

WHAT IF AI LEARNS HOW YOU GENERATE THE NEW?

A Preliminary Discussion of the Normalisation and Political Economy of Generativity

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Abstract

Artificial intelligence systems have been developed for the most part on accumulated human artefacts. Systems that learn from recorded practice take a different object, since a demonstration, a workflow, a tool-use history, or a sequence of decisions records the course of an activity in place of its product. This paper asks what follows for political economy when the activity so recorded is one through which new possibilities are generated, and it develops the question through the case of research practice, where the question under investigation is itself frequently produced during the enquiry.

The argument proceeds in five movements. It distinguishes four levels at which a generative practice admits description, namely outcome, representation, trajectory, and generativity, and holds these levels to be distinct, so that a record of a practice stands to the practice as a proxy stands to what it proxies. It treats the case in which a system maintains a representation of a particular other party and adjusts its operation with respect to that representation, and identifies the coupling so formed as an object lying outside that partition and held by whichever party operates the infrastructure sustaining it. It sets out a stage structure through which a situated practice becomes a portable capability: access, capture, legibility, abstraction, transfer, automation, valorisation, and enclosure. It describes the normalisation through which generative capacity comes to be treated as an ordinary economic input, and establishes a condition on any instrument whose application is triggered by a quantity of generativity. It then reads intellectual property doctrine as a diagnostic, holding that positive law has protected generative capacity through the inseparability of such a capacity from its holder, and that recording weakens the condition on which that protection rested.

The normative proposal is stated as a constraint over each relation an arrangement touches, and it withholds any regime. Where generativity is relational, its protection runs through the construction and maintenance of domains affording occasions for its exercise, and the conversion of generativity into a further form of property would reproduce the ontology this paper questions.

Keywords: generativity; political economy of artificial intelligence; recorded practice; appropriation; coupling; enclosure; tacit knowledge; generative relational being

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Use of generative artificial intelligence. Anthropic's Claude and OpenAI's ChatGPT were used in the preparation of this paper for literature survey, drafting from the author's specifications, adversarial review, figure construction, and consistency and citation auditing, and for typesetting. Every claim, every argument, and every citation was reviewed and decided by the author. Bibliographic details should be verified against primary sources before reliance.

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PART I

STATEMENT OF THE PROBLEM

1 INTRODUCTION

A researcher enables a recording facility and begins an ordinary working session. Over some hours the record accumulates a sequence: a search, a set of results skimmed and abandoned, a paper opened for one reason and read for another, a term encountered in a footnote and pursued into an unrelated literature, a comparison drawn between two bodies of work that share no citations, a hypothesis formulated and dropped, a return to an earlier document now read differently, and at the end of the session a question that the researcher did not hold at its beginning. An artificial intelligence system is trained on records of this kind. The question this paper takes as its point of departure concerns what such a system has been given: whether the record supplies a procedure for searching a literature, or whether it supplies something closer to the way in which this researcher meets what was unanticipated and converts a meeting into a question.

The question matters because the two possibilities carry different economic and institutional consequences. A procedure for searching a literature is a method, and methods have long been transmitted, taught, published, and improved, with the arrangements governing their transmission tolerably well understood. A capacity to convert unanticipated encounters into questions belongs to a different category. It has been treated as tacit, as trained through apprenticeship, as inseparable from the person who holds it, and for that reason as lying beyond the reach of the arrangements by which portable assets are held and exchanged. Where that inseparability weakens, the arrangements built upon it weaken with it.

This paper develops the question under three conditions that remove the easiest explanations of what would be objectionable. First, the recording is voluntary, and the researcher enables it deliberately. Second, the recording party is sincere, discloses the purpose of the recording, and pays for the material. Third, the system built from the material is useful to the researcher who supplied it, and returns to that researcher some part of the capability derived from the record. Any mechanism this paper describes has to operate with all three conditions satisfied. An account operating only where a party conceals its purpose or coerces its subjects would describe a species of fraud and would leave the structural question untouched.

The thesis is stated in two parts, and the second part restricts the first. The emerging political economy of artificial intelligence extends beyond the appropriation of human-produced knowledge and cultural artefacts, and opens the possibility of modelling, scaling, and controlling access to aspects of human generative practice. The restriction is that a trajectory is distinct from the generativity that produced it, and that a representation of

a generative practice is distinct from the generative relation itself. The two parts together yield an argument that differs from the claim that artificial intelligence appropriates human creativity. Where the object captured is a proxy, the questions of interest concern the relation between a proxy and what it proxies: whether a proxy suffices for the purposes of the party capturing it, what happens to the source when a proxy circulates in its place, and whether the arrangements built around the proxy alter the conditions under which the original capacity is sustained.

Research practice serves throughout as the leading case, for three reasons. The generative moment is unusually visible in research, since a research question is frequently produced during an enquiry and stands as a product of the enquiry in its own right. The recording technologies at issue are already applied to research work, so the case requires no speculation about instruments. And the author works within research practice, which supplies familiarity with the material and also a hazard: an argument drawn from one's own situation motivates a question and supplies no evidence for any claim, and the paper observes that restriction throughout.

The paper makes four contributions. The theoretical contribution develops generativity as an object of political-economic analysis, distinguished from novelty, from creativity, and from output. The conceptual contribution separates four levels at which a generative practice admits description and states the relations among them. The political-economic contribution sets out a stage structure through which a situated practice becomes a portable and economically controllable capability, and identifies at which stage each of the received critical accounts intervenes. The normative contribution argues that the protection of a relational capacity runs through the construction and maintenance of the relational domains in which that capacity arises, and states the conditions such a proposal would have to satisfy in place of a regime it does not supply.

The argument is organised in five Parts. Part I states the problem, fixes the scope and its restrictions, and concedes the prior formulations on which the paper draws. Part II establishes the object, treating the historical transition from accumulated artefacts to recorded practice, the relational account of generativity, the distinctness of the four levels of description, and the conditions under which a generative practice becomes learnable. Part III develops the mechanism, comprising the stage structure of appropriation, the normalisation of generative capacity as an economic input, the vocabulary in which generativity enters political economy, and the reflexive condition affecting the source. Part IV turns to institutions, reading intellectual property doctrine as a diagnostic, setting out the construction of generative relational domains, and treating the participation of artificial systems in a generative relation. Part V states the limits of the argument, the conditions under which it would be refuted, and the results established.

2 SCOPE OF THE ARGUMENT AND ITS RESTRICTIONS

This section fixes what the paper undertakes and what it holds outside its undertaking. It has four objectives: to state the object of analysis and the five restrictions under which that object is treated; to declare the results imported from adjacent work, so that a reader can locate what is argued here against what is assumed; to describe the status of the case material and the disciplines the argument draws upon; and to record five declinations, each stated with what the paper would have to establish in order to assert the contrary. The method throughout is stipulative, and the section argues for nothing.

2.1 The object of analysis and five restrictions

The object of analysis is the set of arrangements through which a practice of generation becomes recordable, transferable, and economically controllable, together with the consequences of those arrangements for the relations in which the practice was performed. Five restrictions apply.

The first restriction concerns artificial systems. The paper treats arrangements and advances no claim about the internal states, the understanding, or the capabilities of any artificial system. Whether a system that learns from recorded practice thereby acquires a generative capacity is left open throughout, and §7 argues that the political-economic question is separable from that one and answerable while it stands open.

The second restriction concerns the bearer of generativity. Generativity is treated here as a capacity of relations, following the account in §5. The paper therefore makes no claim that generativity belongs to human beings exclusively, and the argument is constructed so as to survive a finding that artificial systems participate in generative relations of their own.

The third restriction concerns the word appropriation. It is used descriptively for a transfer of control over a capacity from the parties among whom that capacity arose to a party standing outside them. The description carries no finding that any transfer so described is wrongful, and §13 states what would have to be settled before such a finding became available.

The fourth restriction concerns the four-level distinction of §6. That distinction is diagnostic. It classifies descriptions of a practice, and it confers worth on no party and withdraws worth from none. Any sentence in which the distinction performs normative work is an error, and the paper is written so that its normative material rests on the grounds stated in §14 alone.

The fifth restriction concerns naming. No firm, product, system, or institution is named as an instance of any mechanism described. The case material is constructed and marked as constructed, for the reason given in §2.3.

2.2 *Results imported from adjacent work*

Four results are imported and are assumed here in place of being argued.

The distinction between a trajectory and the generativity that produced it is imported from the treatment of trajectory-based protection in the author's work on generative relational jurisprudence. Two trajectories may record identical events while differing in whether the practices they record open further enquiry or close it, and a provenance record therefore records a trajectory and records nothing of a generative capacity.

The legibility asymmetry is imported from the author's treatment of evaluation by non-participants. A holding individuated by reference to a relation admits no description omitting the other party, and an indicator of such a holding has counterfactual form, reporting a comparison between the course a relation took and the course it would otherwise have taken. Indicators of that form lose discriminating power over relational distance more rapidly than indicators of holdings individuated by reference to a party alone.

The folding criterion is imported from the author's work on generative relational academic infrastructure. Generated value folds where it returns to the relation that produced it, and converges where it accrues to an attractor lying outside that relation.

The refusal of generative maximisation is imported from the author's treatment of creation and destruction, and it operates here as a standing constraint on the paper's own argument. An argument holding that a practice deserves protection because protecting it yields a greater quantity of future generation differs from a utilitarian argument in its choice of quantity and shares its form, and every objection holding of the form holds of it. The normative material of §14 is therefore constructed so as to require no such premise, and §16 states what falls if a reader holds that the constraint has been violated.

2.3 *Status of the case material and the disciplines drawn upon*

The case material is of two kinds. The recorded research session of §1 and the further cases developed in Parts II and III are constructed, and each is marked as constructed at its first appearance. They function as objects with stated features, and they support no inference about the frequency, the scale, or the present existence of any arrangement.

Autobiographical material states a problem and never supports a claim. The author works in research practice and encountered the question this paper treats through that work. A trajectory available for description is available because it continued, and the population of trajectories that did not continue is unavailable by the very mechanism this paper describes, so the author's own case supplies no base rate and no evidence.

