

From Ocean Dynamics to Plural Normative Orders

Stratification, Localised Mixing, and the Governance of Interfaces:

A Preliminary Discussion with Multilingual Democracy and International Organisations as Cases

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Abstract

A polity holding several orders of value contains parties whose claims are checkable on different time scales and by different observers, and arrangements of that kind are commonly assessed by measures computed on the whole. This paper takes the ocean as a worked case of a system whose state depends on two constituents transported at rates separated by two orders of magnitude, and carries five mechanisms from it into the analysis of plural normative orders. Each constituent carries an evolution equation and the governing quantity carries none, so the aggregate description possesses no dynamics of its own, and the many processes acting upon the system enter it through four channels only, of which one alters the rule of evolution in place of the state. Advancing the subsystems separately introduces three quantities belonging to neither of them, the order of application, the interval between exchanges, and the operator carrying a flux across the interface, and two computed cases give a separation of 62 per cent of the peak anomaly from sequence alone and a transfer reproducing the shape of a field while removing part of its integral. A combination of two admissible constituents may occupy a state below both, since the map from constituents to the governing quantity is nonlinear. A configuration stable by that quantity may be unstable in its constituents, so an aggregate measure returns a verdict on a condition it has not examined. Plurality may be a maintained condition, with passage across it paid from a separate budget whose conversion into transport is concentrated at a small part of the area. And a system may lack a controller while remaining strongly localised. Carried across under a stated discipline, these yield a description of an international organisation as a site converting a flow already present into passage across an interface, a function distinct from allocation and from the occupation of a centre, and they hold apart the decentring of an arrangement and its dissolution. The mechanisms are entered as constraints upon the assessment of such arrangements, with the standing of a site conditioned on the capacity of those whose orders it converts to reopen its terms.

Keywords: plural normative orders; stratification; localised conversion; interface institutions; international organisations.

A note on the standing of this paper. The physical results reported here belong to physical oceanography and are established there. What is offered is a transposition of their form, carried out under a stated discipline, together with the constraints the transposition yields for the assessment of plural normative arrangements. Every normative claim in the paper is supplied from political theory and is marked where it enters. The companion papers on heteromorphic value conversion, on the distribution of the translation burden, on multilingual democracy, and on relational crystallisation are assumed and are cited at the points where their results are used. Objection, correction, and counter-evidence are welcome at huangwanhong@serendip.ngo.

Draft. This is a preprint draft. It is circulated for comment, and its arguments, formulations, and open questions are subject to revision. Correction and criticism are welcome at huangwanhong@serendip.ngo.

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Use of generative artificial intelligence. An AI assistant (Anthropic’s Claude) was used extensively in preparing this manuscript: for literature survey, for drafting prose from the author’s specifications, for adversarial review of the argument, for the computations underlying the figures, for consistency auditing, and for typesetting. Formulations and objections arose in the course of that exchange as well as from the author. Every claim, argument, and citation was reviewed and decided by the author, who is responsible for the content and for any errors. Bibliographic details are to be verified against published sources before reliance.

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1 Introduction

This section states the governance problem the paper addresses, states the physical case from which its mechanisms are taken, and fixes the level at which its claims are entered. The method is to set out the problem in the terms of the companion papers, to say what the physical case supplies that those papers lack, and to name the four results before the apparatus that produces them is developed.

A polity that holds several orders of value contains parties whose claims are checkable in different ways. One party states its claim in a currency a third party may inspect in advance: a sum, a measured emission, a documented procedure, a technical standard whose satisfaction admits of a certificate. Another states its claim in a currency that becomes assessable only afterwards and largely from within: whether a practice was carried on, whether a relation held, whether what was made of a shared history was faithful to it. The companion paper on the integration of normative languages takes this difference of evidence regime as its primitive and derives from it the direction in which the burden of rendering one order's claims into another's terms falls (Huang, 2026d). The companion paper on the conversion of heteromorphic value states the conditions under which such a rendering preserves what it converts (Huang, 2026a), and the paper on multilingual democracy establishes that the residue surviving a semantically perfect translation is a residue of value ordering (Huang, 2026b).

Those papers leave a question standing. They describe plurality, they describe the labour plurality imposes, and they name devices by which an arrangement may handle a claim it declines to convert. They supply no account of what holds the plurality in place, of what is required for anything to pass between the orders, or of where in an arrangement the passing happens. An arrangement holding several orders is commonly assessed by measures computed on the whole: whether the polity is stable, whether the treaty regime is in force, whether the aggregate indicators are moving in an acceptable direction. Whether such a measure is informative about the condition of the constituents is precisely what is unexamined.

The ocean is a worked case of a system in which that question has an answer. Seawater has a density fixed by two constituents, temperature and salinity, and the dynamics responds to the density alone. The two constituents are transported at molecular rates differing by about two orders of magnitude. The map from the constituents to the density is nonlinear. The layering of the ocean is held by continuous forcing at its upper surface, transport across that layering is paid for from a mechanical budget supplied by winds and tides, and the conversion of that budget into mixing is concentrated at a small part of the area of the sea floor. No agency governs the circulation, and the circulation occupies no equilibrium.

Claim 1.1. (The results carried from the physical case). Six results are carried. The constituents each carry an evolution equation and the governing quantity carries none, so an aggregate de-

scription has no dynamics of its own. Processes of many kinds enter such a system through four channels, of which one determines a coefficient and thereby alters the rule of evolution. Advancing the parts separately introduces an order of application, an interval between exchanges, and a transfer operator, each belonging to the composition and to neither part. A combination of two constituents each of which is admissible may occupy a state below both, since the map from constituents to the governing quantity is nonlinear. A configuration stable by the governing quantity may be unstable in its constituents, since the constituents move at different rates. And plurality may be a maintained state whose maintenance has a cost, with passage across it carrying a separate cost that is converted at a small part of the system, so that absence of a centre and uniformity of function come apart.

Claim 1.2. (The standing of what follows). The physical results belong to physical oceanography and are established there. The transposition is carried out under the discipline stated in §9, which declares the features carried across and the features left behind. The normative content of the paper is supplied from political theory at the points marked in §20, and the mechanisms are entered as constraints upon the assessment of arrangements.

The paper's own contribution lies in the third and fourth results and in what follows from them for the standing of international organisations. Where an organisation is ordinarily described as a coordinator, a rule maker, or a node among several decision centres, the mechanism of §14 supplies a further description: a site at which a flow already present in the system is converted into exchange across an interface that would otherwise pass very little. Such a site supplies none of the energy it converts, and its removal reduces the total passage in place of redistributing it.

The order of what follows is: the scope of the enquiry, the two cases, and the division of labour with the companion papers (§2); the physical part, comprising the equation of state and its nonlinearity (§3), the density of a mixture of two parcels of equal density (§4), the stability of a column under differential transport (§5), the maintenance of stratification (§6), the energy budget of mixing and its spatial distribution (§7), and the absence of a controller and of an equilibrium (§8); the discipline governing the transposition (§9) and the prior work on systems analogy in political and international theory (§10); the transposed mechanisms (§§11–17); the two cases (§§18–19); and the constraint form of the account, the failure modes, the boundaries of the undertaking, and the open questions (§§20–23).

2 Scope, Cases, and Relation to the Companion Papers

This section fixes the object of the enquiry, states the principle by which its two cases were selected, and marks the division of labour with the companion papers so that the results claimed here are narrow. The method is to state the object, then the selection principle, then the assignment of each result to the paper that owns it.

The object is an arrangement holding several orders of value in which the orders differ in how their claims are checked. A *nomos*, in the sense fixed by the companion

paper on multi-nomoi governance, settles what counts as value, what counts as a valid claim about it, and what counts as verification of such a claim (Huang, 2026d; Cover, 1983). The present paper takes the third component as its point of entry and asks what holds several such orders in one arrangement and what is required for a claim to pass between them.

Two cases are treated. The first is a polity holding several linguistic and normative communities under a common authority competent to legislate for all of them. The second is the set of arrangements of international life, in which no such authority exists and the parties are themselves the source of the rules that bind them. The selection principle is that the two differ in whether a common authority is available to impose a conversion, and the mechanisms of §§11–17 are claimed to hold on both sides of that difference. Each case is presented by mechanism and by institutional device, and no verdict is offered upon the policy of any state.

Claim 2.1. (Division of labour with the companion papers). The concept of a nomos, the operation of value conversion, and the criterion of generative preservation belong to the paper on interpretive justice in heteromorphic value conversion (Huang, 2026a). The distribution of the translation burden, its derivation from verification asymmetry, and the device of warranting belong to the paper on multi-nomoi governance (Huang, 2026d). The residue surviving perfect translation, the objection from the very idea of a conceptual scheme, and the graded thesis relating language to relational structure belong to the paper on multilingual democracy (Huang, 2026b). The four failure modes of a plural arrangement and the concession to polycentricity belong to the paper on relational crystallisation (Huang, 2026c). The present paper cites these and re-argues none of them.

Claim 2.2. (What the present paper claims). Six items are claimed here. The non-autonomy of the aggregate, together with the channel taxonomy and the three quantities introduced by composition. The nonlinearity of combination and its consequence for the standing of a mixture of two adequate orders. The rate criterion and the demonstration that an aggregate measure passes over a constituent condition. The maintenance account of plurality together with the separate budget required for passage across it. The localisation of conversion and the reading of an international organisation as a site of conversion. And the reading of an arrangement as a forced state whose maintenance is continuous.

3 The Constituents of Seawater, Their Coupled Evolution, and the Aggregate Diagnosed from Them

This section states the physical setting of the paper, defines the quantities the later sections employ, writes the coupled system that the two constituents obey, and establishes that the aggregate quantity possesses no evolution equation of its own. The method is to give the definitions from the international thermodynamic equation of seawater (IOC, SCOR & IAPSO, 2010), to differentiate the equation of state along the coupled evolution, and to integrate one column numerically.

The state of a parcel of seawater relevant to its motion under gravity is its density ρ . The density is a function of three arguments: the absolute salinity S_A , the conservative temperature Θ , and the pressure p , so that $\rho = \rho(S_A, \Theta, p)$. Two coefficients of that function are employed below. The thermal expansion coefficient and the haline contraction coefficient are

$$\alpha = -\frac{1}{\rho} \frac{\partial \rho}{\partial \Theta} \Big|_{S_A, p}, \quad \beta = \frac{1}{\rho} \frac{\partial \rho}{\partial S_A} \Big|_{\Theta, p}, \quad (1)$$

so that a warming lowers the density and a salinification raises it. The stratification of a column is measured by the buoyancy frequency,

$$N^2 = g \left(\alpha \frac{\partial \Theta}{\partial z} - \beta \frac{\partial S_A}{\partial z} \right), \quad (2)$$

with z measured upward, and a column with $N^2 > 0$ is stable to a vertical displacement of a parcel carrying its properties with it.

