite bank stores digits and their reserves, and the acceptance contact leaves both banks unchanged. The terms and both numbers can therefore be read from the same carrier. When they match the pending proposal, its base equals the current revision and the undertaking is still open, interpreting this acceptance installs those exact terms. Every finite pair of version numbers has a finite encoding in this construction. Larger numbers may require larger banks; one fixed apparatus has finite capacity.

This connects the physical contact to an accepting record and version-matched terms within the installed arrangement. Identifying these records with particular participants' own books, and establishing their local access to the contact, remain unfinished physical connections.

The undertaking identifier and pending history are still supplied to the interpretation; these registers do not yet enact the complete history. The responsibility question must connect these same retained objects to actual authors and their governing relations.

Accepting the proposal and performing the service are different physical changes. In this construction, acceptance changes the formation records from a gap of one to matching records with a gap of zero. The later comparison retains those matched records under every action in its response menu, including refusal. Their zero gap therefore cannot represent the service still owed. To pursue a correction argument for outstanding service, the next construction is to join the retained comparison between accepted content and actual performance to a protected claimant and the resources that pay for continuing activity.

The same finite formation apparatus also permits the causal reference to be recovered from its actual contact sequence. Retain the issued upstream command and offered content, then withhold the offer contact. The acceptance relay can still be active, but the absent offer prevents installation. In the other execution, let the offer occur and withhold acceptance. This also leaves the undertaking unformed. Both are alternative executions from the prepared initial carrier; neither erases an event that has already happened.

The formed status and installed content read from the apparatus supply the input to the existing recipient controller. On the actual branch it selects work. On either withheld-contact branch it selects self-feeding. The two resulting recipient responses are equal, so they determine one causal reference. Completing that displaced response on the actual branch is equivalent to the installed comparator reporting performance, given truthful response inputs, over every feasible later action in the specified menu. Provision supplies a witness; omission remains feasible and fails the comparison.

This connects physical formation, recipient response and performance without choosing a reference to obtain a preferred verdict. The recipient controller, initial resources and contact schedule remain part of this construction. The resource-transfer part of that controller can itself act on the retained formation, as the following construction shows. Completing the physical acquisition, exposure and repair dynamics remains necessary to realize the whole care transition. Deriving why the undertaking governs the participants also requires the connection between this history and their standing relations. Causal completion alone does not assign authority to the comparator.

An accepted history can remain unchanged while its dependence on formation changes. Keep the care opening, accepted terms, resource dynamics and later helper action fixed. Compare two recipient controllers. The first works after formation and self-feeds without it. The second works in either case. Both therefore produce the same actual accepted work history, followed by the same provision or omission. Their different responses to withheld formation are part of their different physical interaction rules.

With omission, the actual recipient response in both cases is multiplier one and reserve zero. Under the first controller, withholding either formation contact instead produces self-feeding followed by waiting, leaving multiplier one and reserve one half. Omission does not restore that response. Under the second controller, withholding either contact still produces work followed by omission. Its reference is therefore the same zero-reserve response as the actual

outcome, and omission matches it exactly. The accepted maintenance content nevertheless remains unperformed at the actual checkpoint in both cases.

This comparison preserves the fixed-controller result: in the responsive case, restoring the displaced response and performing the accepted content coincide. It identifies the condition that limits its extension. Matching the actual accepted trace does not fix the recipient's response to an intervention that prevents acceptance. An assessment of what formation caused needs that additional interaction rule. An assessment of whether accepted content was performed must retain the content itself. A recipient's decision to perform the same work independently can remove formation's marginal causal effect without turning omission into performance of the accepted care.

Two independently sourced contacts make the formation distinguishable in the apparatus itself. Retain two driver pairs. The first fixed relay reads only the first driver and controls the offer pair; the second reads only the second driver and controls the acceptance pair. Both relays run in each execution. What changes between executions is whether each primitive source event occurs. Withholding one source therefore changes its own formation row while the other source and the fixed wiring remain the same. This establishes independent control for these prepared interventions, beyond merely giving the rows different names.

There are four prepared prefixes: neither source, offer alone, acceptance alone, and both. In each, the stages are the initial preparation, the first source and relay, the second source and relay, and installation. The installed reliance content is read exactly when both sources occurred. The two retained driver modes identify which of these four executions happened, and hence recover its prefix after either later command. This is finite protocol recovery. Two source pairs do not recover an arbitrary chronology of repeated or reversed interventions, nor do separate source gates by themselves identify two experiencing persons.

The resources are present before either source event. Alongside the complete formation bank, retain five additional mode pairs: command, self-intake supply, recipient work reserve, later intake supply, and helper work reserve. In that order their preparation is (0,1), (0,2), (0,1), (0,2), (0,1). The first coordinate is the destination mode and the second its paired reserve. Formation changes its own coordinates while retaining all five pairs. Acceptance therefore creates no resource supply. The intake and work names state their roles in this construction; identifying these modes with bodily food and labor remains a further physical task.

