

UNITED WISDOM

Reversible Laws and Irreversible Events

World and Consciousness

Andrey Zarinsh & Maria Evilkut

W-12-N04 · EN

@andrey.zarinsh @ilkutki

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Epigraph

> *these permit either order.*

Joel L. Lebowitz, Boltzmann's Entropy and Time's Arrow, p. 34; an exact clause excerpt. These refers to the selected dynamical laws within the model under discussion. It does not assert that absolutely every physical law is reversible or that every reversed process is practically accessible.

What this article is about

If a selected equation permits reversal, why can an ordinary event not simply be played backwards? The question becomes clearer by naming what is reversed: a mathematical trajectory, a physical state, an accessible transformation, or a record. This article examines those distinctions through bounded readings in statistical mechanics and equilibrium thermodynamics. Lebowitz considers microstates, macroscopic description, preparation, and initial conditions. Lieb and Yngvason define adiabatic accessibility between states. Comparison promises no reproduced proof or numerical calculation. A separate contemporary UW example then distinguishes correcting an erroneous entry, restoring some conditions, and addressing consequences. Physical theory settles no moral question, warrants no fatalism, and measures no spirituality. Within Path, the useful question concerns an available step: what can be corrected now, and which past event does that correction leave as something that occurred? A limited restoration need not claim to delete history.

I. What reversal means

Begin with an original mathematical illustration. In an ideal model, a point moves along a line at constant velocity: $x(t) = x_o + vt$. After an interval T it reaches $x(T)$. Starting a new problem there with velocity $-v$ gives position $x(T) - vs$ after interval s. At $s = T$, the result is x_o. This checks two written expressions rather than experimenting with a real body. It identifies changed conditions: a new starting point and reversed velocity. Without them, wanting the earlier coordinate supplies neither a reversed trajectory nor a changed description of the problem. A condition has to be specified before its consequences can be examined.

Even this illustration requires naming what is restored. After T, the point has its earlier coordinate, but its velocity is now $-v$. Restored position is not identity of every variable.

@andrey.zarinsh @ilkutki

Another task may concern only the coordinate, in which case its result can be called achieved. That is a limited criterion rather than unqualified recovery of the whole state. The distinction follows from the expressions and variables without requiring advanced physics. Before saying restored, ask which variables enter the criterion and which remain outside it. A partial success should not silently acquire the authority of a complete one merely because the endpoint looks familiar.

A further subject is an external movement record. Deleting the endpoint entry changes a document without taking the point along a reversed trajectory. Displaying frames backwards changes viewing order without establishing that the corresponding system preparation is possible. Calculation, physical action, and representation are distinct operations. Backwards fits all three in ordinary language and can conceal the transition between them. A substantive transition requires an action connecting the operations. Otherwise reverse viewing remains reverse viewing, however convincing or familiar the depicted process appears. An image's order does not itself prepare the initial conditions of the event being represented or confirm that the event took place.

The model also has a boundary. Constant velocity and absence of considered interactions are stipulated, rather than descriptions of every body and process. No conclusion about nature's complete reversibility follows. The question is what holds under those conditions and what another formulation needs. This is useful when reading science: a convenient example reveals an operation's structure without removing the need to check applicability. Stronger claims about real events require additional variables, interactions, and the possibility of preparing a state. A result cannot be carried from an ideal problem into every physical situation by adding therefore and leaving the changed conditions unexamined.

II. A trajectory and an accessible transformation

In Lebowitz's paper, pp. 33–35, velocity reversal belongs to selected dynamics and a microstate-macrostate distinction. Relativity and weak-interaction violations of time invariance are explicitly bracketed. Either order therefore does not cover absolutely every physical situation. In Lieb and Yngvason's account, pp. 4–6, the subject differs: adiabatic accessibility of equilibrium states under stated conditions. These are different relations, rather than incompatible answers to an identical question. Retaining their subjects matters more than producing a general slogan that every process either is or is not reversible in exactly the same sense.