Definition 3.1. (Two constituents and one governing quantity). The state of the fluid is carried by two independent scalars, S_A and Θ , and the motion responds to the single scalar ρ formed from them. The pair (S_A, Θ) is the constituent description and ρ is the aggregate description, and the map from the first to the second is the equation of state.

Claim 3.2. (The property on which the argument turns). The map of Definition 3.1 is nonlinear in both arguments, and in particular the coefficient α is itself an increasing function of Θ . Cold water expands little upon warming and warm water expands appreciably. The computation of §4 employs this property and nothing further about the form of the equation of state.

Claim 3.3. (The transport rates of the two constituents). Heat diffuses in seawater at a molecular rate of about $1.4 \times 10^{-7} \text{ m}^2 \text{ s}^{-1}$ and salt at about $1.5 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$, so the ratio of the two, the Lewis number, is about 93. The two constituents that jointly fix the aggregate quantity are therefore transported at rates separated by two orders of magnitude (Turner, 1973; Schmitt, 1994).

3.1 The coupled system and the diagnosis of the aggregate

This subsection writes the system the two constituents jointly obey, differentiates the equation of state along that system, and establishes that no equation in the aggregate quantity alone reproduces its evolution. The method is to differentiate and then to name the terms that obstruct closure.

Collect the constituents in $\mathbf{x} = (\Theta, S_A)^T$ and their transport coefficients in the diagonal matrix $\mathbf{K} = \text{diag}(\kappa_\Theta, \kappa_S)$. In one dimension and with a vertical velocity w , the system is

$$\frac{\partial \mathbf{x}}{\partial t} = -w \frac{\partial \mathbf{x}}{\partial z} + \frac{\partial}{\partial z} \left(\mathbf{K} \frac{\partial \mathbf{x}}{\partial z} \right), \quad \rho = R(\mathbf{x}, p), \quad (3)$$

in which each constituent carries its own equation with its own coefficient, and the

aggregate ρ carries no equation and is obtained from the constituents by the map R of Definition 3.1. The velocity w is itself determined by ρ through the momentum balance, so the constituents drive the motion that transports them.

Definition 3.4. (The coupled system). The system (3) consists of one evolution equation for each constituent, a diagonal matrix of transport coefficients whose entries differ, and a nonlinear map from the constituents to the quantity to which the motion responds. The constituents are prognostic and the aggregate is diagnostic.

Differentiating R along (3) with $w = 0$ gives the tendency of the aggregate,

$$\frac{\partial \rho}{\partial t} = R_{\Theta} \kappa_{\Theta} \frac{\partial^2 \Theta}{\partial z^2} + R_S \kappa_S \frac{\partial^2 S_A}{\partial z^2}, \quad (4)$$

and subtracting the tendency that a single coefficient κ acting on ρ would produce gives

$$\frac{\partial \rho}{\partial t} - \kappa \frac{\partial^2 \rho}{\partial z^2} = (\kappa_{\Theta} - \kappa) R_{\Theta} \Theta_{zz} + (\kappa_S - \kappa) R_S S_{Azz} - \kappa (R_{\Theta\Theta} \Theta_z^2 + 2R_{\Theta S} \Theta_z S_{Az} + R_{SS} S_{Az}^2). \quad (5)$$

Proposition 3.5. (The aggregate has no autonomous evolution). The right side of (5) vanishes identically for some κ only where $\kappa_{\Theta} = \kappa_S$ and the second derivatives of the equation of state vanish. Evaluated at $S_A = 34.800 \text{ g kg}^{-1}$ and $\Theta = 4.401^\circ\text{C}$, those derivatives are $R_{\Theta\Theta} = -1.18 \times 10^{-2}$, $R_{\Theta S} = -2.91 \times 10^{-3}$ and $R_{SS} = 1.01 \times 10^{-4}$ in the units of ρ per unit of each argument, and the ratio of the coefficients is that of Claim 3.3. Neither condition holds, so the evolution of the aggregate is fixed by the constituents together and by no equation in the aggregate alone.

Proposition 3.6. (One column integrated). Take a column of two layers of equal density $1027.332 \text{ kg m}^{-3}$, the upper at $S_A = 35.400 \text{ g kg}^{-1}$ and $\Theta = 8.803^\circ\text{C}$ and the lower at $S_A = 34.200 \text{ g kg}^{-1}$ and $\Theta = 0.000^\circ\text{C}$, and diffuse the constituents from a step. With equal coefficients the column develops a density excess reaching 0.1223 kg m^{-3} at the interface, which is the maximum of §4. With the coefficients separated by the Lewis number the column develops a dipole reaching $+0.492 \text{ kg m}^{-3}$ above the interface and -0.257 kg m^{-3} below it, and an interval in which N^2 falls to $-4.0 \times 10^{-3} \text{ s}^{-2}$. In both cases the column began uniform in the aggregate quantity and acquired structure in it from the evolution of its constituents alone.

Proposition 3.7. (The size of the residual). For the integrated column, the single coefficient κ minimising the residual of (5) in the least-squares sense leaves 97.1 per cent of the norm of $\partial \rho / \partial t$ unaccounted for where the coefficients are separated, and 94.3 per cent where they are equal and the nonlinearity alone operates. The configuration is one in which the two layers have equal density, so the first-order contributions to ρ_{zz} very nearly cancel and the neglected terms carry the tendency, and the two percentages are properties of that configuration.

Figure 1 exhibits the two integrations.

3.2 The processes coupled to the column and the channels through which they enter

This subsection inventories the processes that act upon a column of seawater, states the relation each contributes, and classifies the ways in which each enters the system of (3).

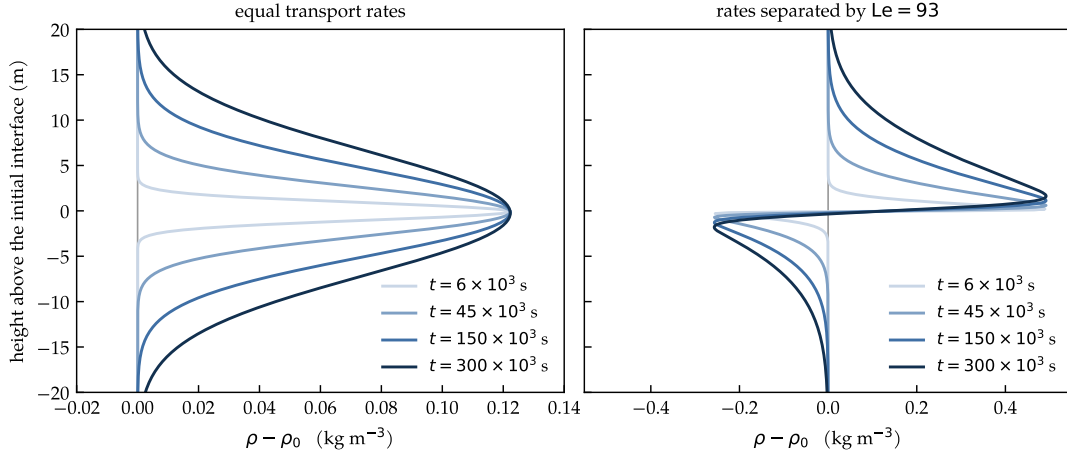


Figure 1: Two constituents evolving together, with the aggregate diagnosed from them. A column of two layers of equal density and unequal composition is released from a step and the constituents diffuse. Left: with equal transport coefficients, a positive density anomaly grows at the interface and reaches the maximum of the mixing line. Right: with the coefficients separated by the Lewis number, the faster constituent spreads further and a dipole forms, with dense water above light water and an interval of static instability. Curves are drawn at four times through the integration, and the column was uniform in density at the initial instant in both panels.

The method is to tabulate the processes with their relations and their points of entry, and then to count the distinct points of entry.

Table 1 collects the processes. Each belongs to a domain with its own variables and its own rules, and the ocean is the place at which they meet. The rightmost column records where each appears in the system (3), which is the question of interest here.

Claim 3.9. (The channels of entry). The processes of Table 1 belong to distinct domains and are governed by relations of distinct form, and they enter the system (3) through four channels only. A process may act as a body force in the momentum equation, may act as a source within the equation of a constituent, may be prescribed as a flux at a boundary of the domain, or may determine a coefficient appearing in the equations of the constituents. The count of processes is open and the count of channels is small.

Claim 3.10. (The fourth channel alters the rule). A process entering by the first three channels changes the values the state takes while leaving the form of the evolution unchanged. A process entering by the fourth changes the evolution itself, since a coefficient stands in the rule and not in the state. The turbulence closure, the optical attenuation set by the biological state, and the spatial distribution of mixing set by the shape of the boundary are of this kind, and the last is the mechanism reported in §7.

3.3 The composition of the subsystems and the exchange between them

This subsection states how subsystems governed by relations of distinct form are integrated together, identifies the three quantities that the manner of integration introduces, and reports two computed cases. The method is to write the composition of two

Table 1: Processes acting upon a column of seawater, the relation each contributes, and its point of entry into the system (3)

Process	Variable carried	Relation contributed	Point of entry
Rotation of the earth	velocity $\mathbf{u}$	$f \mathbf{k} \times \mathbf{u}$, with $f = 2\Omega \sin \varphi$	body force in the momentum equation
Buoyancy	density ρ	$b = -g(\rho - \rho_0)/\rho_0$	body force in the momentum equation
Equation of state	ρ	$\rho = R(S_A, \Theta, p)$	map from constituents to the governing quantity
Heat transport	Θ	$\partial_t \Theta + \mathbf{u} \cdot \nabla \Theta = \nabla \cdot (K_\Theta \nabla \Theta) - (\rho_0 c_p)^{-1} \partial_z I$	constituent equation
Salt transport	S_A	$\partial_t S_A + \mathbf{u} \cdot \nabla S_A = \nabla \cdot (K_S \nabla S_A)$	constituent equation
Atmospheric momentum	wind $\mathbf{U}_{10}$	$\boldsymbol{\tau} = \rho_a C_D \mathbf{U}_{10} \mathbf{U}_{10}$	flux prescribed at the upper boundary
Atmospheric heat and moisture	Θ_a, q_a	$Q_H = \rho_a c_{pa} C_H \mathbf{U}_{10} \times (\Theta_s - \Theta_a); E = \rho_a C_E \mathbf{U}_{10} \times (q_s - q_a)$	flux prescribed at the upper boundary
Solar radiation	irradiance I	$I(z) = I_0 [Re^{z/\zeta_1} + (1 - R)e^{z/\zeta_2}]$	source within the equation for Θ
Sea ice	ice thickness, brine	formation at $\Theta = \Theta_f(S_A, p)$, with salt released to the water and fresh water returned on melting	flux at the upper boundary, admitted above a threshold
Rivers and land drainage	runoff	fresh water delivered at the coastal boundary	flux prescribed at a lateral boundary
Marine biogeochemistry	tracer C	$\partial_t C + \mathbf{u} \cdot \nabla C = \nabla \cdot (K \nabla C) + J(C, I, \Theta)$	source within the equation for C , and determination of ζ_1, ζ_2 above
Astronomical tides	potential Φ	$-\nabla \Phi$, together with the energy delivered to the interior	body force, and supply to the closure below
Sea floor topography	boundary geometry	$\mathbf{u} \cdot \mathbf{n} = 0$; conversion of tidal energy where the boundary is rough	determination of $K(\mathbf{x})$
Turbulence closure	dissipation ε	$K = \Gamma \varepsilon / N^2$	determination of K_Θ and K_S

evolution operators, to expand the difference between the composition and the joint evolution, and to integrate a column under alternative compositions.