Every resource contact rearranges the complete bank into an active pair and a control coordinate containing the entire formation and every other pair. The rearrangement has an exact inverse, so nothing is discarded. If its predicate is active, the native contact exchanges the two modes; otherwise it leaves the pair unchanged. For positive contact strength g, the nonnegative generator reaches this exchange at time $\hbar\pi/(2g)$, and its unitary flow conserves the full holding. During a contact, a state supported in one definite complete-control sector remains in that sector. This support statement does not assert that arbitrary reduced control coherences are numerically unchanged.

Let r record whether the actual formation reads the installed reliance content. The first operation gates self-intake by the absence of r and transfers the recipient's work reserve in both branches. Thus the self-intake pair is (0,2) when r is present and (2,0) when it is absent; the recipient work pair becomes (1,0) in either case. The retained formation has caused an

actual difference in intake, rather than merely being placed beside an independently specified resource state.

The funding correspondence uses an explicit calibration. If ε(n) is the native energy of mode n, its amount in the care account is:

$$u(n) = \frac{\varepsilon(n)}{4\varepsilon(1)} = \frac{n}{4}.$$

The equality follows from the linear native mode-energy formula and positive ε(1). First-stage funding is intake-port gain minus recipient work-reserve depletion. Without formed reliance it is 2/4 − 1/4 = 1/4; with formed reliance it is 0 − 1/4 = −1/4. The helper's first-stage funding is zero. These are exactly the gross funding amounts of the earlier self-feeding or work controller. They include no additional maintenance or elapsed-exposure charge.

A separately writable later command controls provision. Issuing it exchanges the command pair to (1,0), enabling both the later intake contact and helper work contact. Their pairs become (2,0) and (1,0). Withholding the command leaves them at (0,2) and (0,1). The control does not depend on formation: provision remains available without formation, and formed reliance does not remove refusal. In helper–recipient order the later gross funding is:

$$(F_{\text{helper}}, F_{\text{recipient}}) = \begin{cases} (-\frac{1}{4}, \frac{1}{2}), & \text{provision,} \\ (0, 0), & \text{refusal.} \end{cases}$$

The helper entry reads the actual depletion of the helper work reserve, while the recipient entry reads the gain at the separate intake port. Both destination modes remain in the bank. Each exchange conserves its pair energy and retains the other pairs. Formation also preserves its complete holding. Applying these equalities through the sequence shows that final full-bank holding equals the holding before formation, for either later command. The formation coordinates survive both branches, so the same four-prefix recovery remains available after refusal. A local funding change is not a loss of total apparatus energy.

This construction realizes native intake and work-bank transfers whose gross funding matches the first controller and the later slot-zero provision or idle choice. Equality of funding is not equality of the complete bodily care transition. The physical material identity, service-completion record, elapsed exposure, bodily repair, additional supply slots and whole feasible action menu remain to be realized on this bank. Preparation, wiring, source interventions, contact schedule and quarter-unit conversion are supplied. The result neither derives an autonomous complete apparatus nor identifies source gates with participants, their consent or their governing authority. It gives the resource connection that those further identifications must preserve.

Recording failure also has an exact resource account. The prepared verdict mode is empty and its paired reservoir is occupied. A passing performance leaves those modes unchanged; failure transfers the excitation into the verdict. Reservoir loss equals record gain while the offered terms and command source remain retained. Both modes still belong to the complete apparatus. Consequently this one reversible write is not a continuing net loss from a participant merely because the failure remains recorded. Such a loss would require an actual export, inaccessible reserve or further consuming operation.

The consequence of failed performance can be followed into the original care ledger. Execute the same formed undertaking and feasible later action, then apply the existing next maintenance interval with no new provision. Both original care bonds remain present, with the same endpoints. The full formation apparatus remains alongside the care state. No additional debt bond or failure penalty is introduced for this calculation.

Completion leaves both comparison multipliers at one and the total recognition cost at zero. Omission leaves the recipient multiplier at two while the other remains at one, giving total cost one quarter. These are exactly the alternatives in the complete feasible later menu of this care construction. Consequently the actual comparator reports failure if and only if the original continuing ledger has positive cost. The reference is recovered from the withheld-contact responses before this cost is calculated.

This establishes a physical consequence of performance and refusal under the supplied exposure, technology, initial resources and funding conversion. The surviving bonds are the participants' own maintenance bonds. Their unpaid cost does not by itself establish an interpersonal debt or identify the upstream command source with the participant who owes repair. The remaining responsibility argument must connect actual control, formation history and standing relations while preserving refusal as a feasible action.

A refusal must be followed through elapsed time. In the original source contact, withholding the recipient input leaves the selected bank field unchanged. Any readout depending only on that unchanged field gives the same answer before and after it. Such a readout cannot also advance an elapsed-time coordinate or enact a maintenance step that changes reserve. This identifies the missing physical carrier: the construction must include whatever changes while provision is refused.

A finite native clock can supply changing checkpoints while retaining that source and bank. Its occupied pointer moves through distinct slots at the specified times, with the original source and control coordinates preserved. The clock's internal payload and positive holding reserve remain part of the complete evolution. A nonzero prepared bank field is needed to distinguish its coded slots; an empty field cannot carry the same code. The construction establishes finite elapsed checkpoints, with clock preparation and calibration explicit. It does not identify a clock tick with a participant's maintenance interval.