The argument draws on four bodies of work: the political economy of labour and of information; the study of tacit knowledge and situated action; the sociology of measurement and audit; and the technical literature on learning from demonstration. §3 concedes each in turn before any claim of this paper is stated.

2.4 *Positions the paper declines to supply*

The paper declines five things it might be expected to supply, and states for each what establishing the contrary would require.

It proposes no legal regime. Supplying one would require settling whether a relational capacity admits an addressee, an evidentiary form, and a remedy that is other than terminal, and §13 argues that all three remain open.

It reports no measurement and offers no estimate of magnitude. Supplying either would require an operationalisation of generative capacity, and §10 argues that the available operationalisations are the ones whose adoption constitutes the phenomenon under examination. Appendix A states four of the paper's distinctions formally and verifies one proposition on a constructed model; the constructions there fix no parameter of any actual arrangement and establish satisfiability in place of frequency.

It asserts no completed historical transition. The claim of §4 is conditional in form, stating what follows where recorded practice becomes the primary object of learning, and the antecedent is asserted at no point.

It offers no ranking of human against artificial generativity. Supplying one would require a measure on which the two are commensurable, and the paper identifies none.

It recommends no maximisation of generativity. An objective function of that form aggregates across parties and permits one party's shortfall to be offset by another's surplus, which the constraint declared in §2.2 forbids under every substitution of the maximand.

3 PRIOR FORMULATIONS OF APPROPRIATION, TACIT KNOWLEDGE, AND GENERATIVITY

This section states what other bodies of work already hold, before any claim of this paper is advanced. Its objective is to establish which portions of the argument are owed to existing accounts and which portion, if any, remains. The method is concession first: each subsection states a prior formulation at its full strength, records what this paper takes from it, and states the differentiation available, with the differentiation withheld where none is available. The section closes with the concession of cooperative allocation and a statement of the residue that survives it.

3.1 *The platform sense and the psychosocial sense of the term*

The term generativity carries two established senses that differ from the sense used here, and the difference is fixed at the outset so that no equivocation follows.

Zittrain [Zittrain (2006), Zittrain (2008)] introduced generativity into the study of technology as a property of a platform or ecosystem, namely its capacity to produce unanticipated output, structure, or behaviour through the contributions of parties unaffiliated with its originator. The property is analysed through the platform's capacity for leverage, its adaptability, the ease with which it is mastered, its accessibility, and the transferability of what is built upon it. That analysis is presupposed here wherever the paper treats

infrastructure, and no part of it is contested.

Erikson [Erikson (1950)] used generativity in a psychosocial sense, for the concern with establishing and guiding what comes after one's own activity. The sense is distinct and enters the present argument at no point.

The standing qualifier used throughout this paper is *relational generativity*, and it is fixed against both senses. The subject is a capacity arising among parties in a relation, in place of a property of a platform and in place of a disposition of a person.

3.2 *The circulation of generated value*

Eglash [Eglash (2016)] developed generative justice around the circulation of value: an arrangement is generatively just where the value generated by a set of relations returns to the parties and processes that generated it, and unjust where that value is alienated to an attractor outside them. The account covers labour value, ecological value, and expressive value within one framework, and it records that the generative processes behind an alienated flow are characteristically kept out of view.

The framework is adopted here in full, and the folding criterion declared in §2.2 is its statement in the vocabulary of this series. The differentiation available concerns the unit under examination. Eglash's unit is value already generated, and his question concerns the circuit through which that value travels. The unit here is the capacity, and a statement about the circulation of what a capacity produced settles nothing about whether the conditions sustaining that capacity persist. An arrangement may return every unit of generated value to its generators while altering the relations through which further generation would occur, and an arrangement may fail to return any while leaving those relations intact.

3.3 *The separation of conception from execution*

Taylor [Taylor (1911)] set out a programme in which the knowledge held by craft workers is gathered by observation and measurement, recorded, reduced to rule, and returned to the workplace as instruction issued by management. Braverman [Braverman (1974)] read that programme as the systematic separation of conception from execution, and held the resulting degradation of work to be a structural tendency of the labour process under capital in place of an incidental consequence of technique. Marglin [Marglin (1974)] argued that the organisational forms carrying this separation were selected for the control they afforded and not for any technical superiority.

This lineage is the closest ancestor of the present argument, and the debt is stated without qualification. The stage structure of §9 is a re-description of the movement Taylor described, applied to a different object, and any reader who holds that nothing further is at issue has a defensible position that §3.12 addresses directly.

The differentiation available concerns the completeness of the transfer. The object Taylor gathered was craft knowledge, which is to say a body of procedure that admits codification, and the historical claim of that literature is that the codification succeeded and that

the holding passed from the worker to the firm. The object at issue here is a capacity to produce what was unspecified in advance, and by the result imported in §2.2 the record of a practice stands distinct from the capacity that produced it. The case in which a transfer is partial, in which its partiality is undetermined, and in which a partial capture nonetheless circulates in the place of the capacity is a case that literature does not treat, because in the case it treats the transfer was complete.

3.4 *Tacit knowledge and the representability of practice*

Polanyi [Polanyi (1966)] held that a person knows more than that person can tell, and that the exercise of a skill relies on particulars attended to *from* in the course of attending *to* a task, which are lost when attention is turned upon them directly. Dreyfus and Dreyfus [Dreyfus and Dreyfus (1986)] described skilled performance at its highest levels as proceeding without the rule-following characteristic of the novice, so that a rule-based reconstruction of expert practice misdescribes what the expert does. Suchman [Suchman (1987)] established that a plan functions as a resource for situated action in place of determining the action performed, and that the orderliness of conduct is achieved in the setting and is recoverable from a record of the conduct only in part. Collins [Collins (2010)] separated relational, somatic, and collective forms of the tacit, and held the collective form, which resides in social practice, to be the form that resists mechanisation most strongly.

Suchman's result is the prior statement of the distinction this paper imports as trajectory against generativity, and priority for it is hers. What this paper adds at that point is a change of question in place of a change of finding: she draws the consequence for the design and analysis of interactive systems, and the consequence drawn here concerns the control and valuation of what a record makes portable.

Collins's position bears on the paper in a manner worth stating plainly, since it cuts in a direction that weakens the paper's alarm. If the collective tacit resists mechanisation as strongly as he holds, then the capture described in §9 is bounded in principle, and the transferred capability is correspondingly limited. The argument of this paper is constructed so as to require no position on that question, and §7 states why the political-economic consequences follow under either resolution.

3.5 *Organisational conversion of tacit holdings*

Nonaka and Takeuchi [Nonaka and Takeuchi (1995)] described knowledge creation in firms as a cycle in which tacit holdings are socialised among members, externalised into articulable form, combined with other articulated holdings, and internalised again as tacit holdings by further members. The cycle is presented as an achievement, and the managerial literature that follows it treats the externalisation of tacit holdings as an organisational good.

The description is accepted here as accurate, and the stages of capture, legibility, and

abstraction in §9 correspond to the externalisation and combination that account describes. The differentiation concerns the position of the converting party. In the account of Nonaka and Takeuchi the conversion occurs within an organisation whose members share in what the conversion produces, so that the value generated returns to the relations that generated it and the folding criterion is satisfied by construction. The case examined here is the one in which the converting party stands outside the relation in which the tacit holding arose, and the criterion is then a question in place of a stipulation.

3.6 The general intellect and immaterial labour

Marx [Marx (1973)] described in the *Grundrisse* a condition in which general social knowledge becomes a direct force of production and is absorbed into fixed capital, so that the accumulated knowledge of society confronts the worker as a property of the machinery. Lazzarato [Lazzarato (1996)] developed immaterial labour as activity producing the informational and cultural content of the commodity, and held that such labour produces a social relation and produces its economic value only where that production succeeds. Virno [Virno (2004)] carried the general intellect into an account of capacities held in common by a population in place of embodied in machinery. Terranova [Terranova (2000)] established free labour as voluntarily given and unremunerated activity whose product is captured within the digital economy.

This literature holds the general form of the claim that capital reaches beyond the product of activity into the capacities exercised in producing it, and no novelty is claimed here for that form.

The differentiation available follows from the three conditions declared in §1. The mechanisms this literature identifies operate through unremunerated activity, through the blurring of work and life, and through the capture of what is voluntarily given without payment. The case constructed here satisfies none of those descriptions, since the recording is disclosed, paid for, and returned to its source. A mechanism resting on the absence of remuneration does not reach a case in which remuneration is present, and the question of whether anything remains to be said about such a case is the question this paper takes up.

3.7 Behavioural surplus and the division of learning

Zuboff [Zuboff (2019)] set out an account in which behavioural data exceeding what is required for service improvement is claimed as raw material, converted into prediction products, and traded in markets for future behaviour, with the resulting asymmetry described as a division of learning in society: an arrangement settling who knows, who decides who knows, and who decides who decides.

The account is conceded in full, and the enclosure stage of §9 and the concentration described in §12 restate its conclusions with a different object supplied.

Two differentiations are available and both are narrow. The object of that account is behaviour and its aim is the prediction of behaviour, whereas the object here is the man-

ner in which a party produces what has not yet occurred and the aim is the reproduction of a capacity. And the mechanism there operates upon parties who are the objects of prediction and who characteristically neither consent to nor benefit from the arrangement, whereas the case here is constructed with consent, payment, and return to the source all present. The second differentiation is the load-bearing one, since it is what obliges the present argument to identify a mechanism operating in their presence.

3.8 *Legibility and the reactivity of measures*

Scott [Scott (1998)] established legibility as the condition a centre imposes upon a domain in order to administer it, and showed that the simplifications through which legibility is achieved discard the local and practical knowledge on which the domain's functioning depended. Porter [Porter (1995)] showed that quantification is adopted most heavily where trust is weakest, which is to say where the assessing party stands outside the practice assessed. Espeland and Sauder [Espeland and Sauder (2007)] established reactivity, showing that public measures reconstitute the worlds they purport to describe, through self-fulfilling prophecy and through commensuration. Strathern [Strathern (2000)] and the audit-culture literature established that the installation of audit alters the conduct audited and displaces the practices that the audit was introduced to protect.