A system whose parts are governed by relations of distinct form is advanced by advancing the parts separately and exchanging information between them at intervals. Write the joint evolution as $\partial_t \mathbf{x} = (\mathcal{A} + \mathcal{B})\mathbf{x}$, with $\mathcal{A}$ the operator of one subsystem and $\mathcal{B}$ that of the other, and write $\Phi_{\mathcal{A}}(\tau)$ and $\Phi_{\mathcal{B}}(\tau)$ for the flows they generate separately. The joint flow over an interval Δt_c and the composition of the separate flows stand in the relation

$$\Phi_{\mathcal{A}}(\Delta t_c) \Phi_{\mathcal{B}}(\Delta t_c) = \exp\left\{(\mathcal{A} + \mathcal{B})\Delta t_c + \frac{1}{2} [\mathcal{A}, \mathcal{B}] \Delta t_c^2 + O(\Delta t_c^3)\right\}, \quad (6)$$

by the Baker–Campbell–Hausdorff expansion, with $[\mathcal{A}, \mathcal{B}] = \mathcal{A}\mathcal{B} - \mathcal{B}\mathcal{A}$. The symmetric composition

$$\Phi_{\mathcal{A}}(\tfrac{1}{2}\Delta t_c) \Phi_{\mathcal{B}}(\Delta t_c) \Phi_{\mathcal{A}}(\tfrac{1}{2}\Delta t_c) \quad (7)$$

cancels the term in Δt_c^2 of (6). Where the two subsystems are discretised differently, the flux passed from one to the other is carried by a transfer operator $\mathcal{R}$, and the transfer preserves the quantity exchanged where

$$\int_{\Omega} F \, dA = \int_{\Omega} \mathcal{R}[F] \, dA. \quad (8)$$

Claim 3.11. (Three quantities introduced by the manner of integration). Advancing the subsystems separately introduces three quantities absent from the subsystems themselves: the order in which the operators are applied, the interval Δt_c between exchanges, and the transfer operator $\mathcal{R}$ carrying quantities across the interface. Each is a property of the composition and none is a property of either part.

Two cases were computed on a column of 60 m. The operator $\mathcal{A}$ is transport within the column, solved exactly by eigendecomposition of the Laplacian at $\kappa = 1.0 \times 10^{-2} \text{ m}^2 \text{ s}^{-1}$. The operator $\mathcal{B}$ is exchange with the atmosphere, a restoring of each constituent toward an atmospheric value at a rate $\lambda(z) = \lambda_0 e^{z/d}$ with $d = 8 \text{ m}$, and with the surface rates λ_0 separated by two orders of magnitude between the constituents, at $1.0 \times 10^{-5} \text{ s}^{-1}$ for temperature and $1.0 \times 10^{-7} \text{ s}^{-1}$ for salinity. Both operators are exact for any interval, so the departures reported below are properties of the composition alone.

Proposition 3.12. (The order of application changes the outcome). Integrated for $2 \times 10^5 \text{ s}$ with an exchange interval of $2.5 \times 10^4 \text{ s}$, the two orderings of the same pair of operators yield density profiles differing by up to 0.146 kg m^{-3} , which is 62 per cent of the peak anomaly of 0.234 kg m^{-3} in the reference solution. The two computations differ in the sequence of application and in nothing else.

Proposition 3.13. (The departure grows with the exchange interval). Over exchange intervals from 3.9×10^2 to $2.5 \times 10^4 \text{ s}$, the departure of either ordering from the reference grows as a

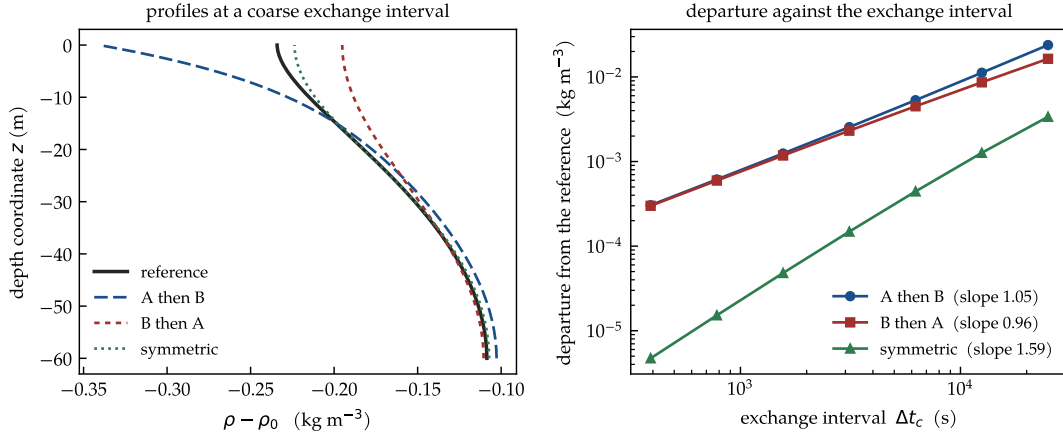


Figure 2: Composition of two subsystems advanced separately. Left: density profiles after the same integration under three compositions and under a reference computed at a very short exchange interval. The two orderings of the same pair separate widely, and the symmetric composition lies close to the reference. Right: the departure from the reference against the exchange interval, with the fitted exponent for each composition. Both operators are exact, so every departure shown is a property of the composition.

power of the interval with measured exponents of 1.05 and 0.96, and the departure of the symmetric composition (7) grows with a measured exponent of 1.59, refined to 1.00 and 1.72 over a finer range of intervals. At the coarsest interval examined the symmetric composition stands 7.0 times closer to the reference than the ordering that always advances the same subsystem first. The classical orders for the two compositions are 1 and 2, and the measured exponent of the symmetric composition falls short of 2 on this problem, a shortfall this paper records and does not explain.

Proposition 3.14. (The transfer across the interface). A flux defined on a discretisation of 17 cells and transferred to one of 53 cells over the same interval has an integral of 0.223676 in the units of the field. Transfer by interpolation of the field returns 0.223371, a loss of 0.137 per cent. Transfer by the overlap weights of (8) returns the integral of the sending side exactly. The quantity crossing the interface is therefore fixed by the transfer operator and by no property of either subsystem.

Claim 3.8. (The two groups of terms and where each is treated). The right side of (5) divides into two groups. The first two terms depend on the difference of the transport coefficients and vanish where the constituents move at equal rates, and their consequences are the subject of §5. The third group depends on the second derivatives of the equation of state and vanishes where the map from constituents to aggregate is affine, and its consequences are the subject of §4. The two mechanisms of the following sections are therefore the two ways in which (3) declines to reduce to an equation in the aggregate.

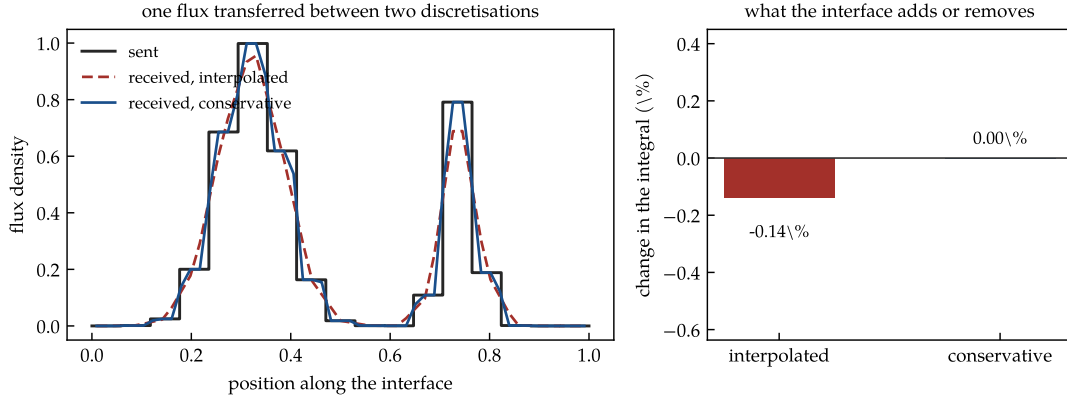


Figure 3: Transfer of one flux between two discretisations of the same interface. Left: the field as sent, and as received under interpolation and under transfer by overlap weights. Right: the change in the integral of the field under each transfer. Interpolation reproduces the shape of the field and removes a part of its integral, and the transfer by overlap weights reproduces the integral exactly.

4 The Density of a Mixture of Two Parcels of Equal Density

This section establishes that a mixture of two parcels of equal density and unequal composition is denser than either, states the magnitude of the effect for a pair of parcels typical of the ocean, and states what the result establishes about combination in general. The method is to compute the density of the mixture from the international equation of state over the whole mixing line, and to report the excess and the depth to which it displaces the mixture in a stratified column.

Two parcels were chosen at the surface reference pressure with equal density and unequal composition. Parcel A has $S_A = 34.200 \text{ g kg}^{-1}$ and $\Theta = 0.000^\circ\text{C}$. Parcel B has $S_A = 35.400 \text{ g kg}^{-1}$, and its conservative temperature was solved for the condition of equal density, giving $\Theta = 8.803^\circ\text{C}$. Both parcels have $\rho = 1027.332 \text{ kg m}^{-3}$. Mixing is linear in the two conservative variables, so a mixture in the proportion λ has S_A and Θ on the straight segment joining the two parcels, and its density follows from the equation of state applied to that point.