Maintenance can also be enacted on an extended physical bank. Retain the complete source, control and old bank amplitudes, and add seven complete mode pairs. Four initially occupied pairs supply two maintenance transfers for each of two participants. Another pair retains two helper quanta. Two further pairs each hold an intake quantum in their source mode. Intake uses the existing joint gate for the source command, current recipient input and retained control; each maintenance contact runs even when intake is refused. Every transfer moves an occupation into its paired destination and retains both modes.

Define the reserve reading in this instance as the participant's retained fuel count minus one. After intake and the first two maintenance contacts, the helper's reserve is two. The recipient's reserve is two with intake and zero without it. After the second pair of maintenance contacts, the readings are one for the helper and either one or minus one for the recipient. The negative value is a signed margin below the supplied reference; physical occupation has not become

negative. These are the earlier two-interval reserve numbers, now obtained from actual finite transfers.

The native contacts preserve the complete source and fuel holding at every intermediate time, including the refusal branch. Their exact coordinate rearrangements retain every unselected pair and the old bank. Thus reserve decline can occur while the retained source, bank and fuel holding remains conserved: the occupation has moved into a retained spent mode. Identifying these occupations with food, bodily work and maintenance still requires the actual material conversion and participant connection. The two intake quanta and one-unit reserve reference are supplied here.

For a clock with at least seven slots, the six transfers have a single finite checkpoint construction. Put their cumulative operations into seven distinct clock slots, beginning with the identity operation. Each prefix is unitary and preserves the complete resource holding. The native pointer code is an isometry. On its image, the constructed fixed Hamiltonian intertwines with the clock and prefix program. Applying its evolution to the initial slot therefore gives the corresponding complete prefix at each checkpoint, together with the retained clock-payload evolution, resource evolution and controller-reserve phase. For a nonnegative supplied bank scale, the constructed Hamiltonian is nonnegative.

This joins the finite transfer sequence to a complete Hamiltonian checkpoint calculation. Installing its correction through elementary interactions, paying for the apparatus and identifying its timing with bodily exposure remain further construction requirements. In particular, simply calling the earlier five equal contact windows two bodily intervals puts the first bodily checkpoint before the old bank can be accessed. A connected timing construction must address that ordering. The finite clock and conserving bank do not supply unlimited provision or determine which participant is obligated to provide it.

Provision can also be followed into a native repair on one complete carrier. A source occupation first moves into the recipient's intake cell. A later operation couples that same supplied resource to restoration of the comparison signal and retains the spent destination. It does not fund the repair from a second copy of the meal. The endpoint requires the specified intake occupation, an empty spent cell and blank exposure inputs, positive comparison operands and a ready complementary record; withholding intake prevents that supplied route from performing the repair.

The complete construction retains twelve signal ports alongside a single shared resource state. Its native flow and conserved holding are defined throughout the contact, including intermediate coherent states. The resource meter counts the shared resource weighted by the total signal norm. To count one prepared resource, that total norm must be one. Normalizing each of three signal blocks separately would count three resources and would fail this condition. Retaining more records does not by itself multiply what is available to spend.

This establishes the specified provision, repair and resource accounting on one carrier. Preparation, wiring and contact strength are still supplied. The conserved holding has not yet been identified with the entire physiological energy account, and the signal ports have not by themselves identified the experiencing participant. Those connections must preserve the original material, work and maintenance history. Neither the native repair nor its truthful record decides who is obligated to supply it.

7 Costly care, conflict, and the virtues

Care can impose a real burden. In the conserving burden-sharing construction, helping raises the helper's recognition cost while reducing the recipient's cost and the total cost. Under the specified charged-renewal law and continuing individual budgets, sharing permits both participants to continue, whereas idleness eventually exhausts the recipient. The comparison retains those budget assumptions; it does not derive the resources or operations that keep supplying them.

A legacy decision rule rejects every increase in the helper's immediate cost and also prefers idleness under its first comparison. In the constructed two-action comparison, it therefore excludes the continuing alternative admitted by that same charged-renewal model. This is a concrete failure of the rule as a general continuation-preserving selector. It does not establish a universal duty to assist. Actual authorship, control, funded work, supply, and governing responsibility still require their connected physical account.

A native comparison apparatus makes the resource issue more exact. Its store retains a main comparison, fresh donor ports, blank ports, spent ports, and exported outputs. One phase uses a donor to reconstruct an unbalanced main comparison. A second phase repairs that comparison into a blank port, leaving equal operand readings in the main output and retaining the complementary output. Preparation preserves accessible energy. Repair lowers the accessible energy by exactly the energy transferred into the retained export; total energy of the complete store is unchanged.

For positive operands A and B, the exported energy is εABJ(A/B), where ε is the apparatus's positive unit-energy scale. Subtract the balanced main output's fixed energy from the accessible store, then divide by εAB. This gives a physical resource reading in comparison-cost units. With N donors remaining after preparation, its value immediately before repair is (N + 1)J(A/B) and afterward is NJ(A/B). The same physical output realizes the native ledger repair. Assigning the account to a payer reproduces the funded-repair debit exactly.