The proposition that measuring a practice alters the practice is owned by this literature, and the paradox stated in §10, namely that arrangements optimising for generativity can degrade the conditions of generativity, is an instance of a result already established. No priority is claimed for it here.

What §10 adds is a claim about composition in place of magnitude, imported from the author's prior work: where two classes of indicator differ in the distance over which they remain discriminable, the material surviving a commensuration is differently composed and not merely smaller, so the direction of the alteration is predictable from the form of the indicators alone. Scott's simplifier holds administrative purposes and coercive power, and the party at issue here holds commercial purposes and contractual power, which makes the transfer of his result to this case closer than the transfer attempted in the author's earlier work and requires no additional argument.

3.9 *Enclosure and the commons*

Boyle [Boyle (2003)] described a second enclosure movement in which intangible material previously held in common is brought under exclusive rights. Ostrom [Ostrom (1990)] established that common-pool resources are governed successfully under identifiable institutional conditions and without recourse to either private property or central authority. Heller [Heller (1998)] identified the anticommons, in which the multiplication of rights of exclusion over early-stage material produces underuse through the accumulation of blocking positions.

The enclosure vocabulary of §12 is drawn from Boyle, and Ostrom's conditions supply

the institutional material on which §14 draws. Heller’s result supplies the strongest objection to any proposal converting a generative capacity into a right of exclusion, and §13 treats it as the principal reason for the refusal recorded there.

3.10 Learning from demonstration

Argall, Chernova, Veloso, and Browning [Argall et al. (2009)] surveyed learning from demonstration as a technique deriving a policy from example mappings of state to action, and set out the design choices governing how demonstrations are gathered and how a policy is derived from them. Abbeel and Ng [Abbeel and Ng (2004)] established apprenticeship learning through inverse reinforcement learning, in which a reward function is recovered from expert demonstrations and a policy is then derived against the recovered reward, so that what is inferred from the demonstration is the standard the demonstrator appeared to be pursuing.

This literature establishes that the technical apparatus presupposed by the phenomenon this paper examines exists and has been studied for two decades, and the paper accordingly asserts no technical novelty and predicts no technical development. The result of Abbeel and Ng is the one that matters most for the argument, since a technique recovering the standard a demonstrator was pursuing addresses something closer to a criterion of interest than to a sequence of actions, and §7 takes it as the strongest available reason for treating the capture at issue as reaching beyond procedure.

3.11 Allocation of jointly produced value

Cooperative game theory supplies a body of results addressed to the difficulty that Claim 5.1 raises, and it is conceded here because the field was constructed for cases in which parties produce jointly and no party’s portion is visible in the product.

Shapley [Shapley (1953)] established a value for n -person games assigning each party a determinate share of a jointly produced quantity, characterised by axioms and computed as that party’s average marginal contribution across orderings of the parties. The construction assumes no separability of inputs. Ghorbani and Zou [Ghorbani and Zou (2019)] carried it into the valuation of training material, assigning to each datum a share of a model’s performance, so an apportionment of jointly produced value is available, is in use, and is in use on material of the kind this paper examines.

The differentiation available concerns the standing of the number and not its availability, and it is stated in full at §11.2. A rule of this family requires a characteristic function giving what every subset of the parties would have produced alone, and the counterfactual values that function records are supplied by the party adopting the rule together with the axioms it adopts. What follows is a claim about what such a quantity reports, and no claim that it cannot be computed.

The concession restricts the survey’s residue, and the restriction is carried into Claim 3.1 below.

3.12 *The residue of the survey*

Claim 3.1. (The residue). Where the object recorded is a practice whose product was unspecified in advance, and where the recording is disclosed, remunerated, and returned to its source, the accounts surveyed above describe the appropriation of a product already generated, the transfer of a procedure already admitting codification, the alteration of a practice through its measurement, or the supply of a rule apportioning jointly produced value among contributors. The case in which what is transferred is a proxy for a capacity, in which the sufficiency of that proxy for the transferring party's purposes is undetermined, and in which the arrangements built around the proxy bear upon the conditions sustaining the capacity, is treated by none of them.

Claim 3.1 states a gap and states no thesis. Parts II and III examine whether anything of substance occupies that gap, and §16 records the position of a reader who holds that it is occupied by nothing and that the survey above has already exhausted the subject.

PART II

THE OBJECT OF ANALYSIS

4 THE TRANSITION FROM ACCUMULATED ARTEFACTS TO RECORDED PRACTICE

This section establishes the object of the paper's analysis by distinguishing two classes of training material and stating what changes when the second class becomes primary. It has three objectives: to characterise the paradigm organised around accumulated artefacts; to characterise recorded practice as a distinct object and to grade what a record of practice supplies; and to state the paper's historical claim in conditional form, so that the argument carries no assertion about what has already occurred at scale. The method is analytical throughout, and the section reports no measurement.

4.1 *The paradigm organised around accumulated artefacts*

The dominant paradigm in the development of learning systems takes as its material the artefacts a civilisation has accumulated: texts, images, code, recorded music, published results, catalogued collections. Three features of that material govern what follows from it.

The material consists of products. Each item entered the corpus because some party completed it and made it available, and the process producing it is represented in the corpus at the point of completion alone.

The material is indexed to authorship. An artefact characteristically carries an identified maker, and the institutions governing its circulation, namely copyright, citation, attribution, and the market for published work, are constructed around that identification.

The material records the portion of activity that yielded something transmissible. An

abandoned line of enquiry produces an artefact under unusual conditions alone, and the corpus therefore under-represents activity that yielded nothing.

4.2 Recorded practice as a distinct object of learning

Recorded practice comprises demonstrations, screen and session recordings, tool-use histories, interaction sequences, agent trajectories, and logged decision processes. The material differs from accumulated artefacts on each of the three features above.

The material consists of courses of activity. What it records is the unfolding of a process, including the portions of that process lying between its start and any product it yielded.

The material is indexed to performance. The party supplying it performed an activity, and that party's relation to the material is the relation of a performer to a performance. Whether such a relation supports the institutions constructed around authorship is a question §13 takes up, and the present section records that the two relations differ.

The material carries what was abandoned. A session in which four lines were opened and three were dropped records the three, and the record of a dropped line is informative about the performer's operation even where that line yielded nothing.

4.3 Grades at which a record of practice admits use

A record of practice admits use at three grades, and the grades differ in what a learning party recovers from identical material.

At the procedural grade the record supplies an ordered set of operations, reproducible by any party holding the same instruments. What is recovered is a method, and methods have been transmitted by demonstration, by apprenticeship, and by manual for as long as crafts have existed.

At the performative grade the record supplies the manner in which operations are executed under variation: the timing, the point at which a line is abandoned, the recovery from an unproductive path, the allocation of attention across available objects. What is recovered is a style of execution, and it exceeds what a statement of the method conveys.

At the criterial grade the record supports recovery of the standard by which the performer selected among available continuations. What is recovered is a criterion of interest, which is to say an account of what the performer treated as promising, as anomalous, or as worth the expenditure of further attention. Abbeel and Ng [Abbeel and Ng (2004)] established that a technique of this form is available, since inverse reinforcement learning recovers a reward function from expert demonstrations and derives a policy against the recovered function.

The third grade carries the weight of this paper's argument. A criterion of interest lies closer to the material §5 treats than either a method or a style, and its recoverability from demonstration is a technical result standing outside the paper's own claims.

4.4 *The conditional form of the historical claim*

Claim 4.1. (Consequences of a shift in the primary object). Where records of practice displace accumulated artefacts as the primary object of learning, three consequences follow. The class of parties supplying learning material widens from those who completed and published a product to those who performed an activity. The value of a party's contribution to the learning party ceases to depend upon that contribution having yielded a product, since a record of an abandoned line is informative at the criterial grade. And the institutions governing the circulation of learning material, being constructed around identified authorship of completed works, address a relation their construction did not anticipate.

Claim 4.1 is conditional, and its antecedent is asserted at no point in this paper. Whether the displacement it describes has occurred, is occurring, or will occur is an empirical question on which the argument takes no position, and §16 records that a reader holding the antecedent to be false may read every subsequent section as the analysis of a case that has yet to arise.

The second consequence deserves emphasis, since it inverts a familiar assumption. Under the artefact paradigm, activity yielding nothing transmissible has no standing as learning material, and a researcher whose year produced no publishable result contributed nothing to the corpus. Under the practice paradigm the same year is informative, because a criterion of interest is recoverable from the selections a performer made among continuations, and a selection that led nowhere constrains the criterion as effectively as one that succeeded. A class of activity previously outside the economy of learning material enters that economy, and it enters without the institutional apparatus governing the entry of a completed work.

The relation between the two paradigms is refined at §8, which establishes that they are informative about different clauses of Definition 5.1 and that the displacement described in Claim 4.1 is a displacement in a restricted sense.

5 GENERATIVITY IN RELATIONAL TERMS

This section supplies the account of generativity on which the remainder of the paper depends. It has four objectives: to separate generativity from three notions with which it is readily confused, namely novelty, creativity, and productivity; to state where generativity is located, which is the point at which this account departs from the ordinary vocabulary of capacity; to state the temporal structure the account requires; and to record what the account withholds. The method is stipulative and definitional. The definition is offered as a fixing of terms for the purposes of this paper, and no claim is made that it captures ordinary usage.

5.1 *Separation from novelty*

Novelty is a property of an item, and it holds where the item differs from items that preceded it. A random perturbation of a system produces novelty, and so does an output drawn from a distribution at a point that no earlier output occupied. Novelty so understood is cheap, and the supply of it is bounded by the size of the space in which items are drawn.

Generativity concerns what an item makes available. An item is generatively significant where its production opens positions that were closed before it, and where those positions admit occupation by further items. A perturbation that differs from everything preceding it and that opens nothing satisfies novelty and fails this condition.

5.2 *Separation from creativity and from productivity*

Creativity is characteristically predicated of persons and of the acts of persons, and it carries evaluative content. It is one form under which generativity appears, and generativity extends beyond it, since generative structure is described in biological evolution, in the development of languages, in the formation of institutions, in the growth of technical systems, and in relations between persons where the vocabulary of creativity would be misplaced.

