

Ontological Excess, Epistemic Partiality, and Operational Limitation in the Governance of Relational Change

A Preliminary Discussion of a Problem Class and Its Research Agenda

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Abstract

Governance theory has developed for fields whose participants can be addressed, whose extent can be represented by a governing party, and whose condition can be altered by that party's action. A class of governance problems satisfies none of these conditions. The relations between human activity and the wider natural and cosmic field are conducted within a field that substantially exceeds what any party represents, that a party alters in portions it cannot describe, and whose affected participants enter no deliberation. This paper constitutes that class and states a research agenda for it. The constitution proceeds in three steps. The conditions defining the class are stated and are grouped by whether each concerns the field, the governing party, or the relation between them. The conditions are then shown to be logically independent, so that the class is distinguished from the fields for which each condition has separately been treated. The traditions presently available are then examined, and for each the paper identifies the single condition the tradition assumes away: precaution assumes identifiable harm, resilience management assumes definable function, adaptive governance assumes learning fast relative to change, earth-system governance assumes a system boundary, and deliberative approaches assume discursive participation. The failure of each tradition on this class is accordingly traceable to a determinate assumption in place of to insufficient development. The paper then reports three results established for the class in companion work, offers them as evidence that the class supports argument, and sets out the questions that remain open, grouped by ontology, observation, operation and termination. The paper closes by stating the criteria by which progress on the agenda would be assessed, and it offers the constituted class, the traceability result and the assessable agenda as its whole contribution.

Keywords: environmental governance; epistemic limitation; criticality; non-discursive participation; research agenda; generative relational governance.

Draft. This is a working 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. Generative AI assistants (Anthropic’s Claude, OpenAI’s ChatGPT, and Google’s Gemini) were used extensively in preparing this manuscript: for literature survey, for drafting prose from the author’s specifications, for adversarial review of the argument, and for consistency and citation auditing and typesetting. No simulation or empirical figure is used in this paper, and its arguments are discursive throughout; the two tables summarise material argued in the text. 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 the primary sources before reliance.

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1 Introduction

This section states what the paper constitutes, states the claim by which the constitution is defended, states the evidence offered for the claim, and sets out the order of the argument. The method is analytical for the constitution of the class and the examination of the traditions, in Sections 3 to 6, and expository for the agenda, in Sections 7 and 8.

Governance theory has developed for fields exhibiting three properties: the participants can be addressed, the field can be represented, and the field can be altered. Under the first property, a party to a dispute can be summoned, a state can be a signatory, a firm can be licensed, and a population can be represented, so that the instruments of governance, which are addressed to parties, find parties to receive them. Under the second, a governing party can in principle survey the population it governs, and where its survey is incomplete the incompleteness is treated as a shortfall in its instruments. Under the third, a governing party can in principle reach what it governs, and where its reach is incomplete the incompleteness is treated as a limitation of its authority or its capacity. A field exhibiting all three admits the questions governance theory has posed, namely which party should hold authority, on what terms, subject to what constraint, and answerable to whom.

The subject of this paper is a class of governance problems exhibiting none of these three properties, and the relations between human activity and the wider natural and cosmic field are the principal members of the class. Addressability fails first: a migration corridor, an atmospheric composition, an orbital shell and a night sky are altered by human activity and answer none of it. Representability and reach fail together and for a common reason: no party represents such a field in the sense the second property requires, the failure follows from the situatedness of every describing party in place of from the state of its instruments, and every party alters portions of the field it holds no description of, so that the portions it alters and the portions it describes stand in no containment relation. This paper constitutes the class defined by that threefold failure, states what has been established for it, and states what remains open.

A paper constituting a problem class invites the objection that the class is a description of difficulty in place of a subject of study. The objection is answered by two claims, and the paper defends both. The first claim concerns the logical structure of the defining conditions.

Claim 1.1 (Independence of the conditions). The conditions defining the class are logically independent. Fields exist satisfying each condition while failing the others, and the traditions addressed to such fields have developed accordingly. The class is therefore distinguished from every field for which a condition has separately been treated, and it is distinguished by the conjunction in place of by any one condition.

The second claim concerns the traditions nearest to the class.

Claim 1.2 (Traceability of the failures). Each tradition presently available fails on this class through a determinate assumption it requires. Precaution requires that a harm be identifiable, resilience management that a function be definable, adaptive governance that learning proceed fast relative to change, earth-system governance that a system boundary be storable, and deliberative approaches that participation be discursive. The failure of each is

accordingly traceable to an assumption in place of to insufficient development, and a tradition developed further along its own line does not reach the class.

Of the two claims, Claim 1.2 carries the greater argumentative weight. A class on which existing traditions merely perform poorly is a class awaiting their improvement. A class on which each tradition fails through an assumption it requires is a class calling for work of another kind.

Beyond the two defending claims, a constituted class earns attention where results can be established for it, and three such results are reported in Section 6 from companion work. The first establishes a criterion allocating the burden of justification where a course would irreversibly foreclose the generative capacity of a trajectory other than the acting party's own, and establishes that the criterion fails to compose and that the repair carries the structure of the exception. The second establishes that the capacity to determine the state of such a system is acquired through use of it, so that the party best equipped to determine that a system stands near a critical value is the party such a determination favours. The third establishes that existing schemes hold developed doctrine for enabling, constraining and preventing a relational change, and hold no doctrine of withholding a possibility while retaining its availability, and derives the absence from the structure by which schemes report performance. The three are offered as evidence that the class supports argument and are not offered as a theory of it: each result is partial, each carries limits its own paper states, and Sections 7 and 8 state the questions they leave.