The difference can be examined through a task's language. A solution exists with variables in reversed order does not mean we can prepare that solution. Initial conditions, intervention, and system boundaries stand between the statements. An imagined instruction to reverse every required velocity does not establish an available device. Mathematical permission and

accessible action require separate examination. This does not make a model useless: it explains the question's structure and identifies the missing condition precisely. But a preparation description cannot become evidence of performed preparation, even when its wording is short and familiar. An instruction's clarity concerns its description, not the existence of an apparatus capable of carrying it out.

State transformation also depends on permitted auxiliary changes. Imagine an original conditional agreement: the main system may change if a selected auxiliary device returns to its initial state afterwards. Leaving the device changed performs a different task. This is a logical illustration of a condition's role, not a new thermodynamic experiment. It explains why the main object looks as before may be insufficient. The action is assessed within a defined boundary: what counts as system, what belongs to surroundings, and what must be restored. Changing that boundary after seeing the result to justify the word reversible changes the question rather than answering the one originally posed.

Possibility consequently needs a complete specification. Mathematically possible? Possible within this class of operations? Possible with an available apparatus? Possible to restore one variable alone? Answers can differ without contradiction. A scientific discussion should identify the relation before examining a case. An action violating a theory's initial condition does not refute that limited theory by belonging to a different problem. Nor does a presently unnamed method turn practical unavailability into eternal impossibility. Each statement should retain the domain for which grounds and checking conditions are actually supplied. Greater precision permits useful disagreement about a specified question instead of a dispute over an undefined universal word.

III. Detailed state and broader description

Consider an original list of points with coordinates and velocities, alongside a summary stating how many points occupy each half of a region. The second description retains some information and omits other details. Different lists can produce the same summary without making either false. They answer different questions. Counting points by half may require only the summary; reversing every movement requires more. This illustrates descriptive levels without calculating physical entropy or asserting that an arbitrary table is a thermodynamic system. It identifies what a description contains before asking it to support a conclusion about details that it did not record in the first place.

The same broader present description can conceal different preparation details. Recovering a detailed sequence requires more information than its summary contains. Omission from a description should not be mistaken for physical disappearance. A coordinate may be unrecorded although the point had a specified position in the model. Documentary incompleteness and a system's property are different subjects. If a record cannot support an

operation, an equation does not thereby prohibit it. If an equation permits it, missing information is not thereby easy to obtain. Both limits can affect accessible action simultaneously. Recognizing one does not remove the other or establish which practical obstacle can actually be addressed now.

Suppose someone knows the final distribution but not velocities and proposes returning everything by assigning arbitrary new movements. The distribution may change, but this does not reproduce a specified reversal of the initial state. That claim requires matching the variables. An outcome matching one broader criterion leaves detailed trajectory questions open. No coincidence probability is established in this illustration. It shows why agreement on a limited outcome does not automatically prove process identity. A report should name its checked criterion instead of promising complete restoration. This allows a useful result to be acknowledged precisely while declining additional claims for which the available information remains insufficient.

Two forms of precision can coexist. A detailed description specifies what an operation would need; a broader one specifies the outcome observed or considered. They need not compete to be the only true account. Different questions need different information. Trouble begins when answers migrate unnoticed: an identical summary becomes identical preparation, and a permitted trajectory becomes an already accessible event. The article frames its physical question through named descriptive levels. It does not require detailed control of every aspect of a life or condemn every incomplete account as inaccurate. A limited account can be appropriate when its limits match the question it is intended to answer.

IV. Initial conditions and the strength of a conclusion

A law, a state, and a procedure have different roles. A law specifies relationships within a model; an initial state specifies where development starts; a procedure specifies the attempted change. A particular process needs more than a law alone to answer preparation questions. Conversely, a detailed preparation history does not replace knowing what relationships the model permits. Our straight-line illustration needs both velocity sign and initial coordinate. The same formula with different values does not produce a single outcome. This is a distinction checked within the task, rather than proof of the world's complete structure or a prediction of every event under every possible circumstance.

Lebowitz's statistical argument associates a macrostate with a region of compatible microstates. Removing a constraint can make the available region much larger; typical development is explained through relative region sizes, rather than a ban on reverse trajectories. Direction also requires low-entropy preparation in the past: a law alone does not supply it. This is a bounded account of pp. 34–36, with no numerical reproduction. Not expected under these conditions differs from forbidden by a law. Stronger conclusions require

preparation and probability meaning checked. No such estimate is transferred to human decisions. Typicality addresses a defined physical question, rather than making every special case impossible or prescribing acceptance of a life event.