The normalization and account assignment remain explicit. Equal comparison prices need not imply equal energy debits when AB differs, and a label assigning the store to a payer does not identify that person's bodily maintenance capacity. Repeated complete cycles consume donors to recreate the strained input before repairing it. If retained exports become available to the controller, recycling changes the available operations and therefore changes the resource bound.

An already-strained input exposes the limit of a stronger payment claim. Take A = 2 and B = 1, an empty fresh-donor bank, and one blank port. The comparison has positive J-cost. The supplied native exchange still produces equal operand readings, retains its full complementary output, conserves total energy, and is reversible. Thus repair and conservation alone do not force a fresh helper-donor debit: this instance has no fresh donor to debit. It does not make the controller, its preparation, or its operation free. A necessary charge on an independently specified helper resource must follow from that resource's actual coupling to the required operation.

Conflicts can be genuine. In the depleted-helper opening, feeding meets the recipient's accepted requirement while exhausting the helper. Omission maintains the helper while

failing the recipient. No available action performs both ends; the result covers the specified action domain, including batches, grants, and credit requests.

Separate possibility does not establish joint possibility. If the helper can be maintained by one action and the recipient by another, there may still be no action maintaining both. An account of necessary means must retain a real witness for a combined end. Otherwise an impossible conjunction makes every purported consequence follow vacuously. Diagnosing that conflict neither cancels the undertaking nor decides whether sacrifice, priority, release, or repair is required.

Love has a precise conserving result. For a positive pair with fixed product, geometric-mean equilibration uniquely minimizes the canonical comparison cost. Under the stated maintenance-capacity constraints, the selected feasible endpoint uniquely maximizes the sum of transformed local values for every common strictly increasing, concave transformation on the relevant nonpositive values. The conclusion is robust across that class; it does not cover every preference or physical operation.

The care history cannot be inserted into that theorem without a connection. Feeding and omission include exposure and funded repair and leave different pair products. They cannot both arise as pure product-conserving redistributions from a common source. Maintenance, funding, work, and retained obligations must be included before the conserving Love result can govern this choice.

Availability of native operations does not force every action to reduce comparison cost. On the actual comparison plane, take positive unequal operands. The existing finite control sequence reaches positive operands with strictly smaller cost. Its explicit inverse is another available finite sequence and returns to the original operands. Applying a supposed universal cost-descent law to that return would say that the larger original cost is no greater than the smaller repaired cost, a contradiction.

Both retained comparison copies remain in the construction, and their combined quadratic endpoint energy is conserved. The result concerns the stated comparison-plane controls and positive endpoints; it supplies neither free actuation nor positive operands at every intermediate moment. Its economic consequence is precise: governing requirements cannot be identified with the direction of every physically available action. A framework that explains repair must also explain the standing of the relations when an available action worsens them.

The fourteen named virtues are Love, Justice, Forgiveness, Wisdom, Courage, Temperance, Prudence, Compassion, Gratitude, Patience, Humility, Hope, Creativity, and Sacrifice. Their account concerns transformations of the same physical recognition structure. The existing constructions connect authored records and event-faithful correction to justice and forgiveness, contextual selection to wisdom and prudence, and real burden-sharing to care and sacrifice.

Their formal scopes differ. A finite bond-direction decomposition does not establish that the fourteen named mechanisms completely and minimally generate every adequate transformation. Some canonical representatives are identities or require additional context. The complete generation and governing applicability claims therefore require their own derivations. Naming virtues cannot substitute for the physical action, conditions, and consequence that make each relevant.

A particular physical access arrangement can also be constructed. Retain separate permission, active-resource and spent-resource registers alongside the native comparison ports. Define M to exchange the permitted loaded sector with the permitted spent sector, applying the existing Fourier comparison exchange to the ports in either direction. On empty and refused sectors, M acts as the identity. Applying it twice restores every vector, and the native Fourier projection's Hermitian symmetry gives M† = M. Thus $M^2 = I$ and $P_- = (I - M)/2$ is an orthogonal projection.

Let F and S count the active and spent tags. In units with $\hbar = 1$, choose a positive baseline K_0 and contact K as follows. The baseline has equal energies on the loaded and spent sectors, so it commutes with M. This is a specified finite apparatus, including its register structure, interaction and time calibration.

$$K_0 = 2\pi(I + F + S), \qquad K = K_0 + \pi P_-, \qquad P_- = (I - M)/2.$$

The contact is positive: (I − M)†(I − M) = 2(I − M), so πP_- is π/4 times a matrix of the form B†B. The complete holding is therefore positive. Since P_- is a projection commuting with the baseline, its exponential is explicit:

$$U(t) = \left[I + (e^{-i\pi t} - 1)P_-\right]e^{-itK_0}.$$

At the calibrated time t = 1, every baseline eigenvalue has completed an integer number of full phase turns, and the contact factor equals $I - 2P_- = M$. The permitted loaded preparation therefore reaches the spent sector with the native exchange performed. Empty and refused preparations return unchanged at that time. Baseline phase remains part of the all-time evolution; the endpoint equality must not be read as literal vector equality at every intermediate time.