The order of the argument is as follows. Section 2 fixes the object, stating the scope, the relation to the companion papers, and the positions declined. Sections 3 and 4 constitute the class: the former states the conditions, grouped by whether each concerns the field, the governing party, or the relation between them, and the latter establishes Claim 1.1. Sections 5 and 6 examine the traditions and report the results: the former establishes Claim 1.2 and the latter reports the three results together with what each leaves open. Sections 7 and 8 state the agenda, the former setting out the open questions grouped by ontology, observation, operation and termination, the latter stating the criteria by which progress would be assessed. Sections 9 and 10 close, the former arguing the positions declined and the latter stating the limits.

2 Scope of the Account and the Restrictions It Accepts

This section fixes what the paper undertakes, states the restrictions confining it, states its relation to the companion papers, and states the positions the paper declines. Its role in the paper is boundary-fixing: every later section argues within the scope stated in this section, and the relation to the companion papers stated at §2.3 determines which of their results the constitution may cite. The section is arranged as follows: §2.1 fixes the object, §2.2 states the restrictions, §2.3 states the relation to the companion papers, and §2.4 announces the four positions declined, whose arguments Section 9 supplies.

2.1 The Object of the Account

The object is a class of governance problems, together with the questions the class raises and the traditions presently addressed to its members.

The paper undertakes three things. It states the conditions defining the class and establishes their independence. It identifies the assumption through which each available tradition fails on the class. It reports what companion work has established and states what remains.

The undertaking is deliberately confined: a comprehensive theory of governance for the class, an institutional arrangement, and the adjudication of disputes internal to the traditions examined all lie outside it.

2.2 Restrictions Accepted by the Account

The account is restricted in four respects, and each narrows what the constitution of the class may be taken to establish.

The first restriction is that the paper constitutes a class and assesses no member of it. Whether any particular arrangement governs its field well is a question the paper does not reach.

The second restriction is that the paper identifies assumptions and charges no error. A tradition requiring an assumption has developed under conditions in which the assumption held, and §9.1 declines the position that the traditions have erred.

The third restriction confines the paper to the class and the traditions addressed to it. The conditions of Section 3 may hold of fields outside the domain examined, and the paper asserts nothing about them.

The fourth restriction is that the paper reports results established elsewhere and re-argues none of them. A reader wishing to assess the results consults the papers establishing them, and §2.3 states the relation.

2.3 The Relation to the Companion Papers

Three companion papers establish results for the class, and the relation of each to the present paper is stated so the division is clear.

The first concerns the allocation of justificatory burden where a course would irreversibly foreclose generative capacity. The present paper reports its criterion, its failure to compose, and the structure its repair carries, and it re-argues none of these.

The second concerns the determination of a system's state where a governing rule depends on that state. The present paper reports its convergence result and the conditions it derives.

The third concerns the operations that existing schemes perform on relational change. The present paper reports its finding about the operation of withholding, and Section 7 carries forward the questions that finding leaves.

The present paper stands before the three in the order of exposition and after them in the

order of composition. The class was constituted in the course of establishing the results, and the constitution is offered in this paper in the form the results have given it.

2.4 The Positions Declined

Four positions are declined in the present subsection, and the argument for each declination is given in Section 9, after the results on which it depends have been established.

The first declination is of a novelty claim for any single condition. Each condition of Section 3 has been treated, several have substantial literatures, and the class's distinction lies in the conjunction, which is where Claim 1.1 places it.

The second is of a charge against the traditions. Each developed for fields in which its assumption held, Claim 1.2 concerns their reach onto this class, and their standing in their own domains is left as it was.

The third is of a priority among the open questions of Section 7. The grouping is by subject matter, and any ordering is left to the parties taking the questions up.

The fourth is of an institutional programme. A research agenda states questions and states the criteria by which answers would be assessed, §8 supplies the second, and the paper's undertaking ends there.

3 The Conditions Defining the Class

This section states the conditions defining the class. They are grouped by whether each concerns the field governed, the party governing, or the relation between the two, and the grouping performs argumentative work stated at §3.4. The section closes by stating what the enumeration withholds. Its role in the paper is constitutive: the conditions stated in this section are what the class consists in, and every later claim of the paper is stated over them. The section is arranged as follows: §3.1 states the conditions of the field, §3.2 the conditions of the governing party, §3.3 the conditions of the relation, §3.4 states the argumentative work the grouping performs, and §3.5 states what the enumeration withholds.

3.1 Conditions of the Field

Two conditions concern the field itself and hold whether or not any party governs it. Heterogeneity, which the companion papers state as a property of the field, is not among them, and §3.3 states the ground on which this paper states it among the conditions of the relation.

Nonlinearity with critical behaviour obtains where the response of the field to a perturbation depends on the field's condition, so that a perturbation absorbed in one regime propagates in another. A field of this kind carries values at which the character of its dynamics changes, and the change may be self-amplifying.

Openness obtains where the field contains relations not presently representable and admits participants and kinds not presently enumerated. A field satisfying this condition

is one whose description is revisable in its categories, and the revision arrives from the field in place of from the describer's refinement.

3.2 Conditions of the Governing Party

Three conditions concern the party and follow from its situation in place of from its instruments.

Epistemic partiality obtains where the portion of the field representable to the party stands properly within the field. The condition follows from the finitude and positionality of any representing system, so that improvement in instruments moves the boundary and leaves the containment in force.

Operational limitation obtains where the portion the party can alter by deliberate action stands properly within the field.

The crossing of the two obtains where neither portion contains the other. A party satisfying this condition may alter relations it holds no description of, and the absence of an observed consequence carries no evidential weight, since the party holds no representation under which the consequence would appear.

3.3 Conditions of the Relation

Four conditions concern the relation between the party and the field, and §3.4 states why these carry the constitution.