Reverse preparation can be highly specific relative to the desired outcome. It cannot simply be called arbitrary parameter change. If a condition requires matching many variables, partial matching addresses another task. This establishes no general amount of effort for a real apparatus, and does not assert that all special states are impossible to prepare. An engineering possibility needs its own investigation. The illustration distinguishes an existing description from a confirmed preparation method. That guards against premature promises and premature rejection where requirements remain unchecked. The missing step can be named without pretending either that it has been achieved or that no possible investigation could ever supply it.

Initial conditions should not become a moral explanation. A physical preparation requirement does not identify blame for a life event or prescribe a participant's response. Those conclusions need information about action, circumstances, agreements, and consequences. A model clarifies questions without supplying an intention judgment. The later UW application therefore uses only a limited analogy: state a desired result and the conditions for changing it. It explains no person as a collection of particles and demands no impossible control as a qualification for correcting an error or requesting help. Its practical relevance depends on the contemporary situation, not on extending a physical premise into an unrelated ethical rule.

V. Entropy needs a definition and a boundary

Lieb and Yngvason's entropy principle concerns comparable equilibrium states and defined accessibility, with additivity, scaling, and explicit premises. Lebowitz distinguishes macroscopic description from other entropy definitions. One word does not establish one interchangeable quantity in every problem. An increase claim needs system, states, and process specified first. No theorem proof, OCR-damaged expression, or numerical example is reproduced here. Neither untidy appearance nor confused thought is treated as measured physical entropy. An analogy creates no unit of measurement. Before using the term in another field, a separate definition and supporting relationship would be needed, rather than a familiar image standing in for a specified quantity.

An original boundary example needs no entropy calculation. Two connected objects change while a report describes only one. A condition established for their combined outcome need not be the same condition for each part. Assessing one requires identifying its relation to the other and the report's subject. This is the logic of a combined description, not a claim about a particular organism or household. It cautions against transferring a general statement onto a selected fragment without further grounds. A changed system question requires restating the

assertion and the information now needed. The old statement cannot retain its full authority while the object to which it refers has silently changed.

Entropy must increase can lose essential conditions without its qualifications. The key quotation retains adiabatic and identifies the authors' principle's domain. Removing that condition for a memorable aphorism changes the content. Even without mathematical training, a reader can recognize that the statement concerns a defined process class rather than everything changing over time. Extending it needs additional grounds; no extension is made here. Restoring part of an outcome is examined separately from a universal slogan alleging that any correction contradicts nature or is inevitably useless. A precise physical statement should not be assigned that larger conclusion merely because both subjects involve change and an earlier state.

Conceptual boundaries preserve science without promising a general life law. Direction in a specified transformation does not entail compulsory spiritual development. Difficulty preparing a reversal does not establish predetermined human action. Distinguishing local change and combined accounting does not make mental order a thermodynamic consequence. These are new claims lacking adequate grounds in the selected material. Declining them does not diminish physics; it preserves its subject and frees contemporary life discussion from apparently borrowed proof. Scientific vocabulary can remain useful for learning without being required to authorize a preferred moral interpretation or decide every question raised by a participant's experience of consequences.

VI. Correcting part and restoring everything

Consider a separate contemporary example: a shared schedule contains the wrong hour. Correction restores the intended number in the document. But an earlier message may already have been sent and someone may have planned around it. Editing, notifying participants, and addressing consequences are therefore separate tasks. This is an original UW analogy, not a thermodynamic process with calculated entropy. Its question is simply what should be restored: an accurate schedule, shared knowledge of a time, or availability for a meeting? Different actions may be needed although ordinary speech calls all of them correcting one error. Naming the result avoids assuming that one completed operation settles the whole situation.

Deleting the erroneous line can help future document use without deleting the earlier transmission. Consequences need suitable information: who received it, what is now known, and which step is available. Everything need not be investigated if nobody was affected and the relevant question is settled. But an absent line does not establish absent consequences. This boundary belongs to the example. It implies no duty to retain every personal record forever or revisit every past act. Further inquiry depends on task, significance, and

participants' conditions. Its extent can be proportionate without denying that an earlier action occurred or pretending that deleting an entry physically reversed it.