Both K_0 and F + S commute with the complete holding, so their observables are conserved throughout the evolution. The spent register is retained. In particular, the same exchange can reverse spent into loaded; this is a reversible transfer of access to a resource. It does not prove irreversible consumption or an inability to recover the active preparation. The target permits unnormalized port vectors, so a statement about one unit of expectation additionally requires normalization.

The port operation is the same native comparison exchange used in repair. For its specified positive-operand preparation and owner-channel identification, its kept and complementary ports have the already derived repair readings. An arbitrary port vector need not describe a damaged participant or a repair. Nor does one register unit have a derived conversion into comparison price, heat, chemical free energy, or bodily capacity.

The construction proves that the stipulated permission and resource sectors can be connected by one conserving finite evolution. Its access rule is supplied in the fixed interaction; no theorem here makes that rule compulsory for every economic arrangement. Its practical use is to expose exactly what an implementation must retain and what the necessity argument still has to derive: the physical origin of access, its relation to maintenance, the preparation of the apparatus, and the author-linked responsibilities carried by its history.

The access registers have an exact continuous-time reading. For a normalized permitted loaded preparation, active occupation is $\cos^2(\pi t/2)$ and spent occupation is $\sin^2(\pi t/2)$. They sum to one. Empty and refused sectors remain in their respective sectors throughout the

evolution, although baseline phases can change their vectors. At t = 2 the complete evolution is the identity. The loaded preparation has returned without a fresh resource tag.

Reuse is not restricted to undoing the first payload. Retain two separate comparison pairs and let the same controller contact the first, then the second, with the stated coordinate switching. It exchanges both payloads and returns to loaded. Each payload prepared as the stated positive-operand comparison with a blank second port has balanced kept readings after its own exchange. Both payloads and their complementary outputs remain in the joint state. Preparing the pairs and installing the contact switching remain supplied operations. The construction establishes reusable control; it does not identify that controller tag with a helper's exhaustible bodily reserve.

A stronger boundary follows from repeatedly applying the actual unit-time evolution to one retained preparation with operand ratio two. At even contact counts the native main ratio is two, giving comparison cost one quarter. At odd counts the main ratio is one, giving cost zero. Every two contacts restore the complete state, and expectation of the complete fixed holding is constant. Nevertheless the sum of comparison costs at the first 2n ticks is n/4 and is unbounded.

This is an internal comparison, with all its controller and signal coordinates retained. It is not yet a realization of two separately authored economic rows with an indefinitely growing chronological memory. Its conclusion is exact: finite conserved holding does not by itself turn a standing comparison cost into a cumulative physical debit. An account that charges such a debit must identify the operation, reserve and access restriction that cause it.

The fresh-export protocol supplies one such concrete debit. It permits each cycle to use fresh source and blank ports while previous exports remain spectators. Starting with N prepared comparison donors, after t cycles the actual remaining normalized resource is max(N − t, 0)J and the retained exported amount is min(t, N)J, where J is the fixed input comparison cost. Induction on the existing physical step proves the formulas, including the exhausted tail. Their sum is NJ, so the original resource is counted once.

After N cycles the complete store is unchanged by every later permitted step. Therefore an actual change at tick t implies t < N, and initial resource minus tJ is nonnegative. This derives affordability from the specified operation rather than inserting an affordability test into it. Allowing access to the old exports changes that operation class. Identifying arbitrary economic posting with this fresh-export cycle, including the payer and any incident share, requires its own physical construction.

A changing row can also leave an actual chronological record. Give each of two successive writes a fresh memory slot with an occurrence pair and a value pair. A native conserving exchange writes the occurrence marker; a controlled exchange records whether the source's free row coordinate is one. Each stage retains the row and all previous memory. After two opposite row changes, the row returns to its opening state while the two addressed slots retain different values and both occurrence markers. The retained slots reconstruct the book state at each of the two writes. Equality of the final row has not erased the history.

The records have a physical resource account. Let q be the positive energy of one occupied memory mode. Writing an occurrence transfers q from its paired reservoir into the record. Recording value one transfers another q; recording zero leaves that second pair unchanged.

The complete row, older memory, new memory and reservoirs conserve their holding energy. This identifies an actual finite record cost for the specified writer and prepared pairs. It does not equate this cost with every economic assessment of the interaction.

The distinction matters in the constructed book readout. The designated relationship remains at ratio two, assigning a half-incidence charge of one eighth to each endpoint. The other endpoint's designated physical mode stays unchanged, and the source's selected free book account does not track the memory reservoirs. That selected account fails the continuation pricing condition even though both chronological records have been written. The conclusion is exact: authored record placement and faithful readout alone do not derive that pricing condition. A complete identification must include the apparatus resources and explain which participant's accessible reserve they constitute.

The identity of a physical funder can be derived from the actual contact. Retain four ports: the main comparison, two donor banks and a blank output. Prepare the main port with the comparison's balanced component and put its complementary component in each donor. One route couples the main port to the left donor, reconstructing the original comparison and emptying that donor; another does the same with the right donor. Each route then applies the identical comparison operation into the blank output. The main and retained output are identical, and the complete four-port energy is conserved, but a different donor has lost its stored energy.