Heterogeneity obtains where no common measure over the participants of the field is available to the party, in the sense that the party holds no scale on which a foreclosure of one participant's capacity and an enlargement of another's may be compared. The companion papers state the condition as a variety of kinds within the field, and a statement of that form is unavailable: a field is one collection of kinds under one description and another under another, so an assertion of variety asserts nothing until a describing party is fixed. The companion synoptic paper treats the point at length and supplies the relational statement adopted in this paper.

Membership obtains where the governing party belongs to the field it governs. A party satisfying this condition governs a whole of which it is a part, and its acts of governance are among the field's own changes.

Non-discursive participation obtains where trajectories affected by the party's acts neither claim, consent, contest, nor render an account of what the acts did to them. A trajectory satisfying this condition may exhibit resistance, and the resistance takes a form the party must interpret in place of receive.

Asymmetry of address obtains where the party alters the field and the field addresses no demand to the party. The condition is distinguished from the preceding one in that a field might contain trajectories that neither speak nor are affected, and the present condition concerns those affected.

3.4 The Grouping and Its Consequence

The grouping of the conditions into those of the field, those of the governing party and those of the relation carries two consequences for the argument.

The first concerns where the class is novel. The conditions of §3.1 have been treated extensively, in ecology, in complex systems research and in the literatures on wicked problems [6], and the classification of open complex giant systems that the companion synoptic paper adopts states criteria for the variety of participant kinds within a field. The conditions of §3.2 have been treated extensively, in the tradition running from the knowledge problem through the analysis of legibility [7]. The conditions of §3.3 have been treated least, and Section 5 establishes that the traditions failing on the class fail on a condition drawn from this group in three cases of five.

The second concerns the order of dependence. The conditions of the second group follow in part from those of the first, since a field heterogeneous and open exceeds what any situated party represents. The conditions of the third group follow from neither, and a field may satisfy the first two groups while its participants address demands to the party throughout. Section 4 establishes the point by exhibiting such fields.

3.5 Exclusions from the Statement of the Conditions

Three matters lie outside the enumeration, concerning respectively thresholds, a condition omitted, and the arrangements the conditions do not reach.

The first is that the enumeration states conditions, the threshold at which each obtains being left open. Heterogeneity, partiality and openness admit degrees, the class is constituted by fields satisfying all nine substantially, and a measure of substantiality remains to be supplied. The unavailability of such a measure is itself an instance of the heterogeneity condition, since a measure of substantiality would range over the conditions and would require a scale common to them.

The second is that it omits self-adaptivity. Whether a field maintains or repairs itself absent intervention is a positive claim about its dynamics, it holds of some fields and fails of others, and Section 6 reports a result turning on a case where it fails. The property accordingly belongs among the matters to be established about a field in place of among the conditions defining the class.

The third is that it concerns fields, reaching no arrangement governing them. Whether a given arrangement is adequate to a field satisfying the conditions is a question Section 5 addresses for families of arrangements and for no arrangement in particular.

4 The Independence of the Conditions

This section establishes Claim 1.1. It states the form of the argument, exhibits fields satisfying the conditions of each group while failing those of the others, states the consequence for the constitution of the class, and states the limits of the argument. Table 1 assembles the exhibits.

Its role in the paper is defensive: Claim 1.1 is what blocks the reduction of the class to any established category, and without it the constitution would name nothing new. The section is arranged as follows: §4.1 states the form of the argument, §4.2 to §4.4 exhibit fields satisfying the conditions of one group while failing those of the others, §4.5 states the consequence for the constitution, and §4.6 states the limits of the argument.

4.1 The Form of the Argument

Claim 1.1 asserts that the conditions are logically independent, so that the class is constituted by their conjunction in place of by any one of them.

The argument is by exhibition. For each group of conditions, a field is exhibited satisfying that group substantially while failing at least one other group, together with the tradition that has developed for such fields. Where such a field exists and a tradition addresses it, the conditions of that group have been treated in separation from the others, and a claim to novelty resting on that group alone is unavailable.

The argument establishes independence and establishes no rarity. Fields satisfying all three groups are common, and the argument concerns what distinguishes them.

4.2 Fields Satisfying the Conditions of the Field Alone

A designed multi-agent system operating under laboratory control contains participants of many kinds and exhibits threshold behaviour, and its designer represents its components, reaches each of them, and holds a common measure over them by construction. The conditions of the first group therefore hold while those of the second fail, and complex systems engineering is the tradition addressed to such fields.

The exhibit establishes that variety of participant kinds and criticality are treated in separation from epistemic partiality, and it establishes that a claim to novelty resting on either alone would be unavailable.

4.3 Fields Satisfying the Conditions of the Governing Party Alone

A national economy satisfies epistemic partiality and operational limitation substantially. No governing party assembles the dispersed and partly tacit knowledge on which coordination rests, and no party reaches more than a portion of the activity. The conditions of the third group fail throughout, since the participants claim, contest, organise and address demands to the governing party continuously.

A second exhibit separates the two conditions of the second group from one another. A distant astronomical body is described by a settled model and is unreachable by any deliberate act. Operational limitation therefore holds while epistemic partiality fails, and the two conditions vary independently.

Table 1: Fields exhibited against the three groups of conditions, with the tradition addressed to each. A field satisfying one group substantially while failing another establishes that the conditions of the first have been treated in separation.