Restoration can also have several criteria. An edited number is one result; participants' confirmation of the new time is another. Someone's remaining inability to attend is a separate condition. Naming them prevents a false report of complete resolution. No ideal solution eliminating every trace is required. Sometimes only a partial change and an honest limit are available. Another person's lost time does not vanish because we want closure, but it does not establish that later action is useless either. Compensation, a new arrangement, or declining continuation must be considered through specific consequences, rather than through a physical image of movement backwards or a promise to recreate an earlier day.

If participants disagree with a correction, one party cannot declare their state restored. Others may name a condition, suggest another time, or decline. Consent is a separate fact absent from an edited number. The practical question concerns current possibilities: which agreement is available, and who needs clarification? It requires no uniform experience of the event. An attitude and a working arrangement can differ. Their discussion belongs to the participants. A philosophical analogy prescribes neither forgiveness, forgetting, nor emotional acceptance for the sake of a common plan. Restoring a document does not confer the authority to decide that everyone affected has accepted its consequences or no longer has a relevant question.

VII. Irreversibility does not prescribe fatalism

The action occurred does not mean every later action is useless. Yesterday's message cannot become something never sent, yet current knowledge can be clarified, the document corrected, and a next step discussed. These actions need no promise of complete return; their criterion concerns the current task. This conclusion comes from the example's structure and available conditions, not entropy as a moral law. Separating subjects acknowledges the past without justifying inaction where consequences can still be changed appropriately. A useful present decision may concern something different from recreating the event, and should be assessed on that stated purpose rather than dismissed for failing an impossible larger one.

The opposite mistake demands a correction restoring everything without remainder. That criterion can make an available step invisible. Someone can edit an entry without recovering another person's day; they can propose a time without guaranteeing consent. If a goal is not fully achievable, name the achievable part and assess its relevance. This does not require satisfaction with any small action. A partial change may leave the essential question unanswered and another solution may be needed. Judgment belongs to the situation rather than a general praise of gradualness, patience, or acceptance mistakenly attributed to physical theory. Neither partial progress nor complete restoration should become an automatic moral obligation merely through analogy.

A constraint may be material: a resource is missing, a participant unavailable, or a deadline past. Clear intention does not create an opportunity automatically. The limit can be communicated, an alternative checked, or an unavailable action acknowledged. That is more precise than demanding a hidden inner reserve. Nobody must prove independence from physical law before changing a plan or requesting help. One impossible correction does not establish universal helplessness. Within Path, the question concerns an available action domain, permitting an honest negative answer in one respect and open inquiry in another. Neither inquiry nor a changed plan guarantees success or supplies conditions that remain externally unavailable.

Scientific comparison remains substantive by leaving those judgments to people. Reversibility of a chosen description, special preparation, and defined accessibility clarified words. The modern example then showed that restoration can be partial and have several criteria. No numerical thermodynamic inference connects them. Ethical judgment, obligation, and consent require their own grounds. Such reading respects physics and participants' autonomy. It permits reflection without demanding a universal doctrine of fate, spiritual order, or inevitable progress as a condition for using one precise question about a particular error's consequences. The analogy helps formulate a question; it does not determine the answer or require agreement with a prescribed worldview.

VIII. A precise next-step criterion

Begin by stating the result. Bring everything back may mean correct a time, establish who received a message, or arrange another meeting. Naming the subject identifies evidence of completion. An edited entry confirms an edit. A participant's reply may confirm present consent without establishing that they lost no time earlier. Such distinction need not add unnecessary complexity. It selects the relevant check and stops where the initial question is answered, instead of indefinitely trying to prove that every consequence disappeared. Precision helps acknowledge a completed task and a remaining issue separately, allowing each to receive only the examination that its significance actually requires.