The loss is read from the donor states themselves. With positive comparison operands A and B, division by the same positive calibration εAB gives endpoint losses (J(A/B), 0) for the left-funded route and (0, J(A/B)) for the right-funded route. At A = 2 and B = 1 these become (¼, 0) and (0, ¼). Thus the common comparison and total conserved energy do not determine the funding distribution. The complete bank history does distinguish the routes. This result concerns actual physical supply; associating donor ports with particular participants, and deriving who ought to supply them, remain separate identifications.

The direction of dependency can be derived on the actual care menu without an extra permission filter. Start at the work checkpoint and ask whether a participant is maintained at the next checkpoint. Every feasible operation advances the actual clock once, so any successful path to that deadline has exactly one operation. For the recipient, every successful feasible operation is provision: it uses one unit of the helper's labor, one actual input unit, and one unit of recipient intake. A funded instance exists. Remove all positive helper contributions from the available menu and the recipient cannot reach the required state.

The reverse dependence fails in the same state with the same menu. Feasible omission maintains the helper without any recipient labor. Thus the recipient needs the helper's contribution while the helper does not need the recipient's. A symmetric shared-bond predicate cannot equal this directed dependency under any relabeling of the two participants: equality would force the reverse dependency as well. Richer oriented relations, actual control and authored history remain available. The argument establishes indispensable contribution, not a duty inferred from need alone.

8 Institutions and practical assessment

A necessary governing structure can admit several institutions because several arrangements can preserve the same constraints and relationships. Institutional freedom consists in those remaining actual possibilities. Renaming an unchanged action cannot alter its physical effects or accepted content.

The two-record price account illustrates the distinction. The interval between disputed recorded amounts is determined symmetrically by those records. A particular agreement point can still vary. An additional matching rule can select a point under its stated conditions. The fixed dispute interval, possible agreements, and consequences of a matching institution are separate results. They do not establish a universal price for a physical good.

Money in the inspected accounting construction is an issuer's two-record liability. Matching cash and deposit claims has exact accounting consequences, including zero standing disagreement cost for matched records. General acceptance in payment is an additional institutional feature. The existence of a bank role in a chart does not establish that all adequate economies require banks or a central monetary authority.

Likewise, an authored posting can fix the shape of a wage, rent, or interest transfer once its amount is given without deriving the amount, rate, direction, or service. Custody conventions in the inspected economic models are supplied. Identified property, security priority, and enforcement need more than a book entry. None should be smuggled into the physical foundation by a familiar name.

Financial balances also fail to determine every valuation. The same books can support opposite rankings within a stated class of own-net-increasing valuations. This shows that those rankings require extra information beyond books. It does not show that actual physical value is arbitrary or that consequences cease to constrain an arrangement.

A household that feeds everyone can still exhaust its producer. Consider the constructed two-person production case. Each person begins with one unit of reserve. Maintenance costs two, each consumed meal contributes two, and each unit of productive work costs one. These are the example's explicit conversion units. They are not measured nutritional constants. One participant has the raw material and effort needed to produce two meals; the other has neither ready food nor productive stock.

Follow the operations in order. The producer uses the raw material and one unit of effort to make two meals. One meal is transferred to the recipient, who consumes it. The producer consumes the other. Both people have now received and consumed a meal. The recipient finishes with reserve one. The producer finishes with reserve zero because the same intake also had to cover productive work. The distribution passes an equal-meal test and fails the stated positive-reserve continuation test.

Adding a spare meal to opening stock does not change that result while it remains unconsumed. The execution theorem allows any number of spare meals and still gives the producer zero reserve after one meal each. With one spare meal, an additional consumption step by the producer gives an executable history in which both finish with positive reserve. The operative difference is the extra intake, not the food's appearance on a stock account.

This case fixes the assessment of collective production: retain the worker's actual expenditure when judging what the group has achieved. Counting output and dividing it equally does not establish continuation for its producers. The example permits a sustaining sequence and an exhausting sequence under the same conversion law. It does not determine who must perform the work, what compensation is due, or a general distribution rule. Those questions require the participants' actual control, undertakings and governing relations.

Care has a history even when the final state is restored. Take the constructed two-person provision arrangement with a food unit, a work interval and accepted maintenance checkpoints. One legal sequence feeds first and then waits. Another waits first and then feeds. The complete final continuation state agrees: stock, consumption, work, reserves, completion counts, credit allocation, grant use and the represented response states are identical. Each participant's total repair expenditure also agrees.

The first checkpoint distinguishes them. Feeding first meets the accepted maintenance content at both checkpoints. Waiting first leaves the recipient with zero response capacity at the first checkpoint and fails that content. The later feeding restores the endpoint. Both sequences remain legal actions of the model; the failed history has not been removed from the action domain by defining legality as success.

Suppose an assessor receives only the final state and is asked whether the accepted maintenance checkpoints were met. The assessor receives identical input for these two histories. It therefore cannot return different answers, although the correct answers differ. Even the represented internal record-move sequence is identical: it records comparison ratios, not all capacity and delivery facts. The missing information is the actual checkpoint history.