Field exhibited	Conditions of the field	Conditions of the governing party	Conditions of the relation, and the tradition addressed to the field
Designed multi-agent system under laboratory control	Satisfied: many kinds, coupled, threshold behaviour	Failed: the designer represents and reaches the whole	Failed. Complex systems engineering
National economy	Satisfied in part	Satisfied: dispersed knowledge, partial reach	Failed: participants claim, contest and address demands. Political economy and the knowledge-problem tradition
Distant astronomical body	Failed: describable by a settled model	Operational limitation satisfied, epistemic partiality failed	Failed. Observational astronomy
Animal welfare within an enclosure	Failed: small and representable	Failed: the keeper reaches the whole	Satisfied: non-discursive participation, asymmetry of address, no common measure. Animal ethics and welfare regulation
Human–nature and human–cosmos relations	Satisfied	Satisfied	Satisfied. No tradition addressed to the conjunction

4.4 Fields Satisfying the Conditions of the Relation Alone

Animal welfare within an enclosure satisfies non-discursive participation and asymmetry of address. The affected participants neither claim nor consent nor contest, and the keeper alters their condition while receiving no demand from them. The conditions of the first two groups fail, since the field is small, its participants are enumerated, and the keeper reaches each of them.

The exhibit is the one that bears most on the constitution of the class. It establishes that non-discursive participation has been treated in separation from ontological excess, that a substantial normative literature addresses it, and that a claim to novelty resting on the silence of the affected parties would be unavailable.

4.5 The Consequence for the Constitution of the Class

Each of the three condition groups, of the field, of the governing party and of the relation, has been treated in separation from the others, and each separation carries a tradition.

The class is accordingly constituted by the conjunction, and the questions it raises are

questions no tradition addressed to a separated group has had occasion to pose. A tradition addressed to heterogeneity under full representation asks how a complex system is designed. A tradition addressed to partiality under discursive participation asks how authority is distributed among parties who can object. A tradition addressed to silence under full representation asks what is owed to a participant that cannot claim. The conjunction asks what is owed to a participant that cannot claim, within a field the party cannot represent, by a party that belongs to the field and alters portions of it that it cannot describe.

4.6 Limits of the Independence Argument

Three limits attach to the argument, concerning respectively its method, the standing of its exhibits, and the question it leaves to Section 5.

The first is that the argument is by exhibition and establishes logical independence in place of statistical independence. Fields satisfying one group may in fact tend to satisfy others, and the tendency would bear on how the class is populated while leaving the constitution intact.

The second is that the exhibits are characterised qualitatively, so that the assignment of a field to a group admits dispute. A reader holding that an economy satisfies the conditions of the third group, on the ground that many affected parties are unable to make their claims heard, would relocate that exhibit, and §10.1 records the point.

The third is that the argument establishes that the conjunction has stood unaddressed; whether a tradition addressed to a separated group might be extended to reach it is a further question. Section 5 addresses that question directly and answers it for five traditions.

5 The Assumption Each Available Tradition Requires

This section establishes Claim 1.2. It states what it is for a tradition to require an assumption, examines five traditions in turn, identifies for each the assumption its central instrument requires and the condition of Section 3 that denies it, and assembles the result in Table 2. The section closes by stating what the argument withholds. Its role in the paper is comparative: Claim 1.2 establishes that the class is unowned by the traditions nearest to it, and the assembled result of §5.7 is what fixes the ordering of the agenda in Section 7. The section is arranged as follows: §5.1 states the form of the argument, §5.2 to §5.6 examine precaution, resilience management, adaptive governance, earth-system governance and deliberative approaches in turn, §5.7 assembles the result, and §5.8 states the exclusions.

5.1 The Form of the Argument

A tradition uses many assumptions and requires few, and the argument of this section concerns the assumptions a tradition requires.

A tradition requires an assumption where its central instrument is undefined without it. An instrument so placed does not operate poorly where the assumption fails; it has no object, and a party attempting to apply it has nothing to apply it to. The distinction determines what follows from the failure. Where a tradition merely uses an assumption, its development along

its own line may dispense with it. Where a tradition requires one, development along its own line reproduces the requirement.

Each subsection accordingly states the tradition's central instrument, identifies the assumption without which that instrument is undefined, and names the condition of Section 3 under which the assumption fails.

5.2 Precaution and the Identifiability of Harm

The central instrument of the precautionary family is a burden-shift triggered by the prospect of serious or irreversible harm under incomplete certainty.

The instrument requires that a harm be identifiable. The trigger refers to a harm, the seriousness that qualifies the trigger is a property of that harm, and a party invoking the instrument states what it apprehends. Where no harm can be stated, the trigger has no object, and the burden-shift has nothing to attach to.

The assumption fails under two conditions of the class. Openness supplies fields whose categories are revisable, so that a consequence of an act may be undescrivable in the terms available when the act is contemplated. Non-discursive participation supplies affected trajectories that render no account of what an act did to them, so that a harm occurring is not thereby stated. Sunstein's [8] objection to the strong formulation operates from within the assumption and reinforces the diagnosis, since a family whose trigger fires on every stated apprehension is a family whose instrument depends entirely on what can be stated.

5.3 Resilience Management and the Definability of Function

The central instrument of the resilience family is the assessment of whether a specified system function persists under disturbance, and the family's own formulation poses the question as resilience of what, and to what.

The instrument requires that a function be definable. A quantity said to persist must be specified before persistence can be assessed, and the specification fixes what the assessment is about. Walker and colleagues [9] distinguish resilience from adaptability and transformability, and each of the three is stated relative to a specified system identity.

The assumption fails under openness. A field admitting participants and relations not presently enumerated affords no fixed identity relative to which persistence is assessed, and a specification made at one time is superseded by the field in place of by the analyst's refinement. Holling's [5] founding distinction between resilience and stability presupposes an identified system throughout.

5.4 Adaptive Governance and the Rate of Learning

The central instrument of the adaptive family is a cycle in which an action is taken, its effect observed, and the next action revised on the observation [4].

The instrument requires that learning proceed fast relative to change, and it requires a second condition on which the first depends: that the effect of an action fall within what the

party observes. A cycle whose observation misses the effect revises on the wrong evidence, and a cycle completing after the field has moved revises toward a state that has passed.