Proposition 4.1. (The density excess of a mixture). For the pair above, the equal mixture has $S_A = 34.800 \text{ g kg}^{-1}$, $\Theta = 4.401^\circ\text{C}$ and $\rho = 1027.455 \text{ kg m}^{-3}$, exceeding the density of each parent by 0.122 kg m^{-3} . Over the whole mixing line the excess is non-negative, and it attains its maximum of 0.1223 kg m^{-3} at $\lambda = 0.49$. The thermal expansion coefficients of the two parents differ by a factor of 3.10, which is the property of Claim 3.2 in numerical form.

Proposition 4.2. (The displacement that follows). In a column with $N^2 = 1.0 \times 10^{-6} \text{ s}^{-2}$, which is a value characteristic of the deep ocean, a density excess of 0.122 kg m^{-3} carries the mixture to a level 1168 m below the level at which its parents were neutral. The excess is therefore consequential on the scale of the system in which it arises.

Figure 4 exhibits the pair, the isopycnal on which they sit, the mixing line, and the

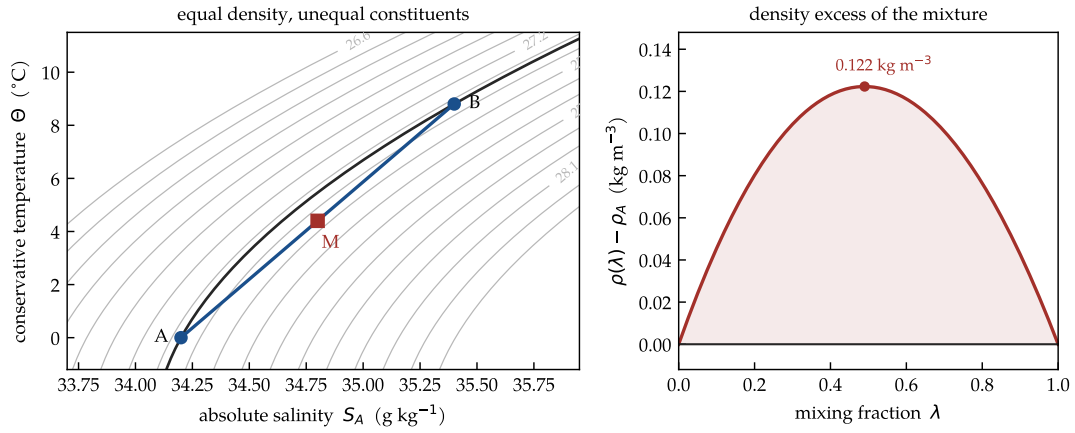


Figure 4: Combination of two parcels of equal density. Left: the plane of absolute salinity and conservative temperature, with contours of density at intervals of 0.1 kg m^{-3} and the isopycnal through the two parcels drawn heavy. Parcels A and B lie on that isopycnal, the straight segment joining them is the locus of their mixtures, and the equal mixture M lies below the isopycnal, so it is denser. Right: the density of the mixture in excess of the parents, along the mixing line. The excess is non-negative throughout and attains 0.1223 kg m^{-3} near equal proportions. Computed from the international thermodynamic equation of seawater at the surface reference pressure.

excess along it.

Claim 4.3. (What the result establishes about combination). The two parcels are equally admissible members of the isopycnal on which they sit, and their combination is a member of no such surface. The property holds because the map from constituents to the governing quantity fails to be affine, and it holds independently of any judgement about the parents. A demonstration that two constituent states are each acceptable therefore places no bound on the standing of the state their combination occupies.

5 The Stability of a Column Under Differential Molecular Transport

This section establishes that a column stable by the aggregate criterion may support a growing motion when its constituents diffuse at different rates, computes the extent of the region in which this holds, and states the diagnostic consequence. The method is to fix a column with realistic gradients, to compute its aggregate stability and its density ratio, and to measure the region of the gradient plane over which the two criteria disagree.

Where the upper part of a column is warmer and saltier than the lower part, the temperature gradient contributes stability and the salinity gradient contributes instability, and the aggregate criterion (2) weighs one against the other. A parcel displaced downward loses its heat to its surroundings faster than it loses its salt, by the ratio of Claim 3.3, so it arrives at its new level saltier than the water there and continues to sink.

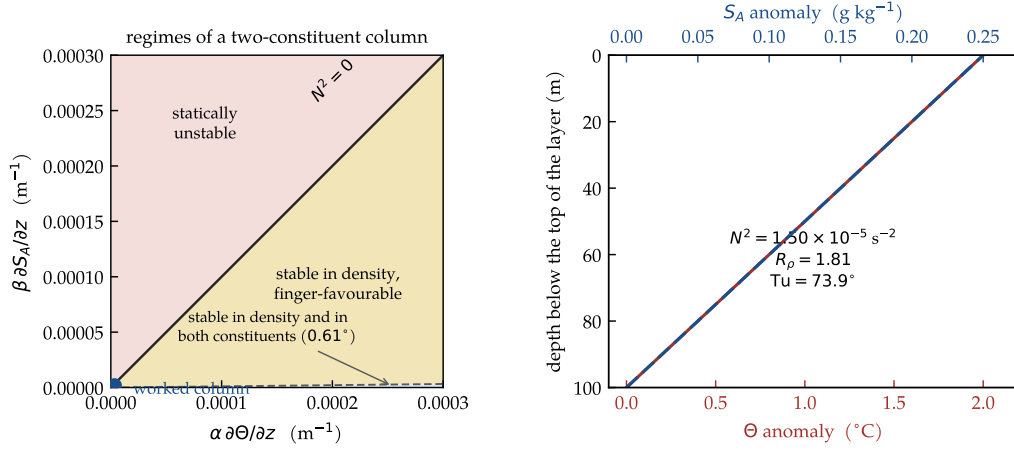


Figure 5: Regimes of a column with two constituents. Left: the plane of the two stabilising and destabilising contributions, restricted to the quadrant in which both gradients have the same sign. Above the diagonal the column is statically unstable. Below the diagonal the column is stable by the aggregate criterion, and all of that wedge except a sliver of 0.61° adjoining the horizontal axis supports a growing constituent motion. The marked point is the column of Proposition 5.1. Right: the profiles of that column, with the temperature anomaly and the salinity anomaly measured from the values at the base of the layer.

The relevant quantity is the density ratio

$$R_\rho = \frac{\alpha \partial \Theta / \partial z}{\beta \partial S_A / \partial z}, \quad (9)$$

and the motion grows where $1 < R_\rho < \text{Le}$, with Le the Lewis number of Claim 3.3 (Stern, 1960; Turner, 1973; Schmitt, 1994). The Turner angle $Tu = \text{atan2}(\alpha \Theta_z + \beta S_{Az}, \alpha \Theta_z - \beta S_{Az})$ records the same information on a single scale (Ruddick, 1983).

Proposition 5.1. (A column stable in density and unstable in its constituents). Take a layer of thickness 100 m at $S_A = 35.0 \text{ g kg}^{-1}$, $\Theta = 10.0^\circ\text{C}$ and $p = 200 \text{ dbar}$, across which the conservative temperature falls by 2.00°C and the absolute salinity by 0.25 g kg^{-1} from top to bottom. With $\alpha = 1.7033 \times 10^{-4} \text{ K}^{-1}$ and $\beta = 7.5151 \times 10^{-4} \text{ kg g}^{-1}$, the column has $N^2 = 1.50 \times 10^{-5} \text{ s}^{-2}$, so it is stable by the aggregate criterion, with a buoyancy period of 27 minutes. Its density ratio is $R_\rho = 1.81$ and its Turner angle is 73.9° , so it lies in the interior of the range within which the constituent motion grows.

Proposition 5.2. (The extent of the disagreement). In the plane whose coordinates are $\alpha \partial \Theta / \partial z$ and $\beta \partial S_A / \partial z$, restricted to the quadrant in which both are positive, the region stable by the aggregate criterion is the wedge of 45° below the diagonal. The region within it that is stable in the constituents as well is the wedge below the line $\beta S_{Az} = \alpha \Theta_z / \text{Le}$, whose angle is $\arctan(1/93.3) = 0.61^\circ$. The remaining 98.6 per cent of the stable wedge supports a growing constituent motion. The figure is an exact ratio of wedge angles and is independent of the scale on which the plane is drawn.

Figure 5 exhibits the plane, the two boundaries, and the column of Proposition 5.1.

Claim 5.3. (The diagnostic consequence). A test applied to the aggregate quantity returns a verdict of stability over almost the whole region in which the constituents are unstable. The disagreement follows from the separation of the transport rates and it holds for any pair of constituents so separated. A monitoring regime observing the aggregate alone therefore reports the condition of a system it has not examined, and the failure is a property of the choice of observable.

6 The Maintenance of Stratification Under Surface Forcing

This section states the sense in which the layering of the ocean is a maintained condition, distinguishes that sense from the metastability of a configuration held by kinetic obstruction, and records the time scale on which the condition relaxes when its forcing is withdrawn. The method is to identify the forcing that sustains the layering and to compute the diffusive time scale of the layer thickness.

The ocean receives heat and fresh water at its upper surface and loses them there, and it receives momentum from the wind at the same surface. Its layering is produced and continuously renewed by that exchange. A companion paper models plurality in a polity on the crystallisation of a solid, in which the plural configuration is metastable, the single crystal is the ground state, and the persistence of plurality is owed to kinetic obstruction (Huang, 2026c). The oceanic case has a different structure. The layered state is the state the system occupies while the forcing acts, and its persistence is owed to the continuation of the forcing.

Proposition 6.1. (The relaxation time of an unforced column). A layer of thickness $H = 4000$ m subject to a diffusivity κ relaxes on the time scale H^2/κ . For $\kappa = 1.0 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ this is 5.1×10^4 years, and for $\kappa = 1.0 \times 10^{-4} \text{ m}^2 \text{ s}^{-1}$ it is 5.1×10^3 years. The layering therefore persists for a finite time upon withdrawal of the forcing, and the length of that time is fixed by the rate at which the interfaces are crossed.

Claim 6.2. (Two structures of persistence). A configuration may persist because a barrier stands between it and a state of lower energy, and a configuration may persist because something continues to act upon it. The first admits of description by an equilibrium and a barrier height. The second admits of description by a forcing and a relaxation time. The oceanic case belongs to the second, and the crystallographic case of the companion paper belongs to the first.