Next identify action conditions. What is available now? Is another participant needed? Can the document change? Is the meeting still possible? These concern the contemporary situation; neither a reverse-motion equation nor an entropy quotation answers them. An unmet condition can lead to a changed or deferred step with its stage stated honestly. If met, the action remains to be performed and checked. Intention, completed operation, and confirmed outcome are separate reports. This makes a proposal concrete and discussable while preserving another person's ability to judge its result by a different criterion important to them. Stating a condition does not by itself establish that it was fulfilled.

Do not silently change the goal during checking. A promised notification needs more than an edited number. A promise to correct a personal note should not be reported as restored shared agreement. The criterion defines an honest report's limit. A further action can be proposed separately where relevant and available. This is original UW application without established efficacy. It does not turn someone into a system requiring optimal reversal. Its subject is proportionate discussion of what was done, what is confirmed, and which remaining question deserves attention now with participants' consent. A limited report can support a useful decision without claiming complete resolution of every consequence.

Reversibility and irreversibility therefore need not remain a general puzzle with one answer across all domains. A model asks about trajectories and variables. A thermodynamic formulation asks about states, accessibility, and boundaries. A contemporary life example asks about correction, consequences, and agreement. Each retains its grounds. Within Path, a next step can be chosen without promising to erase the past or concluding that the future is useless. An available part can change, a limit can be acknowledged, and inquiry can stop when answered. Physics clarifies distinctions; what counts as meaningful action in a particular life is decided within that life's conditions.

What this means in practice

Choose one situation involving restoration: a record, agreement, or available condition. Do not use physics to judge someone else's character. This is original UW application without established benefit or an obligation to revisit a past that needs no present inquiry.

State the result literally. Which variable, entry, or agreement should change? Name separately what the action will not restore. Stop if the question is settled. Where others' consequences matter, do not declare them absent from one document edit. Specify the evidence needed for your limited conclusion.

Identify available conditions and needed consent. Select an action: correct an entry, communicate clarification, propose another time, or acknowledge a constraint. Proposal differs from confirmation. Incomplete return does not prove that every partial step is useless; usefulness belongs to the task and actual possibilities rather than the analogy alone.

After acting, check the promised result and name any significant remaining question. Stop when the answer suffices, or preserve uncertainty where information is missing. The proposal clarifies current action without demanding forgiveness, an obligatory lesson, control over every consequence, or one shared narrative of an event.

Key quotation

> *entropy must increase in an irreversible adiabatic process.*

Elliott H. Lieb and Jakob Yngvason, A Guide to Entropy and the Second Law of Thermodynamics, p. 6, entropy-principle commentary; an exact complete-clause excerpt. Defined accessibility and the equilibrium-state framework are retained. It is not an assertion about every open subsystem.

Connections between traditions

Comparison question	What the selected passages say	Similarity and significance for the topic	Specific boundary
Reversing a trajectory and accessing a transformation	Lebowitz, pp. 33–34, describes how reversing all velocities in selected microscopic dynamics gives a trajectory traversed in reverse. Lieb and Yngvason, pp. 4–5, define adiabatic accessibility through a permitted transformation between equilibrium states using a specified auxiliary device.	Both require states and an operation to be identified before return is asserted. For this article, the comparison separates symmetry of a described motion from transformation possibilities under specified conditions.	A microscopic trajectory and an accessibility relation are different objects. The existence of a reversed solution establishes no availability of every reverse thermodynamic transition.
Entropy definitions and the subject of a claim	Lebowitz, pp. 34–35 and 37, relates Boltzmann entropy to the macroscopic description of a microstate and distinguishes it from Gibbs entropy for an ensemble. Lieb and Yngvason, pp. 1–4, begin with a system’s equilibrium states and the problem of defining thermodynamic entropy through relations among them.	In both approaches, a change claim depends on the description to which its quantity belongs. This explains why the word entropy alone does not identify the subject of a reversibility claim.	Macrostate, ensemble, and equilibrium thermodynamic state are not interchangeable without further grounds. The article does not prove that all their entropy definitions are identical.