An assessment of whether this care arrangement met its accepted checkpoints needs information that distinguishes the two histories. Final delivery, net expenditure and a restored endpoint cannot replace evidence that the relevant capacity persisted when required. A subsequent release does not change what happened at an earlier accepted checkpoint. Here zero capacity means loss of the model's positive next-window budget; the construction does not identify it with biological death or independently derive a universal obligation to provide care.

A separate delivery case distinguishes an available response from a response actually taken. At time 3, the helper has reserve five, the recipient reserve two, and one food unit is at the helper's location. Each interval costs each person one reserve unit; one unit of intake adds two. Transferring the food also costs the helper one unit of labor, covered by an accepted work grant for the interval from time 3 to time 4. The helper may transfer or wait. In the next interval, the recipient may consume or wait. These units, roles, conversions and two-interval horizon are supplied features of the case.

Write each reserve pair in helper–recipient order. Transfer subtracts maintenance from both reserves and labor from the helper's reserve. Timely consumption then adds two to the recipient before the next maintenance deduction. The complete path is:

$$(5, 2) \xrightarrow{\text{transfer}} (3, 1) \xrightarrow{\text{consume}} (2, 2).$$

Both reserves remain strictly positive at every checkpoint. Now let the recipient wait instead. The food remains at the recipient's location, but maintenance takes the reserves to (2,0). Extend the same transition law by one further interval, to time 6. Consuming that same food then adds two to the recipient and subtracts maintenance from both people, giving:

$$(5,2) \xrightarrow{\text{transfer}} (3,1) \xrightarrow{\text{wait}} (2,0) \xrightarrow{\text{consume}} (1,1).$$

The delayed consumption needs no further helper labor or new food. It is a valid operation under these supplied rules, and its endpoint has positive reserves. Nevertheless, the actual path passed through zero recipient reserve at time 5. A continuation that requires positive reserve at every checkpoint therefore rejects that full path. Starting the assessment again at the repaired endpoint would omit the failed checkpoint. Zero here marks failure of this reserve condition; the later arithmetic does not describe biological resurrection.

The finite alternatives can be exhausted. If the helper waits, the food stays at the helper's location: the recipient cannot validly consume it, and another wait exhausts the recipient's remaining reserve. If the helper transfers, consumption gives the positive path above, while waiting reaches zero. Transfer is therefore exactly the helper choice that leaves the recipient a legal response maintaining both people through the original two intervals. This reasoning uses the actual resource and reserve transitions, without requiring performance of an accepted maintenance duty as an extra premise.

That successful response belongs to the recipient. Delivery opens the option; it does not select the recipient's action. Waiting remains legal after delivery, so the helper cannot guarantee uptake against every permitted response. The delivery record also survives refusal: nourishment can fail even though delivery occurred. The construction distinguishes availability, control, performance and continuation. Deriving why an adequate arrangement must preserve this opportunity remains a separate governing question.

Delivery can precede acceptance of its proposed terms. In a version of this example, the helper transfers the food while the proposal is pending, retaining the actual source state and transfer action. Later acceptance permits that same delivery to be credited; it does not create another crossing. Withholding acceptance leaves the proposal pending. In either formation branch the recipient may consume or wait. Acceptance changes the recorded undertaking, while uptake changes the bodily outcome. On the original helper menu, performing the accepted delivery and leaving a viable recipient-owned response identify the same transfer; neither guarantees that the recipient will take the response.

Recording also takes place in time. If acceptance occupies an additional interval of this economic clock, the state after acceptance cannot equal the state before it: every operation advances the clock. An unchanged-clock description would omit that elapsed interval. A concurrent record operation could avoid adding an interval only if its actual implementation and resource account support that schedule.

The bodily accounting of a proposed schedule can be followed without resetting the clock. The original transfer finishes at time 4 with reserves (3,1). Consumption during the next interval gives (2,2) at time 5; waiting instead gives (2,0). One further idle interval gives (1,1) after consumption, or (1,−1) after waiting. A later credit still refers to the original transfer and retains these later reserves, the work already performed and earlier violations. It supplies no further helper labor after the original grant expires. Making acceptance and credit writes

actually run with this schedule remains an apparatus construction, with their own time and resource costs. The positive endpoint in the consumption branch is a finite accounting result under the supplied conversions, not a guarantee against refusal or further delay.

A delivery report also needs to state which part of performance it answers. Suppose accepted content requests one unit by deadline D. Let c be the number of actual deliveries credited to that undertaking, and let t be the retained completion time of the credited crossing. An active accepted record with $c \geq 1$ establishes the quantity condition. Timeliness additionally requires $t \leq D$. The source state, transfer action and destination state identify which occurrence is being credited; a later report supplies no second crossing.

In the delivery case, the retained transfer runs from time 3 to time 4. Acceptance and credit are inspected in the later body state at time 6. For the accepted deadline 4, the occurrence satisfies $4 \leq 4$ even though the query is later. The same quantity-and-credit question also answers positively when the supplied accepted content has deadline 3: one actual unit is still credited. The timeliness question then answers negatively because $4 \leq 3$ is false. This second accepted record is a comparison of represented contents, with the same receipt and bodily outcome. It does not establish that the differently dated formation was physically enacted. Dating the transfer, dating formation and enacting a later credit each require their own retained events.