7 The Energy Budget of Diapycnal Mixing and Its Spatial Distribution

This section establishes that transport across the layering of the ocean is paid for from a mechanical budget supplied separately from the layering itself, states the relation between the energy dissipated and the mixing achieved, and reports the concentration of the conversion at a small part of the area. The method is to state the classical energetic argument, to compute the power required by the standard relation between dissipation and diffusivity, and to compute the share of the flux carried by sites of elevated

diffusivity.

Heating and cooling at the same geometric level drive a circulation of small amplitude, a result established for the ocean at the beginning of the twentieth century (Sandström, 1908). The ocean is heated and cooled at its upper surface, so a thermally direct overturning of the observed amplitude requires a source of mechanical energy, which is supplied by the winds and the tides (Munk, 1966; Munk & Wunsch, 1998; Wunsch & Ferrari, 2004). The relation between the mechanical energy dissipated in turbulence and the diffusivity achieved across the layering is

$$\kappa = \Gamma \frac{\varepsilon}{N^2}, \quad (10)$$

with ε the dissipation rate per unit mass and Γ a mixing efficiency conventionally taken as 0.2 (Osborn, 1980).

Proposition 7.1. (The order of the maintenance budget). Sustaining $\kappa = 1.0 \times 10^{-4} \text{ m}^2 \text{ s}^{-1}$ against $N^2 = 1.0 \times 10^{-6} \text{ s}^{-2}$ requires $\varepsilon = 5.0 \times 10^{-10} \text{ W kg}^{-1}$ by (10). Applied to the ocean mass of $1.4 \times 10^{21} \text{ kg}$ this gives 0.70 TW, and applied to the abyssal 60 per cent of that mass it gives 0.42 TW. The published estimate of the mechanical input required to sustain the observed overturning is about 2 TW, so the calculation reported here is consistent in order with the established figure and is offered as a check upon it and not as an independent estimate (Munk & Wunsch, 1998).

Direct measurement gives a diffusivity in the open interior of the ocean about an order of magnitude below the value the overturning requires, and gives values at and above the required value over rough topography, ridges, and passages (Polzin et al., 1997; Ledwell et al., 2000). The internal tide is generated where the flow meets that topography, and it breaks and mixes in its neighbourhood (St. Laurent & Garrett, 2002).

Proposition 7.2. (The concentration of the flux). Let sites of elevated diffusivity occupy an area fraction a at a diffusivity κ_h , with the remaining area at a background κ_b . The share of the area-integrated diapycnal flux carried by the sites is $a\kappa_h/(a\kappa_h + (1-a)\kappa_b)$. For $a = 0.10$ and $\kappa_h/\kappa_b = 50$, with $\kappa_b = 0.1 \times 10^{-4} \text{ m}^2 \text{ s}^{-1}$, the sites carry 84.7 per cent of the flux and the area mean is $5.9 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$. Removal of the sites leaves the background value, a reduction of the area mean by a factor of 5.9.

Claim 7.3. (The function performed at a site). The topography supplies no energy to the system. The energy is supplied by the tide and the wind, and the topography converts a part of it into mixing at the place where it stands. The function of a site is therefore conversion of a flow already present, and the site is distinguished from the source of that flow.

Figure 6 reports the share of the flux against the area fraction for three contrast ratios, and the effect of removing the sites.

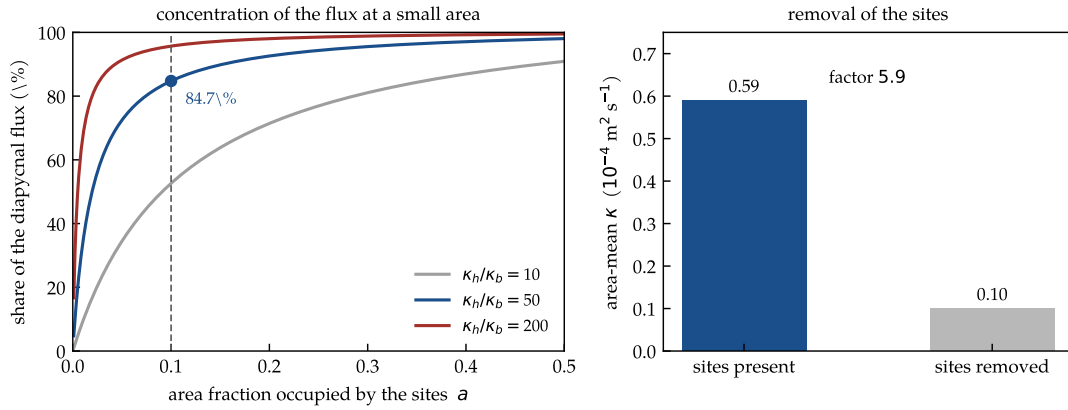


Figure 6: Concentration of the transport at a small part of the area. Left: the share of the area-integrated flux carried by the sites, against the area fraction they occupy, for three ratios of site diffusivity to background. The marked point is the case adopted in Proposition 7.2. Right: the area-mean diffusivity with the sites present and with the sites removed and the background unchanged. Removal reduces the mean by a factor of 5.9 and redistributes nothing.

8 The Absence of a Controller and the Absence of an Equilibrium

This section states two further properties of the oceanic case, distinguishes them from one another, and records the phenomena that exhibit the second. The method is to state each property, to give the sense in which it is established, and to name the standard results that display it.

No agency assigns the winds, directs the currents, or apportions the mixing. The circulation is produced by forcing at the boundaries of a rotating stratified fluid together with the internal dynamics of that fluid, and every quantity of interest is an outcome of local balances. The first property is therefore the absence of a controller.

The second property concerns equilibrium. The state of the ocean is maintained by a continuous throughput of energy and buoyancy and dissipates that throughput continuously, so it is a forced and dissipative state. Two consequences are visible in the standard results. Slow components acquire structure from the statistics of fast ones, so that fluctuation in the atmosphere accumulates in the ocean as long time scale variability (Hasselmann, 1976). And the coupled system supports oscillations whose periods belong to neither component: the coupling of the equatorial ocean to the overlying atmosphere produces an interannual oscillation whose time scale is fixed by the transit of oceanic waves closed through a fast atmospheric feedback (Bjerknes, 1969; Suarez & Schopf, 1988).

Claim 8.1. (Two properties held apart). A system may lack a controller and possess an equilibrium, and a system may possess a controller and occupy a forced state. The oceanic case exhibits both the absence of a controller and the absence of an equilibrium, and the two are established by different considerations: the first by the absence of any agency in the equations of motion, the second by the continuous throughput that sustains the observed state.

Claim 8.2. (Localisation held apart from centralisation). The absence of a controller is compatible with the concentration reported in Proposition 7.2. A system without an agency directing it may nonetheless conduct most of its cross-interface transport at a small part of its extent. Absence of a centre and uniformity of function are therefore separate properties, and the oceanic case possesses the first without the second.

9 The Discipline Governing the Transposition

This section states the method by which the physical results are carried into the analysis of normative orders, declares the features carried across, declares the features left behind, and fixes the standing of what the transposition yields. The method follows the treatment of analogy adopted in the companion paper on relational crystallisation, which takes its apparatus from the theory of models and analogies and its cautionary case from the criticism of unwarranted borrowing (Hesse, 1966; Black, 1962; Sokal & Bricmont, 1998; Huang, 2026c).

An analogy between two domains divides into features known to hold in both, features known to hold in one and to fail in the other, and features whose standing is undetermined. Argument may proceed on the first, is blocked by the second, and is suspended on the third. The value of stating the division in advance is that it fixes what a reader is asked to grant.

Claim 9.1. (The features carried across). Five features are carried. A state described by several constituents and assessed by a quantity formed from them. A map from constituents to that quantity which fails to be affine. Constituents whose rates of transport differ by a large factor. A configuration held by continuous forcing and relaxing upon its withdrawal. And a transport across interfaces whose cost is supplied separately and whose conversion is spatially concentrated.

Claim 9.2. (The features left behind). Six features are left behind. The constituents of a fluid hold no interests and offer no interpretations of their situation. The equation of state is measured, and no counterpart of it is measured for a polity. The mixing efficiency Γ is an empirical constant of a turbulent flow and has no counterpart. The energy of the physical system is conserved and the quantities of a normative arrangement are not. The layering of the ocean is continuous and the orders of a polity are individuated by contest. And the physical system contains no party who may be wronged, so every normative term in what follows is supplied from elsewhere.

Claim 9.3. (The standing of the transposed statements). The statements of §§11–17 are entered as constraints upon the assessment of arrangements. Each states that a form of assessment overlooks a condition, or that an operation carries a cost, or that two properties come apart. None states that an arrangement is good, and none licenses an inference from a dynamical description to a justification, a wall the companion papers maintain and §20 restates for the present material.

10 Relation to Prior Work on Systems Analogy in Political and International Theory

This section identifies the existing work that already carries system concepts into political and international analysis, states what each settles, and marks the residue that the present paper claims. The concession is extensive and the contribution lies outside it.

The description of international politics by the properties of a system is long established. The formal treatment of international systems by their rules of transformation set out the programme (Kaplan, 1957), the analysis of government by the flow of information and the operation of feedback developed it in a cybernetic register (Deutsch, 1963), and structural realism made the arrangement of capabilities the explanatory object (Waltz, 1979). The consequences of interaction among many parts, and in particular the production of outcomes intended by none, have received a full treatment in the study of system effects (Jervis, 1997). Governance by several centres of decision with overlapping jurisdiction is the subject of the polycentric tradition, which established both the coherence of such arrangements and the conditions under which they govern a shared resource (Ostrom et al., 1961; Ostrom, 1990).

The normative plurality of international life has its own literatures. The relations among legal orders that recognise no common superior have been analysed through the norms operating at their interfaces, with denial, deferral, and translation as the modes and recognition, deference, conditional recognition, and taking into account as the devices (Krisch, 2010, 2021). The devices by which plural orders are managed have been catalogued at length (Berman, 2012). The proliferation of partially overlapping international regimes is described as a regime complex (Raustiala & Victor, 2004), the choice between binding and non-binding instruments is explained by obligation, precision, and delegation together with sovereignty and contracting costs (Abbott & Snidal, 2000), and the reception of an external norm into a local order is analysed as localisation (Acharya, 2004). Governance by mutual monitoring under uncertainty, with revisable framework goals, is the subject of experimentalist accounts (Sabel & Zeitlin, 2008). The consequences of rendering a governed object into indicators are established (Merry, 2016; Espeland & Sauder, 2007; Scott, 1998).