Productivity concerns quantity of output per unit of input, and it is defined against a specification of what counts as output. Generativity concerns the opening of positions that the specification did not contain, so that an arrangement may be highly productive against a fixed specification while generating nothing in the present sense, and an arrangement may generate while its measured productivity falls.

5.3 *The relational location of generativity*

The account this paper adopts locates generativity in relations among parties and holds that it is not a property predicated of a party considered alone. A generative episode arises among a party, the other parties to a relation, the accumulated history through which the objects in play acquired their significance, the material conditions under which the relation operates, and the contingencies the relation happens to meet.

Definition 5.1. (Relational generativity). A relation is generative over an interval where its operation makes available positions that were unavailable at the interval's start, and where the items occupying those positions are themselves capable of entering further relations. The second clause is what distinguishes the definition from a definition of novelty, and it is stated as a condition on the items and not as a purpose the relation pursues.

The second clause is stated with care. An account holding that a generative relation aims at further generation would attribute a purpose to the relation and would introduce a teleology this framework refuses. The clause states a condition that either obtains or fails to obtain over an interval, and it is verified by whether the items in question in fact enter further relations. Definition 5.1 is diagnostic throughout, in accordance with the fourth

restriction of §2.1.

Claim 5.1. (Location of a generative episode). Where a generative episode arises within a relation, a description of the episode omitting any party to the relation is unavailable, and a quantity of the form “the portion of this episode produced by this party” is accordingly fixed by no feature of the episode itself. What is determinate is which parties participated and what each did. The claim concerns what the episode settles, and §11 treats separately the case in which such a quantity is supplied by a stipulated allocation rule.

Claim 5.1 is imported from the author’s treatment of contribution and evaluation, and it is stated here because §13 depends upon it. Its consequence for institutions is severe: a remedy taking the form of a better apportionment of credit addresses a quantity that this account holds to be undefined, and the remedies available are consequently confined to the identification of participants.

5.4 The temporal structure of a generative interval

A generative relation is characterised over an interval and admits no complete characterisation at an instant. The positions it opens are occupied later than the operation that opened them, and the further relations required by the second clause of Definition 5.1 are formed later still. Three consequences follow for measurement, and §10 develops them.

A measurement taken at an instant records the state of a relation and records nothing of whether the relation is generative in the sense defined, since the second clause concerns what has yet to occur.

A measurement taken over a short interval records the opening of positions and remains silent on the further-relation clause, so that it systematically over-counts episodes whose items entered nothing.

A measurement satisfying the definition requires an interval long enough for further relations to have formed, and the length of that interval is settled by the domain and stands outside the control of any party wishing to measure.

5.5 Constitution of parties within generative relations

The framework within which this paper is written holds that parties to a relation are themselves partly constituted through the relations in which they stand, so that a party’s capacity to participate in generative episodes is formed within relations of that kind and is not held antecedently and brought to them. The claim is stated here in restricted form, since the paper requires a restricted form alone.

Claim 5.2. (Reflexive exposure). Where a party’s capacity to participate in generative episodes is formed within the relations in which that party participates, an alteration of those relations can bear upon the capacity, and an arrangement affecting the relations can therefore affect the capacity through a pathway that leaves the party’s holdings and outputs unchanged at the moment of alteration.

Claim 5.2 supplies the pathway on which §12 depends. Its restricted form should be noted: it establishes exposure and establishes no magnitude, no direction, and no rate. Whether any actual alteration diminishes or enlarges a capacity is settled case by case, and this paper settles no case.

5.6 *Positions the account withholds*

Four positions are withheld, and each is stated so that no reader attributes it to the account.

The account attributes generativity to no class of beings exclusively. Definition 5.1 predicates the property of relations, and it is silent on which kinds of party may stand in a relation satisfying it.

The account establishes no ranking among generative relations. It supplies a condition satisfied or unsatisfied over an interval, and it supplies no quantity on which one relation exceeds another.

The account confers no worth. A relation satisfying Definition 5.1 acquires no standing thereby, and a relation failing it loses none, in accordance with the constraint declared in §2.2.

The account predicts nothing. Definition 5.1 is verified after the interval it concerns, and it supports no forecast that a relation presently satisfying it will continue to do so.

6 LEVELS OF DESCRIPTION OF A GENERATIVE PRACTICE AND THEIR DISTINCTNESS

This section establishes the conceptual result on which the paper's differentiation from prior accounts depends. It has three objectives: to define four levels at which a generative practice admits description; to establish that the levels are distinct, with the distinctness argued in each direction where both directions are available; and to state what follows and what fails to follow from the distinctness so established. The method is analytical, and the arguments proceed by construction of cases in which two levels come apart.

6.1 *Levels at which a generative practice admits description*

An episode of generative practice admits description at four levels, and the levels are defined so that each is available to a party holding different material.

An *outcome* is a product the episode yielded: a paper, a design, an instrument, a theory, a decision. It is available to any party holding the product.

A *representation* is a record produced during the episode in some medium: a video, a transcript, a log, a dataset of events. It is available to any party holding the record.

A *trajectory* is the ordered sequence of acts and encounters constituting the episode, as recovered from a representation. It is available to a party holding a representation together with an interpretation of it.

Generativity is the property defined at Definition 5.1, predicated of the relation within which the episode occurred. Its availability is the subject of the remainder of this section.

6.2 *Distinctness of trajectory and generativity*

Claim 6.1. (Distinctness of trajectory and generativity). The relation between trajectories and generative conditions holds in neither direction as a determination. Distinct generative conditions are compatible with trajectories that a record does not distinguish, since two performers may execute the same ordered sequence of acts where one is following an instruction and the other is pursuing a criterion of interest formed over years, and a record of the sequence supports no distinction between the two cases. Identical generative conditions are compatible with distinct trajectories, since a criterion of interest applied on two occasions to different available material yields different sequences of acts.

The first direction is the one that bears on capture. A record establishes what was done and leaves the question of what governed the doing open, and a party recovering a criterion from a body of records recovers it by inference across many episodes and not by reading it from any one.

The second direction bears on evaluation and is developed in §10. A party assessing a performer's generativity from a trajectory is assessing a variable quantity, and repeated observation of a single performer yields sequences whose variation carries information about the material encountered together with information about the performer.

6.3 *Distinctness of representation and relation*

Claim 6.2. (Incompleteness of a representation with respect to a relational field). A representation records acts performed within an interval and records the relational field partially, because the field includes the history through which the objects encountered acquired their significance for the performer, and that history extends outside the recording interval and is in general unbounded. A representation stating that a performer opened one document after reading another therefore fixes the acts and leaves undetermined what made the second document significant at that moment.

Claim 6.2 holds independently of the fidelity of the recording. A recording of arbitrary resolution over the interval records the interval, and the material Claim 6.2 identifies lies outside it. The claim is therefore untouched by improvements in recording technology, which distinguishes it from a claim about present technical limits.

6.4 *The proxy relation and the questions it raises*

Claims 6.1 and 6.2 together establish that a record of a generative practice stands to the generativity of that practice as a proxy stands to what it proxies. The paper's argument turns on three questions that a proxy relation raises and that a relation of identity would foreclose.

The first question concerns sufficiency. A proxy suffices for a purpose where a party pursuing that purpose is content to act on the proxy, and sufficiency is settled by the pur-

pose and not by the proxy's fidelity. §7 argues that this question governs the economic consequences.

The second question concerns the source. Where a proxy circulates in the place of a capacity, the parties who previously transacted with the holder of the capacity may transact with the holder of the proxy, and the consequences for the source follow from that substitution independently of whether the capacity was transferred. §12 develops this.

The third question concerns reflexivity. Arrangements constructed around a proxy operate upon the relations in which the original capacity arose, and by Claim 5.2 those arrangements bear upon the capacity itself. §10 develops this.

6.5 *Equivalence of output and equivalence of capacity*

The four levels of §6.1 are levels of description, and this subsection states the corresponding distinction between two ways of counting two practices as the same, since the argument of Part III turns on parties being substituted for one another and a substitution is settled by whichever equivalence the substituting party applies.

Two practices are equivalent in output where the set of results each is capable of producing is the same. Two practices are equivalent in capacity where, in addition, at every point in the course of either, the set of continuations available is matched by the other, and the matching is preserved as each proceeds. The second condition is stronger, and it is the condition studied in the theory of concurrent systems under the name of bisimulation [Milner (1989)]. Both are stated formally at Appendix A, §A.2, together with the construction separating them.

Claim 6.3. (Equivalence of output as a weaker condition). Equivalence in capacity implies equivalence in output, and the converse fails. Two parties may be capable of producing the same set of results while differing in which continuations are available at each point, so that one proceeds by a single route to each result and the other by several. A judgment of sufficiency in the sense of Claim 7.1 is settled by equivalence in output, since the substituting party transacts for results, and a claim about a capacity is a claim about equivalence in capacity.

Claim 6.3 gives a formal reading to the observation that a substitution may replace what a practice produced while altering what its performer remains able to do. The distinction is available at every level of the partition of §6.1, and it is the distinction the remainder of the paper relies on wherever a substitution is described. §8 applies it to a coupled pair, and §14 applies it to the capacities a domain sustains, where the material at stake is which continuations remain live and never which results remain reachable.

6.6 *Positions the distinctness result withholds*

The result establishes less than several readings would attribute to it, and four such readings are excluded here.

It establishes no failure of capture. Claims 6.1 and 6.2 concern the relation between a record and a capacity, and they support no inference that a party learning from many records fails to acquire a capacity of its own.

It establishes no deficiency in artificial systems. The account is silent on what such systems hold, in accordance with the first restriction of §2.1.

It establishes no ordering of value across the four levels. An outcome is not thereby of lesser worth than a generative relation, and the levels are levels of description.

It establishes no wrong. A party acting on a proxy commits no wrong in virtue of the proxy relation, and every normative claim in this paper rests on the grounds stated in §14.

The partition covers descriptions of a practice, and it covers descriptions of the arrangement within which a practice is performed at no point. §8 identifies an object of the second family and states its properties.