The assumption fails under the crossing of epistemic partiality with operational limitation. A party whose reach extends beyond its representation produces effects outside the set within which it observes, and the absence of an observed effect carries no evidential weight. The cycle then closes on the portion of the field the party represents and leaves the remainder ungoverned by it.

5.5 Earth-System Governance and the Statability of a Boundary

The central instrument of the earth-system family is an analytical framework organising questions of architecture, agency, accountability and allocation with respect to a system [1], and the problem of institutional fit [10] states the requirement that an institution's boundaries correspond to those of what it governs.

The instrument requires that a system boundary be statable. Architecture concerns the arrangement of institutions across a system, allocation concerns distribution among the parties within it, and each presupposes that the system and its parties are delimited.

The assumption fails under two conditions. Openness supplies fields whose participants are not enumerated, so that the parties among whom allocation proceeds are not fixed. Membership supplies a governing party belonging to the field, so that the boundary is drawn by a party that is also among the governed, and the drawing is an act within the field it delimits.

5.6 Deliberative Approaches and the Discursiveness of Participation

The central instrument of the deliberative family is the derivation of legitimacy from the assent, actual or reconstructible, of those affected, and its ecological extension [2] seeks routes by which signals from the non-human world enter deliberation. Proposals to reconstitute the state on ecological lines [3] carry the same derivation.

The instrument requires that participation be discursive, and the requirement survives the substitution of representation for direct participation. A representative acts adequately where the represented could in principle confirm or reject the representation, and the criterion of adequacy refers to the represented party's capacity to do so.

The assumption fails under non-discursive participation. A trajectory that neither claims nor consents nor contests supplies no confirmation and no rejection, and a representative's adequacy is assessed by parties other than the represented. The family's extensions to the non-human world are attempts to repair exactly this, and the extensions substitute a criterion the represented party cannot apply.

5.7 The Assembled Result

Claim 1.2 is established for the five traditions. Three of the five fail on a condition drawn from the group of §3.3, which §3.4 identified as the least treated, and the remaining two fail

Table 2: The five traditions, the assumption each requires for its central instrument, and the condition of the class under which that assumption fails.

Tradition	Central instrument	Assumption required	Condition denying it
Precaution	Burden-shift on apprehended harm	A harm can be identified and stated	Openness; non-discursive participation
Resilience management	Assessment of persistence of a function	A function can be specified	Openness
Adaptive governance	Act, observe, revise	Learning fast relative to change, effects within what is observed	Crossing of epistemic partiality with operational limitation
Earth-system governance	Architecture, agency, allocation across a system	A system boundary can be stated	Openness; membership
Deliberative approaches	Legitimacy from assent, actual or reconstructible	Participation is discursive	Non-discursive participation

on openness and on the crossing.

One feature of the assembled result bears on the agenda of Sections 7 and 8. Openness appears in three rows, and it appears in each as the condition denying a specification the tradition requires: of a harm, of a function, of a boundary. A field whose categories are revisable by the field defeats every instrument requiring that something be fixed in advance, and Section 7 accordingly places the questions of individuation first.

5.8 Exclusions from the Argument

Three matters lie outside this section, concerning respectively the traditions examined, the charge the examination does not make, and the compositions it does not reach.

The first is that the section examines five traditions, Claim 1.2 being confined to the five. Commons theory, environmental law, environmental ethics and the customary systems recorded at §10.2 are treated in the companion papers or stand outside the examination.

The second is that it identifies assumptions and charges no error, since each tradition developed for fields in which its assumption held, and §9.1 declines the position that the traditions have erred.

The third is that the section establishes that development along a tradition's own line reproduces its requirement; hybrid arrangements stand outside the result, since where instruments from several traditions operate together the composition may reach cases none reaches alone, and an account of such compositions remains to be given.

6 The Results Established for the Class and Their Residues

This section reports three results established for the class in companion work, states for each what it leaves open, and establishes in Claim 6.1 a feature the three share. The section re-argues no result, and a reader wishing to assess any of them consults the paper establishing it. Its role in the paper is evidential: the three results reported in this section are the evidence that the class supports argument, and Claim 6.1 states the feature of the class they jointly exhibit. The section is arranged as follows: §6.1 states the form of the report, §6.2 reports the result on justificatory burden, §6.3 the result on the determination of system state, §6.4 the result on the operations, and §6.5 establishes Claim 6.1.

6.1 The Form of the Report

A result is established for a class where its argument uses the conditions defining the class and where its conclusion holds across the members. The three reported in this section satisfy the first requirement in a determinate way, and each subsection states which conditions the argument uses.

The reports are offered for the purpose stated in the introduction: a constituted class earns attention where results can be established for it. A constituted class earns attention where results can be established for it, and the three are evidence of that in place of a theory of the class.

6.2 The Allocation of Justificatory Burden

The first result concerns the conditions under which a party proposing a course carries the burden of justifying it. Where a course would irreversibly foreclose the capacity of a trajectory other than the acting party's own to continue generating, the burden falls on the party adopting the course, and below that threshold competing claims remain plural.

The argument uses epistemic partiality and operational limitation, since the criterion is constructed to be statable on information a party holds at the point of decision. It uses non-discursive participation, since the criterion constrains the acting party and requires no claim from the affected trajectory.

Three residues are recorded by the paper establishing it. The criterion fails to compose, so that a sequence of courses on none of which it fires may produce the foreclosure it exists to allocate a burden for. The repair that composition requires makes the governing rule a function of the field's dynamical state, and a rule of that form carries the structure of the exception. And the product of a course satisfying the criterion is an absence, so that a party performing it exhibits nothing.