Claim 10.1. (The residue after concession). The description of plural orders is available and is conceded. The description of the devices operating at their interfaces is available and is conceded. The description of governance without a single centre is available and is conceded. Three items are absent from these literatures. An account of what holds a plurality of orders in place and of the cost of that holding. An account of the separate cost of passage across the orders and of the spatial concentration of that passage. And a criterion by which an assessment computed on an aggregate is shown to overlook a condition of the constituents. The present paper claims these three.

Claim 10.2. (The relation to the polycentric and interface accounts). The polycentric tradition

Table 2: The physical results and the statements carried from them

Physical result	Section of origin	Statement carried
The aggregate carries no evolution equation of its own	Propositions 3.5, 3.6, 3.7	The aggregate description of an arrangement has no dynamics of its own (§11)
Constituents transported at rates separated by two orders of magnitude	Propositions 5.1, 5.2	An assessment computed on the aggregate passes over a constituent condition (§11)
A mixture of two parcels of equal density is denser than either	Propositions 4.1, 4.2	The adequacy of two orders places no bound on the standing of their combination (§12)
Layering held by continuous forcing; crossing paid from a separate budget	Propositions 6.1, 7.1	Plurality is a maintained condition and passage across it carries its own cost (§13)
Conversion of the budget concentrated at a small part of the area	Proposition 7.2, Claim 7.3	A site converts a flow already present, and removal reduces the total (§14)
No controller and no equilibrium	Claims 8.1, 8.2	Absence of a centre is compatible with strong localisation; arrangements are forced states (§§15, 16)

describes several centres and their relations, and the interface literature describes the norms operating between orders. Neither yields the result of Claim 8.2, that a system without a centre may conduct most of its cross-interface transport at a small part of its extent. That result concerns the distribution of a function over a system and it is compatible with the presence or the absence of any number of centres.

11 Rate Difference and the Concealment of Instability by Aggregate Measures

This section carries the result of §5 into the analysis of an arrangement holding several normative orders, states the form of the transposed claim, and states the conditions under which it fails. The method is to identify the counterpart of each term in Proposition 5.2, to state the claim over those terms, and to name what would refute it.

Table 2 collects the five physical results and the statements carried from them, so that the reader may see at the outset which section of the physical part supports which of the sections that follow.

The counterpart of the two constituents is the pair of orders holding claims within one arrangement. The counterpart of the difference of transport rates is the difference of evidence regimes established in the companion paper on multi-nomoi governance: one order states claims a third party may check in advance, and the other states claims assessable afterwards and largely from within (Huang, 2026d). The counterpart of the aggregate quantity is any measure computed on the arrangement as a whole, such as the continued operation of a treaty regime, the absence of open dispute, or a set of

indicators.

Claim 11.1. (Concealment by an aggregate measure). Where two orders within one arrangement differ substantially in the rate at which their claims can be checked, a measure computed on the arrangement as a whole may return a stable verdict over a wide range of conditions in which the slower order is losing standing. The mechanism is the one exhibited in Proposition 5.2: the aggregate weighs contributions against one another and records their difference, and the difference is silent about the separate motion the rate difference sustains.

Claim 11.2. (The direction of the transposed statement). Claim 11.1 concerns the choice of observable and it makes no assertion about the frequency with which the concealed condition occurs. Proposition 5.2 reports the extent of the region of disagreement in the physical case, where the boundaries are fixed by a measured Lewis number. No counterpart of that measurement is available for an arrangement of normative orders, so the transposed statement carries the form of the disagreement and carries no figure.

Claim 11.4. (The aggregate carries no dynamics of its own). Proposition 3.5 transposes to the following. Where an arrangement is described by a measure computed on the whole, that measure possesses no evolution of its own, and whatever regularity it displays is inherited from the orders whose claims it aggregates together with the map by which they are aggregated. An account that models the trajectory of such a measure directly, and that fits a law to it, has fitted a law to a diagnosed quantity, and the law will fail wherever the constituent orders change their relation to one another.

Claim 11.3. (Conditions of refutation). Claim 11.1 fails where a measure computed on an arrangement as a whole is exhibited that registers the differential condition of its constituent orders. Such a measure would have to respond to the position of the slower order separately from the faster, which is what an aggregate declines to do by construction, so the exhibition would be a strong result. It also fails where the difference of evidence regimes is shown to leave the standing of the slower order unaffected, which is the claim the companion paper's derivation of the translation burden already addresses (Huang, 2026d).

12 The Standing of a Combination of Two Adequate Orders

This section carries the result of §4 into the analysis of arrangements, states what follows for a settlement composed from two orders each of which is adequate to its own conditions, and marks the relation to the residue established in the companion paper on multilingual democracy. The method is to state the transposed claim, to identify the property of combination on which it depends, and to state its limits.

The companion paper on multilingual democracy establishes that a settlement reached between two communities may leave a residue that survives a semantically perfect translation, and locates the residue in the ordering of values (Huang, 2026b). The result of §4 supplies a structurally distinct point about the same operation.

Claim 12.1. (Combination and adequacy). Where two orders are each adequate to the condi-

tions they govern, a settlement formed by combining their terms may occupy a position that neither would license. The property required is that the map from the terms of the orders to whatever the arrangement is assessed by fails to be affine, so that the assessment of a combination is not the corresponding combination of the assessments. Where that property holds, the demonstration that each party's order is in order supplies no warrant for the combination.

Claim 12.2. (The relation to the residue after perfect translation). The residue established in the companion paper concerns what fails to pass through a translation. The present claim concerns what a combination produces. The two are independent: a combination may produce a position below both parents while every term of both orders has passed into it, and a residue may survive a translation in which no combination was attempted.

Claim 12.3. (What the claim withholds). Claim 12.1 states a possibility and supplies no procedure for determining whether a given combination realises it. Determining that would require the counterpart of an equation of state, which the physical case has and an arrangement of normative orders does not, as recorded in Claim 9.2. The claim therefore operates as a caution against an inference and not as a diagnostic instrument.

13 The Maintenance of Plurality and the Cost of Crossing Between Orders

This section carries the results of §§6 and 7 into the analysis of arrangements, states the two costs the transposition distinguishes, and states the consequence for a familiar proposition about diversity. The method is to separate the cost of holding a plurality in place from the cost of passage across it, and to state each in the terms of the companion papers.

Two distinct expenditures appear in the physical case. The layering is held by continuous forcing at the surface, and it relaxes upon the withdrawal of that forcing on the time scale of Proposition 6.1. Passage across the layering is paid for from a mechanical budget supplied by winds and tides, and its magnitude is the subject of Proposition 7.1. The first sustains the difference. The second moves something across it.

Claim 13.1. (Plurality as a maintained condition). Where several orders persist within one arrangement, their persistence may be owed to something that continues to act: the reproduction of a language in its institutions of teaching, the continued conferral of standing upon a body of practice, the continued recognition of a jurisdiction. On this reading the question put to an arrangement concerns what sustains the difference and at what cost, and an answer citing the absence of pressure toward uniformity is incomplete.

Claim 13.2. (The separate cost of passage). The existence of a difference between two orders supplies nothing toward the passage of a claim across it. Passage requires a further expenditure: the labour of rendering, the standing to be heard, the institution that receives, the guarantee that permits reception without conversion. Where that expenditure is absent, difference persists and passage does not occur, and the arrangement exhibits the coexistence of orders with no exchange between them.

Claim 13.3. (Against a familiar proposition). The proposition that diversity is itself a source of exchange, of innovation, or of integration is refused by Claim 13.2 and is refused independently of any view about the value of diversity. The refusal is structural: the term supplying the passage is absent from the proposition. The companion paper on multi-nomoi governance declines the same proposition on the ground that it states an objective function (Huang, 2026d), and the present ground is distinct and compatible with it.

14 The Localisation of Conversion and the Function of the Sites

This section carries Proposition 7.2 and Claim 7.3 into the analysis of arrangements, states the resulting description of an institution positioned between orders, and states what the description excludes. The method is to transpose the three elements of the physical result in turn: the concentration of the flux, the conversion of a flow already present, and the effect of removal.

Claim 14.1. (Concentration of passage). Passage between two orders within an arrangement may be concentrated at a small number of sites, so that most of what crosses does so at institutions occupying a small part of the arrangement. An arrangement distributing its integrative effort uniformly across an interface may therefore achieve very little passage, and an arrangement conducting it at a few sites may achieve a great deal, with the two indistinguishable by any measure of total effort.

Claim 14.2. (The function of a site). A site of the kind described converts a flow already present in the arrangement into passage across an interface. The flows so converted include the interests parties already hold, the disputes they are already conducting, the exchanges they already maintain, and the obligations they have already undertaken. The site supplies none of these, and its function is distinguished from the supply of what it converts and from the allocation of a quantity among claimants.

Claim 14.3. (The effect of removal). Removing a site of conversion reduces the total passage across the interface, and it redistributes the passage nowhere. Proposition 7.2 exhibits this in the physical case, where deleting the sites leaves the background diffusivity unchanged and lowers the area mean by the factor computed there. The transposed statement is that the dispersal of a function performed at a few sites is a separate operation from the performance of that function elsewhere, and the second requires its own account.

Claim 14.4. (Relation to the adaptive mediation literature). The proposition that a third party to a conflict may work by supporting the self-organisation of the parties, and by declining to impose a settlement, is established in the literature on adaptive mediation and adaptive peace-building (de Coning, 2018; de Coning et al., 2022). Claim 14.2 supplies a mechanism for that proposition: the third party converts flows the parties already sustain, and its position is defined by the conversion and by the interface at which it stands. The mechanism is offered as a description of the position and it supplies no warrant for any occupant of it, a restriction stated in full in §20.

15 Coupling Without a Centre in Relation to Polycentric and Interface Accounts

This section states the transposed form of Claim 8.2, distinguishes it from the propositions of the polycentric and interface literatures conceded in §10, and states the consequence for arguments about decentring an arrangement. The method is to separate two properties commonly treated together and to exhibit the consequence of separating them.

Claim 15.1. (Two properties held apart). An arrangement may have no centre competent to decide for the whole and may nonetheless conduct most of its cross-order passage at a small number of sites. Absence of a centre is a claim about authority. Localisation is a claim about the distribution of a function. The oceanic case possesses the first and the second together, which establishes their compatibility.

Claim 15.2. (Decentring and dissolution held apart). Removing a site at which conversion is concentrated is a separate operation from removing a centre of authority, and Claim 14.3 states its effect. An argument for decentring an arrangement therefore requires a further step before it reaches a conclusion about the sites, and the further step must say where the converted passage is to occur once the sites are gone.