Delay can also remove a repair option that was available. In the closed one-unit care case, the recipient begins with comparison multiplier one and reserve one eighth. The helper begins with reserve two, and one food unit remains. Immediate provision is a legal action: it funds the one-quarter repair charge and leaves the recipient balanced with reserve three eighths. Waiting is also legal. It leaves the recipient with multiplier two and the same one-eighth reserve.

After that delay, the next repair charge is nine eighths. Even granting the recipient the entire remaining food unit, reserve plus its converted intake can supply only five eighths. This is deliberately an optimistic bound: it gives one person all remaining stock before considering competitors or work. Failure of that bound rules out funding the specified repair.

The exclusion is stronger than the failure of one selected plan. Under closed material balance, fixed conversion and the specified exposure law, this all-stock upper bound cannot increase through an enabled operation. Intake moves provision from stock into reserve; work, waste and actual repair payments can only reduce the available bound. The uncorrected multiplier continues to grow. Induction therefore excludes restoration by every legal finite continuation in that action system.

The practical distinction is between postponing an operation and preserving the possibility of doing it later. They are different physical claims. The example's conclusion remains tied to its closed supply, conversion and repair mechanism. Importing usable resources or making a different physical repair available changes the problem. Loss of access to this repair is not a theorem that every possible recovery, or all continued recognition, has ended.

A common supply can suffice for either person and fail for both. Consider two participants who each have multiplier two and reserve one quarter. Each faces repair charge nine eighths. In this example a unit of actual intake contributes one half of reserve, and the demonstrated meals require no helper labor. The shared stock contains three units. Each participant needs

at least seven quarters of intake to fund the repair, so their combined lower bound is seven halves.

A two-unit meal can be given to either participant. It restores that participant to multiplier one with reserve one eighth. Nevertheless, no enabled operation from the three-unit opening funds both repairs. This conclusion covers all enabled allocations in the model, rather than comparing only the two exhibited meals. Every enabled operation must leave at least one participant below the required funding.

Four units supply a constructive contrast. A single enabled operation gives two units to each participant, and both finish balanced with reserve one eighth. Thus the shared-resource obstruction has an explicit feasible counterpart. It is not produced by an inconsistent set of premises or by having excluded every successful action from the definition.

The general argument starts with each participant's actual charge, reserve, positive conversion and this operation's work. Rearranging the funding inequality gives a lower bound on that participant's intake. Sum those lower bounds over distinct participants. Material balance bounds their actual summed intake by the one common stock. If the lower bounds already exceed the stock, simultaneous repair is impossible. Individual upper bounds that each grant a person the whole stock must never be added as though they were separate allocations.

For common-resource management, the resulting question is joint feasibility under the actual operations. Separate claims that each person could be helped do not answer it. Sufficient stock alone also does not establish an executable schedule: recipes, integer quantities, labor capacity, timing and authority remain. The shortage result identifies an unavoidable unfunded repair; it does not select its recipient or settle whether priority, release, sacrifice or compensation governs the conflict.

Exchange preserves another distinction: an accepted claim, a physical delivery and a truthful record of delivery are separate events. In the authenticated-delivery construction, an offer is followed by acceptance and an actual unit crossing. The retained crossing fixes the delivered claim at subsequent checkpoints. The chart's positive opening reference belongs to the record representation; it is not an additional delivered unit.

The physical event constrains which later source and destination readings accurately represent that delivery. It does not make every writer truthful. The correction result preserves actual source authorship and its separate bounded-inflow, pricing and continuing-activity conditions. A record correction can therefore be attributed to the relevant source within that construction without assuming that every physical process automatically corrects every false claim.

An exchange assessment should keep the resource, the crossing, accepted terms, authors and available correction actions in one history. Two accounts claiming the same unit do not create another unit. Agreement between accounts does not by itself prove the unit crossed. A delivery does not, by itself, prove consent to every associated use or identify an unrestricted ownership right. Those are further relations whose actual formation and effects must remain visible.

An open household or productive group must retain its source. The elementary open-continuation construction begins with one participant, reserve one and no stock. Each interval receives one actual unit, consumes it and pays one unit of maintenance, with unit

conversion and no labor. This supplies a continuing history at every finite horizon. Removing that interval's receipt makes the proposed consumption operation unavailable.

The record counts each received unit. It proves continuation with those deliveries, not an inexhaustible supplier. Representing the exterior as finite stock requires each arrival to withdraw the same unit there. Count the enlarged stock once: positive maintenance makes arbitrary continuation from finite provision impossible.

A household's continuation may deplete its supplier; a firm's throughput may consume upstream resources or a worker's reserve. Enlarging the boundary must retain those expenditures. An unexplained inflow is not self-renewal.

Assessment follows the same physical sequence: identify participants and affected capacities, retain shared stock, follow transformations and histories, then compare grounded requirements and remaining alternatives. Feasibility, performance, description and responsibility remain distinct conclusions. Universal coverage still requires participant and maintenance identification, history-preserving authority across carriers, incompatible duties, changing populations and renewal beyond finite prepared apparatuses. Each connection must retain actual violations, burdens, sources and alternatives.