6.3 The Determination of a System's State

The second result concerns the party competent to determine the state on which such a rule depends. The capacity to determine the state of a system of this kind consists in instruments,

records and observation sustained over a period, these are acquired in the course of using the system, and a determination that the system stands near a critical value contracts the permissions of parties whose use lies in prospect. The party best equipped to determine is accordingly the party the determination favours.

The argument uses nonlinearity with critical behaviour, since the determination concerns proximity to a value at which the character of the dynamics changes. It uses epistemic partiality, since the determination is made on partial evidence and admits reasonable disagreement among parties observing with different instruments.

Two residues are recorded. A public observational record of duration approaching the longest private one dissolves the convergence, and such a record must be established long before the arrangement requiring it. And the paper establishes that no party is positioned to check a determination while establishing nothing about whether checking would improve it.

6.4 The Operations Performed on Relational Change

The third result concerns what existing schemes do. A scheme acting on a possible relational change enables it, constrains it, prevents it, or withholds it while retaining its availability. Existing schemes hold developed doctrine for the first three and hold no doctrine of the fourth, and the absence follows from the structure by which schemes report performance.

The argument uses openness only weakly and uses membership and non-discursive participation substantially, since the withholdings at issue are performed for parties who are unenumerable and who render no account of any gain.

Two residues are recorded. A doctrine of the fourth operation requires a measure of what a performance preserved, and a measure ranging over preserved possibilities aggregates, which licenses a substitution the first result withholds. And a repair operating on doctrine alone leaves the reporting structure in place, so that the repair indicated operates on the constitution of the withholding as a recorded act.

6.5 The Feature the Three Results Share

Claim 6.1 (Common terminus of the three results). Each result terminates in an unavailability of the same form: what the governance act accomplishes, or what a determination about the field rests on, cannot be verified from the field by the party that would need to verify it. The first result terminates in an absence, since restraint leaves no product to exhibit. The second terminates in an unequal distribution, since the record supporting a determination is held by the party the determination favours. The third terminates in an indistinguishability, since a withheld possibility and a possibility no scheme addressed present the same configuration.

The claim identifies where the class is difficult, and the location is worth stating precisely, since it differs from the location the conditions of Section 3 suggest.

The conditions suggest that the difficulty lies in what a party can know about the field. Claim 6.1 locates it one step further on, in what a party can show about its own acts and about the acts of others. A field that exceeds representation produces, as a consequence, governance

acts that leave no trace by which they may be attributed, and the traceless act is what defeats the instruments of assessment, of contestation and of reporting alike.

Section 7 accordingly places the questions of record alongside the questions of individuation and ahead of the questions of operation.

7 The Questions the Class Leaves Open

This section sets out the open questions in four groups. The ordering follows two findings established in Sections 5 and 6: the pattern of §5.7, under which openness defeats every instrument requiring a prior specification, and Claim 6.1, under which the class's characteristic difficulty lies in what a party can show. The questions of individuation and of record accordingly precede the questions of operation and of termination. Its role in the paper is the agenda itself: the questions stated in this section are what the constituted class leaves open, and Section 8 supplies the criteria by which proposed answers would be assessed. The section is arranged as follows: §7.1 states the questions of individuation, §7.2 the questions of record and attribution, §7.3 the questions of operation, §7.4 the questions of termination, and §7.5 states the questions excluded.

7.1 Questions of Individuation

The questions of individuation concern what is counted, and the group is placed first because three of the five traditions examined fail on the impossibility of a prior specification.

The individuation of a trajectory is unsettled. The results reported in Section 6 quantify over trajectories, a course foreclosing the capacity of one may enlarge the capacity of another the same description would merge with it, and no criterion of identity for a trajectory has been stated.

The individuation of a change is unsettled. A development admitting description as one change or as many is treated as the description supplies, and the operations of the third result inherit whatever individuation a scheme employs.

The revisability of categories is unsettled in its consequences. A field supplying categories its describer did not hold defeats any instrument specifying a harm, a function or a boundary in advance, and no account states what an instrument robust to such revision would look like.

7.2 Questions of Record and Attribution

The questions of record and attribution concern what can be shown, and Claim 6.1 places the group alongside the first.

The constitution of a governance act as a recorded event is unsettled. Where the field affords no item by which an act is attributed, the act is available only from a record of its own making, and the conditions under which such a record is credited, contested and maintained are not stated.

The distribution of observational capacity is unsettled as a matter of justice. The second

result establishes that a rule keyed to a state observable by some parties and not others allocates argumentative burden by a prior allocation of instruments, and no account of what that prior allocation owes has been given.

The standing of observation held by parties whose knowledge takes a form the record does not receive is unsettled, and the question is partly owned already. Wynne [11] established that local observation sustained over long periods may carry standing that institutional assessment fails to receive, and that the failure is a defect of the assessment in place of a defect of the observation. Observation sustained over long periods by resident populations exists across the settings at issue, its relation to the records entering a determination is substantial, and the second result establishes that the credibility deficit attaching to a record-poor party is warranted while leaving open whether the deficit attaching to such observation is warranted at all.

7.3 Questions of Operation

The questions of operation concern what a governing party does, and three of them are stated here.

The composition of individually warranted courses is unsettled. The first result establishes that its criterion fails to compose and that neither available attribution rule is both invariant under ordering and proportionate to the loss, and no rule satisfying both has been proposed.

The measure of preserved possibility is unsettled, and the difficulty is stated sharply by the third result. A measure ranging over preserved possibilities aggregates, aggregation licenses the substitution of one foreclosure for two preservations, and a measure avoiding the substitution while supplying a report has not been constructed.

The composition of instruments drawn from several traditions is unsettled. Section 5 establishes that each tradition fails through an assumption it requires; arrangements combining instruments whose assumptions fail separately stand outside that result.

7.4 Questions of Termination

The questions of termination concern what ends a governance act, and the group is placed last because each of its questions presupposes an answer within the preceding groups.