Claim 15.3. (The relation to polycentricity). The polycentric tradition establishes that governance may proceed through several centres of decision with overlapping jurisdiction (Ostrom et al., 1961; Ostrom, 1990). Its unit of analysis is a centre. Claim 15.1 concerns the distribution of a function over an arrangement and takes no position on the number of centres, so it applies to a monocentric arrangement, to a polycentric one, and to an arrangement with no centre whatever. The companion paper on relational crystallisation records the same asymmetry from the side of boundaries (Huang, 2026c).

Claim 15.4. (The relation to the interface literature). The analysis of interface norms establishes the modes and devices by which orders recognising no common superior handle one another's claims (Krisch, 2010, 2021; Berman, 2012). The object there is the norm operating at the interface. The object of Claims 14.1 to 14.3 is the distribution of passage over the interface and the effect of removing the sites at which it is concentrated. The two are complementary, and the second is absent from the first.

16 Arrangements as Forced States

This section carries the second property of §8 into the analysis of arrangements, states the consequence for the search for a settled institutional form, and marks the difference from the account of plurality given in the companion paper on relational crystallisation. The method is to state the transposed claim and to identify what it requires of an arrangement.

Claim 16.1. (Arrangements maintained by continuous action). An arrangement holding sev-

eral orders may occupy a state maintained by continuous action upon it, so that its persistence is owed to what continues to be done and its relaxation follows the withdrawal of that action after a finite interval. On this reading a constitution, a treaty regime, or a standing organisation is described by the action that sustains it together with the time over which it would relax, and the description by an equilibrium toward which the arrangement tends is unavailable.

Claim 16.2. (Consequence for institutional design). Where Claim 16.1 holds of an arrangement, the search for a form that would hold without continued maintenance has no object, and the questions that remain concern what the maintenance consists in, who performs it, and what its withdrawal would cost. The claim is conditional and its antecedent is an empirical matter for any given arrangement.

Claim 16.3. (The relation to the crystallisation account). The companion paper models plural orders on a polycrystalline solid, in which plurality is metastable and its persistence is owed to kinetic obstruction (Huang, 2026c). Claim 16.1 describes a different structure of persistence, stated in Claim 6.2. The two accounts are therefore applicable to different arrangements, and determining which applies to a given arrangement requires evidence about what would follow the withdrawal of the action that presently sustains it. The question is entered among the open questions of §23.

17 The Composition of Two Orders and the Properties of the Composed Arrangement

This section carries the coupled behaviour of §8 and the composition results of §3.3 into the analysis of arrangements, states the properties that belong to a composition and to neither of its parts, and collects the design questions those properties put to an arrangement holding several orders. The method is to state each transposed claim, to identify the institutional quantity it concerns, and to gather the results in a table.

Two components coupled at an interface support behaviour that neither component supports alone, and the equatorial ocean and atmosphere furnish the standard case, where the period of the coupled oscillation is fixed by a transit time in one component closed through a feedback in the other (Bjerknes, 1969; Suarez & Schopf, 1988). A slow component moreover acquires long time scale structure from the fluctuations of a fast one (Hasselmann, 1976).

Claim 17.1. (Behaviour of the coupled arrangement). An arrangement formed by coupling two orders through a device supports developments belonging to neither order taken alone, and the time scales of those developments may be fixed by the coupling. An assessment addressed to each order separately therefore leaves a class of developments unexamined, and the device requires an assessment of its own.

Claim 17.2. (Accumulation of fast fluctuation in a slow order). Where one order is subject to frequent revision and the other to slow revision, the fluctuations of the first may accumulate as structure in the second. The companion paper on multi-nomoi governance states the cor-

responding institutional finding: rendering an order's claims into an ex ante checkable form transfers the rhythm of audit into the practice being audited, which is the moment at which the practice is captured (Huang, 2026d; Espeland & Sauder, 2007; Merry, 2016). The physical statement and the institutional finding agree in form, and the second is established independently.

Claim 17.3. (The pathologies of the device). A device standing at an interface requires treatment of its own pathologies, since Claim 17.1 places those pathologies outside the assessment of either order. The companion paper enumerates three for the device of warranting: the hardening of a guarantee into a conversion rate, the demanding of an excessive guarantee, and the demanding of a guarantee from one side alone (Huang, 2026d).

Claim 17.4. (The channels by which an order enters an arrangement). Claims 3.9 and 3.10 transpose as follows. An order external to another may enter it as a force acting upon every party alike, as a contribution within the receiving order's own accounting, as a condition imposed at the boundary of the receiving order, or as a determinant of the rule by which the receiving order operates. The fourth is distinguished from the other three in the same way: it alters the rule and leaves the state to follow. The distinction between an intervention that changes what an order produces and an intervention that changes the grammar by which it produces is developed in the companion work on the two levels of relational degradation, and the fourth channel is the formal position of the second level within a coupled system (Huang, 2026a).

Claim 17.5. (Sequence as a determinant of outcome). Where two orders act upon the same matter and their operations fail to commute, the sequence in which they act is a determinant of what the arrangement produces. Proposition 3.12 exhibits the magnitude available to sequence alone in the physical case, where two computations differing in nothing else separated by 62 per cent of the peak anomaly. An arrangement with a fixed sequence therefore confers upon the order that acts first an advantage recorded in the rules of neither order, and an examination of the two orders separately does not disclose it.

Claim 17.6. (The exchange interval bounds what the arrangement registers). Two orders that exchange at intervals compose into an arrangement in which interaction faster than the interval is absent. The reporting period, the review cycle, the conference of the parties, and the audit round each fix such an interval, and each thereby fixes a class of interactions the arrangement cannot register whatever its parties intend. Proposition 3.13 reports the growth of the departure with the interval in the physical case.

Claim 17.7. (Alternation of precedence). The symmetric composition (7) removes the leading term of the departure attributable to sequence, and Proposition 3.13 reports the resulting reduction. Transposed, an arrangement that alternates precedence between two orders, in place of according it always to the same one, removes the leading part of the advantage identified in Claim 17.5. The transposition holds where the operations of both orders admit of division into parts, and an arrangement whose operations are indivisible falls outside it.

Claim 17.8. (Preservation across the interface). A rendering from one order into the terms of another is carried by an operator, and whether that operator preserves what is at stake is a property of the operator. Proposition 3.14 exhibits a transfer reproducing the shape of a field and

Table 3: Properties of a composition, and the questions each puts to an arrangement holding several orders

Property	Source	Question put to an arrangement	Condition it names
The operations fail to commute	Eq. (6), Prop. 3.12	Which order acts first on a matter concerning both	A fixed precedence confers an advantage recorded in neither order's rules
The departure grows with the exchange interval	Prop. 3.13	How often the orders exchange	Interaction faster than the interval is absent from the arrangement
The symmetric composition cancels the leading term	Eq. (7), Prop. 3.13	Whether precedence alternates	Alternation removes the leading part of the advantage
Transfer preserves the integral only under an operator built for it	Eq. (8), Prop. 3.14	Whether the rendering preserves what is at stake	A rendering may keep the content and alter the magnitude
A subsystem may fix a coefficient	Claim 3.10	Which order sets the rule the other operates under	The rule is altered and the state follows

removing a part of its integral. Two failures are thereby distinguished: a rendering preserving what is said while altering the magnitude of what is claimed, and a rendering preserving the magnitude while altering the content. The companion paper on multi-nomoi governance settles who performs the rendering (Huang, 2026d); the present claim concerns what the rendering preserves.

Table 3 collects the properties of a composition with the question each puts to an arrangement holding several orders.

18 Multilingual and Multi-Value Democracy Under the Transposed Mechanisms

This section reads the first case through the mechanisms of §§11–17, organises the reading by mechanism, and states what the reading yields and what it leaves to empirical enquiry. The method is to take each mechanism in turn, to identify the institutional material it addresses, and to state the question it puts to that material. The case is a polity holding several linguistic and normative communities under a common authority, and the treatment is confined to institutional devices, with no verdict offered upon the policy of any state.

18.1 Assessment by aggregate measure

This subsection applies Claim 11.1 to the measures by which a plural polity is ordinarily assessed. A polity holding several communities is commonly assessed by measures computed on the whole: participation rates, the absence of open dispute, the pas-

sage of legislation, the movement of composite indicators. Claim 11.1 puts the question whether such a measure would register a differential condition of the communities whose claims differ in checkability. Where one community states its claims in a currency inspectable in advance, such as a documented share of expenditure or a measured provision of service, and another states claims assessable afterwards and largely from within, such as whether a practice was carried on or a form of life reproduced, the measure records the difference of contributions to the aggregate and passes over the separate motion.

18.2 Combination of settlements

This subsection applies Claim 12.1 to the procedures by which a legislative settlement is assembled. Claim 12.1 puts a question to the composition of settlements. Where a legislative settlement is assembled from terms each of which is acceptable to the order that supplied it, the assembled settlement may occupy a position that neither order licenses. The question the claim puts is whether the arrangement possesses any procedure by which the standing of a composed settlement is examined separately from the standing of its parts, and the answer for most legislative procedures is that the examination is conducted on the parts.

18.3 Maintenance and passage

This subsection applies the two cost statements of §13 to the institutions of a plural polity. Claims 13.1 and 13.2 put two questions. The first asks what sustains the plurality of the polity and at what cost, which directs attention to the institutions of teaching, of professional formation, and of official recognition through which a community's order is reproduced. The second asks what supplies the passage of a claim from one order into the terms another can act upon, which directs attention to the standing to be heard, the availability of a body competent to receive a claim in its own terms, and the guarantee under which such a claim may be received without conversion. The companion paper on multi-nomoi governance describes the last as warranting and states the conditions under which it holds (Huang, 2026d).

18.4 Localisation of passage

This subsection applies Claim 14.1 to the distribution of integrative work within a polity. Claim 14.1 puts the question where the passage between orders occurs. Its consequence for the polity is that the effort devoted to integration may be widely distributed and the passage narrowly concentrated, so that a small number of institutions, offices, or procedures carry most of what crosses. Identifying those sites is an empirical task, and the claim supplies the reason for undertaking it.