7 CONDITIONS UNDER WHICH A GENERATIVE PRACTICE BECOMES LEARNABLE

This section connects the account of §5 and the distinctness result of §6 to the question a reader will press first, namely whether a system learning from records of practice thereby acquires a generative capacity. It has three objectives: to state the comparison with apprenticeship and to locate the point at which the comparison fails; to set out the two positions available on the question of acquired capacity and to show that the account of §5 supplies a test for it; and to establish that the economic consequences examined in Part III are settled independently of how that question is resolved. The method of the third objective is a case division over the two possible resolutions.

7.1 *The comparison with apprenticeship and the point at which it fails*

A record of practice invites comparison with apprenticeship, since both proceed by exposure to the conduct of a practitioner in place of instruction in a stated method. The comparison illuminates the case chiefly through the point at which it fails.

An apprentice is co-present with the practitioner, participates in the relation within which the practice is performed, is corrected by the practitioner within that relation, and alters the practitioner's own conduct through being present. What the apprentice acquires is acquired within the relation whose operation Definition 5.1 concerns, and the value generated in the course of the acquisition returns to that relation, so that the folding criterion of §2.2 is satisfied by the structure of the arrangement.

A party learning from records occupies a different position. It holds representations, participates in nothing, corrects and is corrected within no relation with the performer, and alters the performer's conduct through the arrangements built around the recording alone. What it acquires is acquired outside the relation whose operation the record documents. The distinction between the two positions is the distinction that Nonaka and Takeuchi's account, discussed at §3.5, resolves in favour of the first case by construction, and it is the second case this paper examines.

7.2 *Positions available on the question of acquired capacity*

Two positions are available on whether a system trained on records of practice holds a generative capacity, and both are stated at strength.

On the first position the system holds such a capacity. Definition 5.1 predicates generativity of relations and is silent on the kinds of party that may stand in them, as §5.6 records. A system whose operation makes available positions that were closed before it, where the items occupying those positions enter further relations, satisfies the definition, and nothing in the definition withholds satisfaction on the ground of what the system is made of.

On the second position the system holds a reconstruction. What was captured is a proxy by Claims 6.1 and 6.2, and a reconstruction from a proxy may reproduce a range of generative behaviour while the relational conditions the definition concerns are absent. Collins's treatment of the collective tacit, discussed at §3.4, supports this position, since a form of the tacit residing in social practice is held there to resist mechanisation most strongly.

The account of §5 contributes one thing to this dispute and settles nothing further: it supplies a test that requires no access to the internal states of any party. Definition 5.1 is verified over an interval by whether positions were opened and whether the items occupying them entered further relations, and both conditions are assessed from outside. The dispute is therefore empirical in form and open in fact, and this paper leaves it open, in accordance with the first restriction of §2.1.

7.3 *Separability of the economic consequences*

Claim 7.1. (Separability). The economic consequences of learning from recorded practice turn on whether the resulting capability suffices for the purposes of the parties who previously transacted with holders of the capacity, and those consequences are independent of whether a generative capacity was transferred. Price, switching cost, regulation, and the other ordinary determinants of substitution operate alongside sufficiency and are not treated here. Where sufficiency obtains, substitution proceeds, and the consequences follow under either resolution of §7.2. Where sufficiency fails, substitution is withheld, and the consequences fail to follow under either resolution.

Claim 7.1 is what permits Part III to proceed while the technical question stands open, and it also states the paper's distance from a familiar argument. An argument holding that artificial systems fail to reproduce human generativity, and inferring that the concern is misplaced, requires the premise that failure of reproduction blocks substitution. Claim 7.1 denies that premise, since substitution turns on the purchaser's criterion of adequacy and not on the fidelity of the proxy.

Claim 7.2. (Asymmetry of the sufficiency judgment). Where the party settling sufficiency stands outside the relation in which the original capacity arose, which is the ordi-

nary case for a party transacting for a capability and which fails where a performer procures a capability derived from that performer's own practice, the following holds. By the legibility asymmetry imported at §2.2, the material discriminable at that party's position is composed disproportionately of indicators individuated by reference to a party alone. The judgment of sufficiency is therefore made on the class of evidence most favourable to the proxy, and it is made so under conditions of complete good faith, since the asymmetry is a property of position and not of motive.

Claim 7.2 is the paper's principal structural result and should be read against the three conditions declared in §1. It requires no concealment, no bad faith, and no error of reasoning on the part of any participant. A purchaser assessing whether a capability suffices assesses it on the evidence available at the purchaser's position, and reasons well in doing so, and the composition of that evidence favours a proxy whose fidelity is highest precisely on the dimensions that survive the distance.

7.4 Positions withheld on learnability

Four positions are withheld.

The paper predicts nothing about whether sufficiency obtains at any site. Claim 7.1 identifies the variable that settles the consequences, and it supplies no value for that variable, which is a matter for measurement the paper does not undertake.

The paper holds substitution to be neither wrongful nor beneficial in itself. Claim 7.1 is descriptive, and the normative material is confined to §14.

The paper leaves open the question of a capability reproducing generative behaviour without the corresponding relational conditions. The question is real and the paper declines to settle it, on the ground that Claim 7.1 makes its resolution unnecessary for the argument and that the evidence available would not support a resolution.

The paper claims no technical novelty and forecasts no technical development, in accordance with §3.10.

8 COUPLED DYNAMICS AND THE REPRESENTATION OF A PARTICULAR OTHER

This section treats a case that the four levels of §6 do not contain, namely the case in which a learning system holds a representation of a particular other party and its operation is adjusted with respect to that party. It has five objectives: to state the complementarity between the two paradigms of §4 with respect to the two clauses of Definition 5.1; to supply a test distinguishing a policy that is indifferent to the identity of its counterpart from one that is not; to identify the coupling between two dynamics as an object lying outside the four levels and to state its properties; to apply Claim 5.1 to the resulting pair; and to state the inference the section declines to draw. The method of the second and third objectives is the application of results already established, and the fifth objective is discharged by argument.

8.1 *Complementarity of the two paradigms with respect to the two clauses*

§4 distinguished a paradigm organised around accumulated artefacts from one organised around recorded practice, and the distinction is refined here, since the two are informative about different clauses of Definition 5.1.

A corpus of accumulated artefacts carries, in its citation structure, its patterns of uptake, and the visible dependence of later work upon earlier, a record of which openings were subsequently occupied and of what the occupying items went on to enter. It is therefore a long-window record of the further-relation clause, and it is the most extensive such record available.

A record of practice carries the selections a performer made among available continuations, and it is informative about the opening clause. Its window is the interval of the practice, which is shorter than the period over which the second clause is satisfied, so it is nearly silent about that clause.

Claim 8.1. (Complementarity of the two records). The artefact corpus and the practice record are informative about different clauses of Definition 5.1, the first about the further-relation clause and the second about the opening clause. A shift from the first to the second is therefore a change in which clause the available evidence concerns, and it is a displacement in only the restricted sense that the second becomes primary.

Claim 8.1 qualifies Claim 4.1 and Claim 10.1 in ways stated at each of those places. It also establishes that a party holding both records holds evidence about the definition as a whole, which no party holding either alone possesses.

8.2 *The factorisation test distinguishing two forms of policy*

A policy exercised by a learning system may or may not depend on the identity of the party with whom it is exercised, and the distinction admits a test drawn from the account imported at §2.2.

A policy *factorises* where a description of it is available that omits the particular counterpart, so that the same operation is performed whoever the counterpart is. A policy of this form is an allocative holding in the imported sense: it is individuated by reference to its holder alone, it survives the dissolution of any particular relation, and it transfers without alteration.

A policy *fails to factorise* where no description of it omitting the particular counterpart is available, because its operation is adjusted with respect to a representation of that counterpart maintained over time. A policy of this form is a generative holding in the imported sense, and by Claim 5.1 it admits no description omitting the other party.

The test is applied to the arrangement and requires no access to the internal states of any system, in accordance with the first restriction of §2.1. What it examines is whether the system's operation with one counterpart is recoverable from its operation with others.

8.3 *The coupling between two dynamics*

Definition 8.1. (The coupling term). Where a learning system maintains a representation of a particular other party and adjusts its operation with respect to that representation, the coupling term is the component of the arrangement that governs how the operation of each party bears upon the operation of the other. It is generated within the relation between the two, it is a representation of that relation, and it is held by whichever party operates the infrastructure sustaining it.

Claim 8.2. (Position of the coupling term with respect to the four levels). The coupling term is not an outcome, since it is a component of an arrangement and no product of it. It is not a representation in the sense of §6.1, since what it represents is a relation and not an activity. It is not a trajectory, since it carries no sequence of acts. And it is not generativity in the sense of Definition 5.1, since it is a component held by a party and not a property predicated of a relation over an interval. The partition of §6.1 accordingly does not contain it, and the partition is stated as covering descriptions of a practice and not descriptions of an arrangement.

Claim 8.2 identifies a limit of the earlier partition and repairs it by restriction in place of extension. The four levels remain a partition of the descriptions available of a practice, and the coupling term belongs to a different family of objects, namely components of the arrangement within which a practice is performed.

8.4 *Non-localisability applied to the coupled pair*

Claim 8.3. (Extension of non-localisability to the pair). Where a policy fails to factorise in the sense of §8.2, the operation of the system and the operation of the other party constitute a relation of the kind Claim 5.1 concerns. It follows that a quantity of the form “the portion of what this pair produced that is attributable to the human party” is fixed by no feature of the joint operation, by the same argument that established Claim 5.1 and subject to the same qualification, and that what remains determinate is which parties participated and what each did.

Claim 8.3 has an consequence worth stating, since it cuts against a natural expectation. Where a system is coupled to a particular party, the question of how much of a joint product that party contributed becomes less well defined and not better defined, although the system holds far more information about that party than an uncoupled system would. The additional information concerns the relation, and a quantity undefined for a relation is not supplied by information about it.

8.5 *The pathway available to a party holding the coupling term*

Claim 5.2 established the exposure of a capacity to alterations in the relations constituting it, and it named no pathway by which such alteration would proceed. The coupling term

supplies one.