Comparison question	What the selected passages say	Similarity and significance for the topic	Specific boundary
Statistical typicality and a conditional theorem	Lebowitz, p. 35, explains typical increase through relative volumes of compatible microstate regions and earlier low-entropy preparation. Lieb and Yngvason, pp. 6–8 and the opening of p. 9, connect monotone, additive entropy with adiabatic order under A1–A6 and the comparison hypothesis CH.	In each case, direction depends on stated conditions rather than the word irreversibility alone. The comparison identifies two different warrants for a directional conclusion about a selected transition.	Typicality under preparation is not the axiomatic equivalence of order and entropy. The theorem is retained as a statement with premises, without an independently reproduced proof.
Preparation and restoring one quantity	Lebowitz, pp. 35–37, examines initial conditions and preparation of a microstate for velocity reversal. Lieb and Yngvason, p. 5, use gas and a piston to show that restoring an earlier volume does not restore the complete state and every auxiliary change.	The comparison distinguishes a match in one observed quantity from recovery of the specified condition set. It clarifies exactly which process the article calls a reverse process.	Preparing a precisely reversed microstate and transforming gas with a device are different operations. Neither argument promises practical restoration of every earlier situation.

Comparison question	What the selected passages say	Similarity and significance for the topic	Specific boundary
Sensitivity and a directional relation	Lebowitz, pp. 32 and 38, separates chaotic behavior with few degrees of freedom from macroscopic irreversibility and discusses typical rather than merely averaged behavior. Lieb and Yngvason, pp. 2–4, formulate accessibility among specified states and separately define system composition and scaling.	Both need a structured description but address different questions: dependence on preparation and which transformations count as accessible. Their comparison prevents unpredictability from replacing the thermodynamic question of direction.	Sensitivity to perturbation is not an adiabatic accessibility relation. Chaos alone supplies no time arrow, and system-scaling rules cannot simply be applied to a personal decision.
System boundaries and combined accounting	Lebowitz, pp. 36–37, includes experimentalist and apparatus when discussing a process description and distinguishes entropy concepts. In Lieb and Yngvason, pp. 6–7, compound-system entropy is additive, while the directional restriction concerns the specified combined transformation.	Both require an explicit boundary around the whole being considered. This separates local restoration from a claim about joint change in a system and the means participating in its transformation.	Monotonicity of the combined quantity does not require every summand to change in the same direction. No measured household, mental, or relational entropy is inferred here; the physical subject and accounting assumptions remain explicit.
Complete-return criteria and a separate UW analogy	Lebowitz, p. 37, qualifies reverse motion by velocity reversal and isolation conditions. Lieb and Yngvason, pp. 4–5, require an auxiliary device to return to its initial state while allowing the specified change in a weight's position.	Both make return depend on named variables and means. The article uses this distinction as a prompt to identify separate criteria for editing a record, notifying people, and obtaining consent in its own UW example.	The life example is not deduced from a physical theorem. Responsibility and available remedies require their own grounds; entropy prescribes neither acceptance, forgiveness, nor fatalism.

Primary sources

1. Joel L. Lebowitz, Boltzmann's Entropy and Time's Arrow, Physics Today, 46, September 1993, pp. 32–38; original English, institutional copy. Reversibility and macroscopic description; relativistic questions are bracketed and cosmological conjectures are not adopted as current findings.

2. Elliott H. Lieb and Jakob Yngvason, A Guide to Entropy and the Second Law of Thermodynamics, author preprint, arXiv:math-ph/9805005v1, 6 May 1998; manuscript header 27 February 1998. Pages 1–8 and opening p. 9: equilibrium states, accessibility, premises, and Theorem 1's statement. The complete proof and remainder are outside this article.

Tags

reversibility, irreversibility, time, physics, statistical mechanics, thermodynamics, entropy, microstate, macrostate, trajectory, initial conditions, preparation, accessibility, equilibrium, adiabatic process, system boundary, Lebowitz, Lieb, Yngvason, model, time direction, outcome criterion, consequences, correction, Path, consent, analogy limits, fatalism

About the authors

Andrey Zarinsh is the author and founder of United Wisdom. He explores inner transformation, the unity of traditions, intercultural dialogue, and contemporary spiritual discipline. Instagram: @andrey.zarinsh.

Maria Evilkut is a co-author of United Wisdom. Alongside her research, she seeks to test these ideas in practice and observe how principles of unity and mutual understanding work in real life between people and cultures. Instagram: @ilkutki.