The termination of a state-dependent rule is unsettled. The second result establishes that the record required to establish departure from a critical region exceeds the record that established approach to it, so that a rule whose relaxation is keyed to the state relaxes late without any party intending it.

The termination of a withholding is unsettled. The third result establishes that a withholding described as instrumental has its duration fixed by an end external to it and that a withholding performed for its own sake has no such end, and no condition of relaxation proper to the operation has been stated.

The distinction between a withholding correctly relaxed and a withholding abandoned is unsettled, and it is the question on which the preceding two converge. Where a withholding

lapses and the possibility is realised, the realisation enters the record as a development and the lapse enters nowhere.

7.5 The Questions Excluded from the Agenda

Two classes of question are excluded and the exclusions are stated so the agenda is not read as comprehensive.

Questions internal to the traditions examined are excluded. Whether the precautionary principle admits a coherent formulation, whether resilience is a depoliticising concept, and whether an ecological state is achievable are live questions within their literatures, and Section 5 takes no position in any of them.

Questions of institutional design are excluded. The three results reported supply conditions assessable against an arrangement and propose no arrangement, and §9.4 states the ground for the exclusion.

8 The Criteria by Which Progress on the Agenda Would Be Assessed

This section states what would count as progress on the questions of Section 7. A research agenda stating questions and supplying no criteria of assessment leaves each proposed answer to be judged by whether it appeals, and the criteria stated in this section are derived from the constitution of the class in place of being adopted for rigour. Its role in the paper is to make the agenda assessable: the criteria stated in this section are what distinguish an answer from a proposal that merely appeals. The section is arranged as follows: §8.1 states the ground of the criteria, §8.2 states the criterion of prior specification, §8.3 the criterion of exhibition, §8.4 the criterion of dynamical presupposition, and §8.5 states the standing of the three.

8.1 The Ground of the Criteria

Three criteria are stated and each follows from a result established in Sections 3 to 6.

The first follows from Claim 1.2, which establishes that a tradition fails on this class through an assumption its central instrument requires. A proposed answer importing an instrument that requires one of those assumptions has reproduced the failure, and the criterion accordingly examines what an answer requires to be specified in advance.

The second follows from Claim 6.1, which establishes that the class's characteristic difficulty lies in what a party can show. A proposed answer whose application depends on exhibiting something the field does not supply has not advanced past the difficulty, and the criterion accordingly examines what an answer requires to be exhibited.

The third follows from §3.5, which places self-adaptivity among the matters to be established about a field in place of among the class's conditions. A proposed answer holding only where a field recovers absent intervention has restricted its own scope, and the criterion accordingly examines what an answer presupposes about the field's dynamics.

8.2 The Criterion of Prior Specification

A proposed answer is assessed by what it requires to be specified before it operates.

An answer requiring that a harm, a function, a boundary, a set of participants or a set of possible changes be fixed in advance has adopted a requirement that openness denies, and Section 5 establishes that three of five traditions fail on exactly this. An answer surviving the criterion states its conditions over properties available at the point of decision.

The first result reported at §6.2 satisfies the criterion, since irreversibility of a proposed foreclosure is a property of the proposal assessable without an enumeration of what would be foreclosed. The criterion is thereby shown to be satisfiable, and §10.1 records that satisfiability establishes no adequacy.

8.3 The Criterion of Exhibition

A proposed answer is assessed by what it requires a party to exhibit, and the criterion sorts answers into two classes.

An answer requiring the exhibition of a preserved possibility, of an avoided foreclosure, or of a state the field does not display has adopted a requirement Claim 6.1 denies. An answer surviving the criterion either requires the exhibition of an act, which a record may supply, or requires no exhibition and states what follows for its assessability.

The third result reported at §6.4 satisfies the criterion in the second manner and states the cost, since it establishes that the operation it identifies admits no verification from the field and locates the repair in the constitution of the act. The second result satisfies it in the first manner and states the condition, since it requires a record and states the duration such a record must attain.

8.4 The Criterion of Dynamical Presupposition

A proposed answer is assessed by what it presupposes about the field's own dynamics.

An answer holding only where the field recovers absent intervention has restricted itself to fields satisfying a property the class does not include, and the restriction is frequently unstated. The doctrines of non-forcing supply the standing instance, since a counsel to refrain presupposes that the field left unforced continues generating.

An answer surviving the criterion states the dynamical conditions under which it holds. The first result reported at §6.2 satisfies it, since its criterion is stated over the irreversibility of a foreclosure and requires no assumption that any field recovers.

8.5 The Standing of the Criteria

The criteria are stated as conditions on a proposed answer and are not offered as a method.

Each is derived from a stated result, each is assessable against a proposal, and each is satisfiable, since the results reported in Section 6 satisfy them severally. A proposal satisfying all three has cleared the difficulties the class is constituted by, and §10.1 records that clearing

them establishes no adequacy on any further ground.

9 Positions Declined and the Arguments for Declining Them

This section argues the four declinations announced at §2.4. Each is stated at the strength its proponents would give it, the ground for declining it is derived from a result established in Sections 3 to 6, and the cost is stated. Its role in the paper is to discharge the four announcements of §2.4 with arguments, so that each declination stands on a stated result in place of on preference. The section is arranged as follows: §9.1 declines a charge against the traditions, §9.2 declines a novelty claim for any single condition, §9.3 declines a priority among the questions, and §9.4 declines an institutional programme.

9.1 The Declination of a Charge against the Traditions

The position declined holds that the traditions examined in Section 5 have erred, and that a tradition requiring an assumption the class denies has been constructed carelessly.