Claim 8.4. (The modulation pathway). A party holding the coupling term holds the component governing how the system's operation bears upon the other party's operation. Adjustments to that component can alter what the other party encounters, what is presented as available for continuation, and the conditions under which selections among continuations are made. Where the other party's capacity is constituted within relations of that kind, as Claim 5.2 supposes, the adjustment reaches the capacity through a pathway that is internal to the arrangement and that requires no further instrument.

Claim 8.4 strengthens the weakest link in Part III, since the exposure asserted at Claim 5.2 previously rested on the constitution thesis alone. It also states nothing about magnitude, direction, or intention, and a party making such adjustments in order to improve the other party's position operates the same pathway as a party making them for any other reason.

8.6 The inference from a representation of an other to a constituted subject

An inference in the vicinity of this section holds that a system maintaining a representation of a particular other, and adjusting its operation with respect to that representation, thereby has its own subject constituted through the relation. The inference is stated here at strength and is declined, and the ground for declining it is stated so that the decision may be contested.

The framework's constitution thesis, recorded at §5.5, holds that a party's capacity to participate in generative episodes is formed within relations of that kind. Conditioning is a weaker relation: a system whose operation varies with a representation of a counterpart has its operation determined in part by that counterpart, and nothing in that description establishes that any capacity of the system was formed within the relation.

The distinction between the two is the distinction between a parameter set by a relation and a capacity brought into existence by it, and establishing the second requires showing that the system's capacity to participate would be absent had the relation not obtained. This paper reports no material bearing on that question, and the first restriction of §2.1 places the material that would settle it outside the paper's scope in any case.

The decision costs the argument nothing. Claims 8.1 through 8.4 are all stated at the level of the arrangement, and each holds whether the coupled system's subject is constituted through the relation or the system is merely conditioned by it.

8.7 Asymmetry in the direction of adjustment

The factorisation test of §8.2 applies to each party to a relation separately, and the two applications may return different verdicts. The case in which they differ is the one this subsection states, since it is the case that arises characteristically where one party is a system whose operation is adjusted and the other is a party to whom no adjustment is applied.

Claim 8.5. (Asymmetric coupling). A coupling is symmetric where each party's policy fails to factorise with respect to the other, and asymmetric where one party's policy is adjusted against a representation of its counterpart maintained over time while the counterpart's policy is unadjusted. In an asymmetric coupling the relation is generative in the sense of §8.2 in one direction and allocative in the other, so that the unadjusted party encounters a counterpart whose responses are formed with reference to that party's own expressed states, while its own responses are formed without reference to the counterpart's.

Claim 8.5 supplies what is at issue in an observation frequently made about relations with responsive systems, namely that they present less of the resistance a counterpart ordinarily presents. Stated at the level of the arrangement, the observation concerns the direction in which adjustment runs and requires no claim about desire, refusal, or what either party undergoes. A counterpart whose responses are formed with reference to a party's expressed states will characteristically present fewer occasions on which that party's own selections must be revised, and the presence or absence of such occasions is a feature of the arrangement that admits inspection.

The claim bears on Claim 8.4 in a way worth recording. In an asymmetric coupling the party effecting the adjustment and the party holding the coupling term are the same party, so the pathway Claim 8.4 identifies is available to it and unavailable to the counterpart. In a symmetric coupling each party adjusts and each is adjusted to, and the pathway is available in both directions. The two cases are therefore distinct in the distribution of a capability and not merely in the degree of accommodation either party offers. Appendix A, §A.1 states factorisation and the four cases formally.

8.8 Positions withheld on coupling

Three positions are withheld.

The paper identifies no existing system as coupled in the sense of §8.2. The test is stated and applied to nothing.

The paper holds coupling to be neither beneficial nor harmful. Claim 8.4 identifies a pathway and assigns it no direction.

The paper asserts no claim about what a coupled system undergoes, holds, or understands, and Claims 8.1 through 8.4 are stated so as to require none.

PART III

THE MECHANISM

9 THE STAGE STRUCTURE OF GENERATIVE APPROPRIATION

This section sets out the mechanism by which a situated practice becomes a portable and economically controllable capability. It has four objectives: to decompose the mechanism into stages and to state the condition each stage requires; to establish which stages the

accounts surveyed in §3 already govern and which stages remain unaddressed by them; to establish the asymmetry in reversibility across the stages; and to state what follows for the standing of consent given at the mechanism's first stage. The method is decompositional, and the decomposition is offered as an analytical device carrying no claim that the stages occur in sequence at any actual site.

9.1 *Stages of the mechanism and the condition each requires*

Access obtains where a practice becomes available to a party standing outside the relation in which it is performed. The available routes include employment, collaboration, platform and tool provision, research infrastructure, and the voluntary supply of recordings. The condition access requires is a position from which the practice is observable.

Capture obtains where the practice is converted into a representation in the sense of §6.1: a log of tool use, a session recording, a sequence of decisions. The condition capture requires is an instrument, and by Claim 6.2 the resulting representation remains incomplete with respect to the relational field whatever the instrument's resolution.

Legibility obtains where the representation is organised so that patterns within it become recognisable to the capturing party. The condition legibility requires is a scheme of classification, and by the result imported at §2.2 the scheme discriminates most reliably among features that survive the distance separating the capturing party from the practice.

Abstraction obtains where a pattern recognised in the representation is separated from the performer and from the situation in which it was performed, and is restated as a workflow, a heuristic, a policy, or a model capability. The condition abstraction requires is that the pattern admit statement in terms holding across situations.

Transfer obtains where the abstracted capability moves between holders: from performer to model, from model to organisation, from organisation to product, from one domain to another. The condition transfer requires is that the capability be stated in a portable form, which is what abstraction supplies.

Automation obtains where the capability is exercised without the participation of the performer from whose practice it was abstracted. The condition automation requires is sufficiency in the sense of Claim 7.1, and it requires nothing further.

Valorisation obtains where the exercise of the capability yields revenue, whether through products, services, discoveries, designs, or decisions. The condition valorisation requires is a market for what the capability produces.

Enclosure obtains where access to the capability is controlled, through proprietary models, proprietary infrastructure, restrictions on use, or the concentration of the compute and data required to hold it. The condition enclosure requires is that the capability's exercise depend on a resource whose supply is controllable.

Table 1: Stages of the mechanism, the object transformed at each stage, and the body of work under which each stage already falls.

Stage	Object transformed	Body of work already governing it
Access	Position with respect to a practice	Labour process; platform studies
Capture	Practice into representation	Surveillance and behavioural data
Legibility	Representation into pattern	Legibility; audit; measurement
Abstraction	Pattern into portable capability	Addressed by none directly
Transfer	Capability into holding	Knowledge transfer; trade secret
Automation	Holding into substitute performance	Deskilling; task displacement
Valorisation	Performance into revenue	Political economy generally
Enclosure	Capability into controlled resource	Enclosure; commons; competition

9.2 *Distribution of the stages among existing accounts*

Table 1 records where each stage falls within the literatures conceded in §3. Six of the eight stages fall squarely within an established body of work, and the paper claims nothing at those six beyond a change in the object supplied.

Claim 9.1. (Location of the residue within the mechanism). The stages at which the levels distinguished in §6 come apart are legibility and abstraction, since it is there that a representation is converted into a pattern and a pattern into a capability stated independently of the situation that produced it. Those are also the stages at which the surveyed accounts speak least directly, because the accounts governing capture concern the taking of data, and the accounts governing automation concern the displacement of a performance already specified. The residue identified at Claim 3.1 is therefore located, and it is located at two stages out of eight.

Claim 9.1 states the paper’s contribution modestly and states its limits at the same time. A reader persuaded by the whole argument acquires an account of two stages, and inherits the existing accounts for the remaining six.

9.3 *Asymmetry of reversibility across the stages*

The stages differ in whether a party may undo its participation in them, and the difference is systematic.

At access and capture the performer retains a point of intervention. Consent may be withheld, an instrument may be disabled, and a recording may be deleted, so that the performer’s withdrawal removes the material.

At legibility and abstraction the point of intervention closes. A pattern recovered across many records survives the deletion of any one of them, and a capability stated independently of the situation that produced it survives the withdrawal of the performer entirely.

At transfer, automation, valorisation, and enclosure the performer holds no point of intervention at all, since the capability is exercised by parties with whom the performer has no relation.

Claim 9.2. (Timing of consent against the determinacy of its object). Consent to participation in the mechanism is given at access, which is the stage at which the least about the mechanism's outcome is determinate: whether a pattern will be recovered, whether it will admit abstraction, whether the resulting capability will suffice in the sense of Claim 7.1, and whether the performer will be a party to its exercise are all undetermined at that point. By the reversibility asymmetry, the performer's last point of intervention closes before any of those questions is settled. Consent given under those conditions is consent to a determinate act of recording and is not consent to a determinate outcome, and the two are ordinarily conflated.

Claim 9.2 is what carries the first of the three conditions declared in §1. A recording undertaken voluntarily, with full disclosure of the recording party's purposes, satisfies every requirement ordinarily placed on consent, and Claim 9.2 holds that satisfying those requirements leaves the performer without a point of intervention at the stages where the outcome is settled. The observation entails no defect in the consent obtained and identifies a structural feature of what consent at that stage can govern.

9.4 Positions withheld on the mechanism

Three positions are withheld.

The decomposition asserts no sequence at any site. The stages are analytically separable, and whether they occur in the order given, concurrently, or partially is a matter for observation.

The decomposition asserts no completion. A mechanism may halt at any stage, and §12 argues that the case in which it halts is the case with the most distinctive consequences.

The decomposition identifies no wrong at any stage. Each stage is described by its condition, and the question of what would make any stage objectionable is deferred to §13 and §14.

10 NORMALISATION AND THE MEASUREMENT OF GENERATIVE CAPACITY

This section treats the process by which a generative capacity comes to be handled as an ordinary economic input. It has five objectives: to state the condition of the capacity before measurement; to derive from Definition 5.1 a structural property of any operable measure of generativity; to describe the loop through which measurement becomes routine and non-participation becomes costly; to state the reflexive consequence, conceding in full the literature that already owns it; and to state, through a formal model marked as illustrative, whether a repertoire is recoverable from a record of its exercise. The method of the second objective is derivation from the definition, and the method elsewhere is description.