Claim 18.1. (What the reading yields). The mechanisms yield four questions for the first case: whether the polity's measures would register a differential condition of its communities,

Table 4: Functions distinguished by the conversion description, with instruments in which each is visible

Function	Operation	Instrument in which it is visible
Allocation	Division of a quantity among claimants	Assessed contributions; quota arrangements
Rule making	Statement of a common requirement	Harmonising instruments; binding standards
Non-conversion with disclosure	An order's terms left unconverted, with notice to those exposed	Filed differences from international standards under the Chicago Convention, Article 38
Conversion on a demonstration	A party's own measures received as sufficient upon a demonstration to the receiving party	Equivalence determinations under the Agreement on Sanitary and Phytosanitary Measures, Article 4
Conversion without a guarantee	Recognition extended with no undertaking posted	Mutual recognition in the absence of an equivalence procedure

whether composed settlements are examined as compositions, what sustains the plurality and what supplies the passage, and where the passage is concentrated. Each is answerable by enquiry into the institutions of a given polity, and none is answered here.

19 International Organisations as Sites of Conversion

This section reads the second case through the mechanisms, organises the reading by function, and states the description of an international organisation that the mechanisms support. The method is to state the functional description, to exhibit instruments in which the function is visible, and to state what the description leaves undetermined. The case is confined to institutional instruments, and no verdict is offered upon the conduct of any organisation or state.

An international organisation is conventionally described in one of three ways: as a forum in which states coordinate, as a maker of rules, or as one decision centre among several with overlapping jurisdiction (Abbott & Snidal, 2000; Raustiala & Victor, 2004; Ostrom et al., 1961). Claims 14.1 to 14.3 supply a fourth description, and Table 4 sets out the functions it distinguishes.

Claim 19.1. (The conversion description). An international organisation may be described as a site at which flows already present among the parties are converted into passage across an interface between orders that would otherwise pass very little. The flows so converted include the disputes the parties are already conducting, the exchanges they already maintain, and the obligations they have already undertaken. The description is distinguished from allocation, since the organisation divides nothing, and it is distinguished from occupation of a centre, since Claim 15.1 separates the two.

Claim 19.2. (Two instruments in which the function is visible). Article 4 of the Agreement on Sanitary and Phytosanitary Measures provides that a member shall accept the measures of another as equivalent where the exporting member objectively demonstrates that its measures achieve the importing member's appropriate level of protection. The instrument converts a claim stated in one regulatory order into a form the other can act upon, and it places the demonstration upon the party seeking recognition, which is the direction the companion paper derives from verification asymmetry (Huang, 2026d). Article 38 of the Convention on International Civil Aviation provides that a state departing from an international standard shall notify the difference, and the instrument leaves the departing order unconverted while addressing what the other parties stand to lose. All citation details are to be verified against the primary texts before reliance.

Claim 19.3. (The consequence for arguments about decentring). An argument that international arrangements should proceed with fewer centres of authority reaches no conclusion about the sites of conversion, by Claim 15.2. Where the conversion presently performed at a site would be performed nowhere after its removal, the removal reduces the passage between the orders concerned, by Claim 14.3. An argument for dispersal therefore owes an account of where the conversion is to occur.

Claim 19.4. (What the description leaves undetermined). The conversion description identifies a function and settles nothing about who should perform it, about the terms on which an organisation holds its position, or about the justice of any particular conversion it performs. Those questions are addressed in §20 by a criterion supplied from the companion papers, and the description supplies no part of the answer.

20 The Constraint Form of the Account and the Separation of Description from Justification

This section states the form in which the account's normative content is entered, states the criterion governing a site of conversion, and states the inference the account refuses. The method is to state the form, to import the criterion from the companion papers with its ground, and to state the refused sentence explicitly so that it may be checked against the preceding sections.

The account is entered in constraint form. It states conditions under which an arrangement fails and it supplies no ordering over arrangements that satisfy them. The ground for this form is stated at length in the companion papers: an objective stated in generative terms licenses the very sentence such an account exists to refuse, since it makes the free unfolding of a system's dynamics into a reason, and a reason of that kind is available to justify the removal of whatever obstructs it (Huang, 2026a,d). The form has a precedent in the treatment of the internal morality of law as a set of constraints upon the enterprise of subjecting conduct to rules (Fuller, 1969).

Claim 20.1. (The refused inference). The sentence refused is this: because a site converts a great part of the passage between two orders, the site holds its position rightfully. The refusal is

required because the mechanism of §14 makes the antecedent easy to establish and the inference easy to draw. The companion paper on governance after allocation refuses the same inference in the form that authority is warranted because it lowers the cost of interpretation (Huang, 2026e).

Claim 20.2. (The criterion governing a site). A site that concentrates the conversion between two orders holds its position legitimately in the narrow sense available here while those whose orders it converts retain the standing to reopen the terms on which the conversion proceeds. The criterion is imported and is not derived from any of the mechanisms of this paper. Its ground is the interest an occupant of a position retains in entering an account of its own situation into a common record and in having that record revised (Huang, 2026a; Fricker, 2007).

Claim 20.3. (Asymmetry of the standing to reopen). The standing of Claim 20.2 is held by the party bearing the cost of the conversion, and it is directional for that reason. A criterion resting upon the collective reflection of all parties would be satisfied by an arrangement in which the majority is content, so the asymmetric form is required for the criterion to have work to do.

Claim 20.5. (The composition results supply no objective). Claims 17.5 to 17.8 state what a given sequence, a given exchange interval, and a given transfer operator exclude from an arrangement, and they supply no reason to exchange more often, to alternate precedence, or to adopt a preserving transfer. An arrangement exchanging continuously and preserving every magnitude may still close the path by which its terms are reopened, and it fails the criterion of Claim 20.2 on that ground alone. The results are diagnostic of what an arrangement has excluded, and the reason for reopening any exclusion is owed to the party bearing its cost.

Claim 20.4. (No trade across parties). No mechanism of this paper licenses the trading of one party's position against another's. Proposition 7.2 reports a quantity, the share of a flux, and that quantity enters no criterion here. An arrangement conducting a great volume of conversion while closing the path by which its terms may be reopened fails the criterion of Claim 20.2 without regard to the volume.

21 The Failure Modes of a Stratified Arrangement

This section states the modes in which an arrangement of the kind analysed here fails, takes four of them from the companion paper on relational crystallisation, and adds the mode that the mechanisms of this paper make visible. The method is to state each mode by the condition that has been lost and to identify the test that misses it.

The companion paper on relational crystallisation establishes four modes by which co-creation between two domains ceases: separation, in which exchange between them falls to zero; domination, in which one imposes its terms upon the other; homogenisation, in which the difference between them vanishes; and extinction, in which a domain ceases (Huang, 2026c). The companion paper on multi-nomoi governance adds redirection, in which a party continues to generate while doing so only in the register that passes the other's audit (Huang, 2026d).

Claim 21.1. (Spurious stability). A sixth mode is made visible by Claim 11.1. An arrangement

may return a stable verdict on every aggregate measure applied to it while the position of its slower order deteriorates, and the deterioration is undetected because the measure weighs contributions against one another. The mode is distinguished from the other five by the fact that its detection requires a change of observable and no change of standard.

Claim 21.2. (The exposure of each device). A device of non-conversion is exposed to separation, since it supplies no passage. A device of conversion into a common measure is exposed to homogenisation and to redirection. A device of conversion on a guarantee is exposed to the hardening of the guarantee into a rate, recorded in Claim 17.3. A device concentrating conversion at a site is exposed to the closure of the path by which its terms may be reopened, which is the condition of Claim 20.2. Every device is exposed to spurious stability where the arrangement is assessed on an aggregate.

22 The Boundaries of the Undertaking

This section states what the account holds of, states the conditions its statements require, and states what would have to be established before the account bears upon a particular arrangement. The method is to take the elements of the account in turn and to state the standing of each.

The physical results of §§3–8 are established in physical oceanography, and the computations reported here reproduce standard relations from the international equation of state and from published parameter values. They hold of seawater.

The transposed statements of §§11–17 hold of arrangements possessing the five features of Claim 9.1, and establishing that a given arrangement possesses them is a matter of evidence about that arrangement. The features left behind in Claim 9.2 mark where the transposition stops: an arrangement of normative orders admits no measured equation of state, no measured mixing efficiency, and no conserved quantity, so the transposed statements carry the form of the physical results and carry none of their numbers.

The readings of §§18 and 19 are readings of institutional devices through the mechanisms, and they establish nothing about the conduct of any polity or organisation. Their citation details are to be verified against the primary texts.

The normative content is confined to §20 and is imported from the companion papers with its ground stated there. The account rules arrangements out and supplies no ordering among those it admits, and it therefore leaves the question which of two admissible arrangements is preferable without an answer.

23 Open Questions

This section records the questions the account leaves unsettled, in the order in which the material raises them.

The first concerns the standing of separation. The companion paper on relational crystallisation treats separation as a failure mode, and the present paper treats sup-

pressed exchange as the maintained normal condition of a stratified system whose crossing is expensive. Whether the two accounts can be held together, and if so by what criterion an arrangement's low exchange is assigned to one description or the other, is undetermined, and the question bears upon every device of non-conversion in the companion paper's typology.

The second concerns which structure of persistence applies. Claim 16.3 states that the crystallographic and oceanic accounts describe different structures of persistence, and determining which applies to a given arrangement requires evidence about what would follow the withdrawal of what presently sustains it. No such evidence is offered here, and the means of obtaining it are undeveloped.

The third concerns the identification of the sites. Claim 14.1 states that passage may be concentrated, and identifying the sites within a given arrangement requires an observable for passage between orders. What that observable would be, and whether it can be constructed without the conversion into indicators that Claim 17.2 identifies as the moment of capture, is open.

The fourth concerns the individuation of the orders. The transposed statements presuppose that the orders within an arrangement can be told apart, and the companion paper on value conversion records the individuation of the relata as an open question there (Huang, 2026a). The present paper inherits it.

The fifth concerns the counterpart of the mixing efficiency. The physical relation (10) carries an empirical constant relating energy expended to transport achieved. Whether an arrangement admits any counterpart of that ratio, and what it would mean for one arrangement to convert effort into passage more efficiently than another, is open, and the question is delicate because a ratio of that form invites the treatment as a maximand that Claim 20.4 refuses.

The sixth concerns the coupled modes. Claim 17.1 states that a coupled arrangement supports developments belonging to neither order, and the physical case supplies an example in which the period of such a development is computed from transit times. Whether any counterpart of that computation is available for an institutional interface is undetermined.

The seventh concerns evidence for Claim 11.1. The claim states that an aggregate measure may pass over a constituent condition, and the physical case supplies a measured rate ratio from which the extent of the disagreement follows. An institutional counterpart would require a measure of the difference in checkability between two orders, and constructing one would face the difficulty recorded in the third question.

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