The ground for declining it is derived from §5.1. A tradition requires an assumption where its central instrument is undefined without it, and each tradition examined developed for fields in which the assumption held. Precaution developed where harms were statable, resilience management where functions were specifiable, adaptive governance where effects were observable. A tradition satisfying its own domain has done what its situation required.

The cost is that a party whose conduct might be corrected must be identified by other means, and §10.3 records the consequence for the prospect of an answer.

9.2 The Declination of a Novelty Claim for Any Condition

The position declined holds that the class is constituted by a condition previously unnoticed.

The ground for declining it is Section 4. Each group of conditions has been treated in separation from the others and each separation carries a tradition, and §4.4 records that non-discursive participation in particular carries a substantial normative literature addressed to fields the present class excludes.

The cost is that the paper's claim to constitute something rests entirely on Claim 1.1 and Claim 1.2, so that a reader defeating either has defeated the constitution.

9.3 The Declination of a Priority among the Questions

The position declined holds that an agenda should rank its questions, and that a paper declining to rank has left the reader without direction.

The ground for declining it is derived from §7.1. The ordering of the groups follows two established findings, and the ordering within each group follows the order in which the companion papers encountered the questions. Neither supplies a ranking by importance, and a ranking so supplied would rest on a judgement about which answers would matter most, which the paper holds no basis for making.

The cost is that a party choosing among the questions receives from the paper an ordering by dependence and no ordering by value.

9.4 The Declination of an Institutional Programme

The position declined holds that a paper constituting a governance problem class should propose the arrangements by which its members would be governed.

The ground for declining it is derived from Claim 6.1 together with the residues recorded at §6.2 to §6.4. Each result reported establishes a difficulty its own arrangement would inherit: a criterion that fails to compose, a determination whose competence converges with the interest it serves, and an operation whose performance admits no verification. An arrangement proposed before these are addressed would carry all three, and its adoption would furnish an appearance of settlement.

The cost of the four declinations taken together is the following. The paper constitutes a class, reports what has been established for it, and states what remains; a party presently governing a member of the class receives from it a description of its situation, and any arrangement must come from elsewhere.

10 The Limits of the Account

This section states the limits of the account in three classes and closes by stating the standing of the paper within the series. Its role in the paper is closing: it states what the constitution has not established, so that the class is carried forward at its warranted strength and no further. The section is arranged as follows: §10.1 states the limits internal to the constitution, §10.2 states the traditions omitted and the objection they carry, §10.3 states the prospect of an answer, and §10.4 states the standing of the paper within the series.

10.1 Limits Internal to the Constitution

Four limits attach to the constitution itself, running from the statement of the conditions to the criteria by which answers would be assessed.

The first is that the conditions of Section 3 admit degrees, and the threshold at which each obtains remains to be supplied. A field satisfying all nine weakly and a field satisfying all nine substantially are both members on the statement given, and the questions of Section 7 arise with different force in each.

The second is that the assignment of the exhibits in Section 4 admits dispute. A reader holding that a national economy satisfies the conditions of §3.3, on the ground that many affected parties are unable to make their claims heard, would relocate that exhibit and would thereby narrow the separation the argument requires. The objection is substantial, it bears on the boundary between participation that is non-discursive and participation that is silenced, and the paper does not settle it.

The third is that Claim 1.2 is established for five traditions and is asserted for no others. A tradition omitted from Section 5 may reach the class, and the omissions are recorded at §5.8.

The fourth is that the criteria of Section 8 are satisfiable and are not shown to be jointly sufficient. A proposal clearing all three may fail on grounds the class does not raise, and §8.5 records the point.

10.2 The Traditions Omitted and the Objection They Carry

The survey of Section 5 omits customary and indigenous governance systems, and the omission carries an objection to the paper's central move.

Such systems are reported to perform governance of fields satisfying the conditions of Section 3, over long periods, with accounts of what the governance accomplishes. Where such an account states what is owed to a participant that renders no claim, within a field its holders do not represent exhaustively, the class has been addressed and Claim 1.2 would require restatement: the traditions constituting contemporary environmental and orbital governance would fail on the class while traditions addressing it exist elsewhere.

Two cautions attach to the examination that would settle the matter. An account rendered in terms proper to a tradition is not assessed by criteria drawn from another, and the criteria of Section 8 are derived from within the present constitution. And the assimilation of such accounts into a framework built elsewhere is contested on grounds concerning the standing of the parties whose accounts are assimilated, which the second result reported at §6.3 bears on directly and which the paper does not adjudicate.

10.3 The Prospect of an Answer

The paper constitutes a class on which each available tradition fails through an assumption it requires, and §9.1 declines to charge the traditions with error. The two together carry a consequence for what an answer would be.

An answer cannot consist in the correction of a tradition, since no tradition has erred within its domain. It cannot consist in the extension of a tradition along its own line, since Claim 1.2 establishes that such extension reproduces the requirement. And Claim 6.1 establishes that it cannot consist in improved observation alone, since the difficulty lies in what a party can show about acts in place of in what it can know about the field.

What remains is the construction of instruments whose conditions are stated over properties available at the point of decision, whose application requires the exhibition of acts in place of states, and whose scope is stated in terms of the dynamics they presuppose. The three results reported in Section 6 are instruments of that kind, each partial and each carrying residues its own paper states.

10.4 The Standing of the Paper within the Series

The paper stands before the three companion papers in the order of exposition and after them in the order of composition, and §2.3 records the consequence.

Its claims are accordingly of two kinds. Claim 1.1 and Claim 1.2 are established in this paper and stand independently of the companion results. Claim 6.1 is established from those

results and inherits their limits, so that a reader defeating any of the three would qualify it.

The agenda of Section 7 is offered in the form the results have given it, and a reader for whom the constitution holds while the results do not would retain the questions of §7.1 and §7.2 and would lose the grounds on which they were placed first.

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