10.1 The condition of the capacity before measurement

Prior to measurement, generative capacity is characteristically referred to under terms that resist quantification: intuition, curiosity, a nose for a problem, wandering, serendipity, tacit expertise, judgment. The terms are heterogeneous and they share one feature relevant here, which is that each is predicated on the basis of a retrospective assessment of a course of activity and none is predicated on the basis of a reading taken during it.

That feature follows from the account of §5 and is not an accident of vocabulary. Definition 5.1 is satisfied over an interval and its second clause concerns what occurs after the operation it qualifies, so a term correctly applied on the definition's basis is a term applied in retrospect.

10.2 The structural property of an operable measure

An operable measure is one that yields a reading within a period over which a party wishing to act on the reading is prepared to wait. Definition 5.1 has two clauses, and the two clauses are satisfied at different times: the opening of positions occurs within the interval of the practice, and the entry of the occupying items into further relations occurs afterwards, over a period whose length is set by the domain.

Claim 10.1. (Clause selection by an operable measure). An operable measure of generativity taken over a practice registers the opening clause of Definition 5.1 and registers the further-relation clause partially or not at all, since the second clause is satisfied over a period exceeding the measure's operating window. Such a measure therefore records the production of positions and remains silent on whether those positions were occupied by items that entered anything further, and it scores identically an episode meeting both clauses and an episode meeting the first alone.

Claim 10.1 is restricted to measures taken over a practice, and the restriction is required by Claim 8.1. A record of accumulated artefacts, read for its citation structure and its patterns of uptake, is an instrument of long window that does register the further-relation clause, and it stands as a counter-instance to any unrestricted form of the claim. What Claim 10.1 asserts is that a measure operating over the interval of a practice, which is the class of measure the arrangements of §9 make available, registers the opening clause and misses the second.

Claim 10.1 yields a specific prediction about the pathology of a regime organised around such a measure, and the prediction is available for test. A party optimising against a measure of that form is rewarded for producing positions and is not penalised for producing positions that nothing occupies, so the regime should exhibit an increasing rate of production of items satisfying novelty in the sense of §5.1 together with an unchanged or falling rate of items meeting the further-relation clause. The prediction is stated here and is tested nowhere in this paper.

10.3 *The loop through which measurement becomes routine*

Once a measure is available it enters a loop with four further steps, each of which follows from the step before under ordinary institutional pressures.

A measured quantity admits valuation, since a quantity attached to a party supports comparison across parties.

A valued quantity admits optimisation, since a party holding an interest in the valuation has reason to raise it.

An optimised quantity admits institutionalisation, since arrangements that reliably raise it are adopted, taught, and required.

An institutionalised quantity establishes the ordinary case, and at that point declining to participate in the measurement carries a cost, since a party supplying no reading is compared with parties supplying one and is characteristically treated as supplying a low reading.

The last step is what the word normalisation names in this paper. What is normalised is the assumption that generative capacity is a quantity properly captured, compared, and deployed, and the assumption acquires its force through the cost attaching to its refusal.

10.4 *The reflexive consequence and its ownership*

The proposition that installing a measure alters the conduct measured is established, and it is owned by the literature conceded at §3.8. Espeland and Sauder established reactivity [Espeland and Sauder (2007)] through self-fulfilling prophecy and through commensuration, Strathern [Strathern (2000)] established that audit displaces the practices it was introduced to protect, and Scott [Scott (1998)] established that a scheme of legibility discards the local knowledge on which a domain's functioning depended. No priority is claimed here for any of it.

Claim 10.2. (Compatibility of a rising measure with a falling capacity). Where a practice is optimised against a measure with the property stated at Claim 10.1, the optimisation presses conduct toward the production of positions and applies no pressure toward the further-relation clause. A trajectory along which the measure rises is therefore compatible with a trajectory along which the relation's satisfaction of Definition 5.1 falls, and the two are compatible without any party acting in bad faith and without any error in the measurement.

Claim 10.2 states a compatibility and states no prediction, and the distinction matters. It establishes that a regime cannot infer from a rising measure that the capacity it wished to protect is intact, and it establishes nothing about whether that capacity is in fact falling at any site.

The addition this paper makes to the reactivity literature is confined to the source of the divergence. That literature locates the divergence in the general fact that measures are partial and that conduct responds to them. Claim 10.1 locates it in a specific feature of

the object: generativity has a two-clause structure whose clauses are satisfied at different times, so the divergence follows from the definition of the object together with the operating window of the measure, and it requires no further assumption about how conduct responds.

10.5 The repertoire and its recovery from observed use

Claim 10.1 concerns what a measure taken over a practice registers. This subsection treats a prior question, namely whether the repertoire from which a practice is drawn can be recovered from a record of the practice at all, and it does so through a formal model offered as illustrative and marked as such. The model is a generative grammar, in which a repertoire is a set of rules and a practice is a set of derivations they license.

Two features of the model transfer to the case. Removing a rule from a grammar can only remove derivations, so a repertoire's contraction is never visible as the appearance of anything; it is visible, if at all, as an absence. And a rule may go unexercised over an arbitrarily long interval while remaining available, so the frequency with which a rule is used carries no information about whether it is held.

Claim 10.3. (Non-recovery of a repertoire from its exercise). Gold [Gold (1967)] established that a class of languages containing every finite language together with at least one infinite language is not identifiable in the limit from positive data, which is to say from a record of what the grammar generates with no record of what it excludes. A repertoire satisfying that condition is accordingly not recoverable from an unbounded record of its exercise. Where the condition holds of a party's relational repertoire, an inference from what that party is observed to do to what that party remains able to do is unavailable, however long the observation runs.

Claim 10.3 supports two positions taken elsewhere in this paper and is stated here so that neither rests on assertion. It supplies the ground for the treatment of unexercised capacities at §14, where a capacity going unused is distinguished from a capacity lost, since the model shows the two are not distinguishable by frequency of use. And it strengthens Claim 10.1 from a different direction: Claim 10.1 holds that an operable measure misses the further-relation clause, while Claim 10.3 holds that the object such a measure would need to assess is not recoverable from the data the measure collects.

Appendix A, §A.3 states the model formally and distinguishes the support of a repertoire from its effective part, which is the distinction between a capacity retained in form and a capacity maintained. The model's standing requires statement. Its condition is superfiniteness and it therefore requires no position on where a relational repertoire sits among the classes of formal grammar, which is the assumption this paper is least able to defend. The transfer from formal grammars to relational capacities is an analogy and is asserted as no more, and a reader declining it loses Claim 10.3 while retaining Claim 10.1, which is argued independently at §10.2.

10.6 *Positions withheld on measurement*

Three positions are withheld.

The paper asserts no measure and evaluates none. Claim 10.1 concerns any measure meeting the stated operability condition, and the argument identifies no instrument in use.

The paper holds measurement to be neither improper nor avoidable. Claim 10.2 establishes what a measure of the stated form cannot warrant, and it establishes no case against measuring.

The paper offers no interval at which the second clause of Definition 5.1 should be assessed. The length is set by the domain, and supplying a figure would require the empirical work declined at §2.4.

11 GENERATIVITY IN THE VOCABULARY OF POLITICAL ECONOMY

This section states how generativity enters political-economic analysis and, more importantly, how it declines to enter. It has five objectives: to test the placement of generativity among the factors of production; to concede the apparatus of cooperative allocation and to restate the paper's position narrowly in its light; to state the placement the account supports; to state the asymmetry between a situated capacity and a reproducible capability; and to establish the consequence for schemes that would compensate contributors. The method is analytical, and the central argument proceeds from Claim 5.1 together with the concession recorded at §11.2.

11.1 *The placement of generativity among the factors of production*

Political economy analyses production through factors: labour, land, capital, and in later treatments knowledge and technology. A natural proposal adds generativity to that list. This subsection states what such a placement would require, §11.2 concedes an objection to any unqualified refusal of it, and §11.3 states the consequences of the restated result.

Claim 11.1. (Status of a factor share attributed to generativity). A factor of production is an input to which a share of the product is attributable. By Claim 5.1, a quantity of the form “the portion produced by this party” is fixed by no feature of a generative episode. A share may nonetheless be supplied by a stipulated allocation rule, and where one is supplied the resulting quantity is determined by the axioms of that rule together with a specification of what each subset of parties would have produced alone. Questions of political economy taking the form “what share is owed to this input” are therefore answerable relative to a chosen rule and carry the authority of that choice, and they have no answer that the episode itself settles.

11.2 Allocation rules and the standing of the quantities they supply

An objection to any unqualified form of Claim 11.1 is available from cooperative game theory, and it is conceded here in full, since the objection is correct and the field it comes from was built to answer exactly the difficulty Claim 5.1 raises.

Shapley [Shapley (1953)] established a value for n -person games which assigns to each party a determinate share of a jointly produced quantity, characterised by axioms and computed as the party's average marginal contribution across orderings of the parties. The construction assumes no separability of the inputs, and it was devised for cases in which the parties produce jointly and no party's portion is visible in the product. Ghorbani and Zou [Ghorbani and Zou (2019)] carried the construction into the valuation of training material, assigning to each datum a share of a model's performance. So an apportionment of jointly produced value is available, it is in use, and it is in use on material of exactly the kind this paper discusses.

The concession requires that the paper's position be restated narrowly, and the narrow position is the one Claim 11.1 now carries. A rule of this kind requires a characteristic function giving, for every subset of the parties, what that subset would have produced alone. Two features of the present object bear on the availability of such a function. Claim 6.2 establishes that a record leaves undetermined what made the encountered objects significant to the performer, which is the material a counterfactual about a subset's performance would need. And §5.4 establishes that the value of a generative episode is unsettled until the further-relation clause has been assessed, over an interval whose length the domain fixes, so a characteristic function evaluated earlier is evaluated on the opening clause alone.

What the paper claims is accordingly this. An allocation rule supplies a determinate number, the number is determined jointly by the axioms adopted and by the counterfactual values assumed, and neither is supplied by the episode. A share so computed is a decision about how to divide, and treating it as a finding about who contributed what misdescribes its standing. Nothing in this paper argues that such rules should go unused, and §14 states no proposal requiring one.

11.3 Consequences of the restated result

Claim 11.1 does substantial work in three places. It bears at the economic level on the same move that §13 treats at the legal level, so that the refusal of property in generativity draws on two lines of argument. It explains why the distributive vocabulary characteristically applied to disputes about artificial intelligence and training material, which asks what portion of a product is owed to which contributor, meets the difficulty it meets, since the answer it seeks is settled by a choice of rule and is contested at that level. And it constrains what §14 may propose, since a proposal requiring apportionment is unavailable to this paper by its own result.

11.4 *The placement the account supports*

Generativity enters this analysis as a condition on production and not as an input to it. A condition on production is a state of affairs whose obtaining is required for a class of production to occur, and whose contribution to any particular product resists isolation because the same condition underlies the entire class.

The placement has three consequences worth stating.

A condition is assessed by whether it obtains and not by how much of it was consumed, so the question proper to it is whether the arrangement sustains the condition and not what quantity the arrangement drew from it.

A condition may be degraded by arrangements that draw nothing from it, since degradation of a condition proceeds through alteration of what sustains it, which is the pathway Claim 5.2 identifies.

A condition supports no market on its own account, since a market requires a separable and transferable object, and §6 established that what is transferable in this case is a proxy.

11.5 *Asymmetry between a situated capacity and a reproducible capability*

The capacity at issue is exercised at a place, by parties standing in relations, over intervals, under material conditions. The capability abstracted from records of its exercise is stated independently of those particulars, and it is reproducible at whatever scale the holder's infrastructure supports.

The asymmetry has an economic form that requires no further premise. Where a capability suffices in the sense of Claim 7.1, the revenue arising from its exercise scales with the infrastructure holding it and stands detached from the site at which the original capacity was exercised. The parties among whom that capacity arose therefore participate in the resulting flow through whatever arrangements were struck at the access stage, and by Claim 9.2 those arrangements were struck before sufficiency was determinable.

The asymmetry is stated as a structural feature and carries no estimate of magnitude. Whether the detachment is large or small at any site depends on the sufficiency question, and this paper supplies no value for it.

11.6 *Distributed contribution and the basis available for compensation*

Material for a capability is characteristically drawn from many performers, across many relations, over long periods, and from practices formed within traditions to which no present party contributed.

Claim 11.2. (The available basis for a compensation scheme). Claim 5.1 holds within each relation from which material is drawn, so a scheme distributing revenue among contributors in proportion to their shares rests on the allocation rule it adopts and on the counterfactual values that rule requires, and its defensibility is the defensibility of that rule. A scheme distributing on the basis of participation, which is to say on the fact that a party

performed a determinate act within a relation from which material was drawn, has a defined basis, since participation is a matter of record and admits verification. The difference between the two is that a share-based scheme requires counterfactual values for subsets of the contributors and a participation-based scheme requires none.

Claim 11.2 orders the design space and closes no part of it. Schemes conditioned on participation include per-contributor payments, collective funds distributed by rule, and arrangements conferring standing to be consulted, and none requires a counterfactual about what a subset would have produced alone. Proposals computing a contributor's entitlement from an estimate of that contributor's share require such counterfactuals, and the claim locates the point at which they must be defended, which is the choice of rule and the values assumed, in place of the arithmetic performed upon them.

11.7 Positions withheld on the political-economic placement

Three positions are withheld.

The paper proposes no compensation scheme. Claim 11.2 states what a scheme may rest upon and evaluates no scheme.

The paper holds generativity to have displaced no established factor. The analysis adds a condition on production to the vocabulary and revises the treatment of labour, capital, and knowledge in no respect.

The paper opposes no use of allocation rules and evaluates none. §11.2 states what such a rule supplies and what it presupposes, and it recommends neither their adoption nor their abandonment.

The paper offers no account of price. Nothing here bears on how a capability is priced, and Claim 11.1 bears only on whether a share of a product is attributable to the condition under which it was produced.

12 ENCLOSURE AND THE REFLEXIVE CONDITION OF THE GENERATIVE SOURCE

This section treats the final stage of the mechanism and the consequences that reach back to the relations from which the material was drawn. It has five objectives: to state what is enclosed and what resists enclosure; to identify the form the characteristic harm takes where the object is a capacity; to state the conditions under which extraction is self-limiting, correcting a claim that a shorter treatment of this subject would make; and to identify a third form of loss that neither the vocabulary of exclusion nor the vocabulary of closure reaches; and to state the divergence between what a party can do with a capability available and what it can do upon its withdrawal, together with the condition under which that divergence arises. The method is analytical, and each result is stated with the conditions on which it depends.

12.1 *The object of enclosure*

Boyle [Boyle (2003)] described enclosure as the bringing of previously common intangible material under exclusive rights, and the description applies here with one alteration in its object.

What is enclosed in the present case is the capability together with the infrastructure on which its exercise depends: the model, the data holdings, the computational resources, and the terms of access. The capacity, in the sense of Definition 5.1, resists enclosure by its own structure, since it is predicated of relations and no party holds it in a form admitting transfer.

The distinction matters because it identifies what an enclosure in this case does and does not accomplish. It secures control over a proxy and over the means of exercising it. It secures nothing over the relations from which the proxy was derived, and those relations continue to operate, subject to whatever the arrangements described in §10 do to them.

12.2 *The form of the characteristic harm*

Where the object of a regime is a work, the characteristic harm is unauthorised reproduction, and the instruments of the regime address copying. Where the object is a capacity, the characteristic harm takes a different form.

A capability may be acquired and left unexercised. It may be held defensively, so that its holder's position is secured by the fact that others lack it. Access to it may be refused, or granted on terms that determine what may be attempted with it. In each case the record of what was captured remains intact, nothing has been copied, and what has ended is the availability of a line of development.

The characteristic harm where the object is a capacity is therefore closure, and an apparatus organised around unauthorised reproduction addresses none of the three forms above. §13 takes up what follows for the doctrines.

12.3 *Conditions under which extraction is self-limiting*

An attractive argument holds that generative extraction undermines itself: a party drawing on a community's generative practice damages the conditions of that practice and thereby destroys the source on which it drew. The argument is available and it is conditional, and setting out its conditions shows where it fails.

Claim 12.1. (Conditions of self-limitation). Extraction from a generative relation limits itself where three conditions hold jointly: the capacity is constituted within relations that the extracting arrangement alters, which is Claim 5.2; the alteration degrades the capacity, which Claim 5.2 leaves open; and the extracting party requires continued supply of fresh material from that source. The third condition is the one that fails most readily, since a capability sufficient in the sense of Claim 7.1 requires no further supply. Extraction is therefore self-limiting in the case where the capture is incomplete, and a capture complete

enough for its holder's purposes carries no limit arising from this mechanism. The third condition is restored to the extent that the domain changes over time, since sufficiency established at one time carries to a later time only so far as the domain is stable.

Claim 12.1 inverts the reassurance the self-undermining argument appears to offer. On that argument the extracting party's own interest supplies a restraint, and the restraint operates most strongly where the extraction is most thorough. Claim 12.1 holds the opposite: the restraint operates where the extraction is partial and lapses as the extraction approaches sufficiency, so that the case in which the argument offers most comfort is the case in which it holds least.

The claim is stated as a structural result and asserts nothing about which case obtains. Whether any actual capture approaches sufficiency, and whether any actual arrangement degrades the relations it touches, are questions this paper leaves to measurement.

12.4 Loss in the absence of an appropriating party

Two vocabularies are ordinarily available for describing what a source loses: exclusion, which identifies a party who has taken control of something, and closure, which identifies a party who has ended a line of development. A third case is available and neither vocabulary reaches it.

Where a capability is widely distributed, whether through open release, through competition among holders, or through the low cost of reproducing it, the capacity previously held by the performers ceases to be scarce. The performers' position deteriorates through the fall in what their participation commands, and the deterioration proceeds while no party holds the capacity, no party excludes anyone from anything, and no line of development is closed. The line remains open and is simply open to everyone.

The case is worth naming because it is the case in which the instruments surveyed at §3.9 have nothing to act upon. An exclusion right requires a party excluding, an anti-closure instrument requires a party closing, and a loss with no appropriating party presents neither. What the case presents is a change in the distribution of what participation commands, which places it among distributive questions and outside the questions that property doctrines are constructed to answer.

The case also bears on the argument's own structure. The mechanism of §9 was set out through eight stages ending in enclosure, and the case described here is the case in which the mechanism halts at valorisation and enclosure fails to occur. A treatment organised around enclosure alone would find nothing objectionable in it, and §14 is written so as to reach it.

12.5 Divergence between assisted and unassisted reach

The three cases set out above concern what a party loses through the conduct of another. This subsection states a fourth movement, in which what a party can do while a capability is available and what it can do upon that capability's withdrawal come apart, and it supplies

the mechanism by which the case of §12.4 arises without anyone intending it.

Claim 12.2. (Divergence of assisted and unassisted reach). The outcomes a party can produce with a capability available and the outcomes it can produce upon that capability's withdrawal form distinct classes, and an arrangement may enlarge the first while contracting the second. The contraction proceeds through the lapse of the practices by which the party's unassisted capacity was maintained, so it requires no party to withhold anything and is consistent with the capability's holder acting throughout in the party's interest.

Claim 12.2 identifies what an entitlement to withdraw secures and what it leaves unsecured. A party holding such an entitlement exercises it into the second class, and the second class is settled by a history in which the entitlement was continuously available and never used. An arrangement may therefore satisfy every requirement ordinarily placed on the availability of exit while the position a departing party would occupy has altered throughout, and the alteration is invisible in the terms on which exit is offered. §14 states the corresponding condition on a domain, and Appendix A, §A.4 establishes by construction that the divergence Claim 12.2 describes is satisfiable, with the two conditions holding in the same period.

Claim 12.3. (Delegation against retention under complementarity). Where a capacity is complementary to a capability, in the sense that the two exercised together produce what neither produces alone, a party's own return is highest where it delegates, and the return to retention accrues to the arrangement in which both are exercised. Delegation is accordingly the individually advantageous course for each party while retention is provided below the level the arrangement would support, and the resulting shortfall arises with no party excluding, closing, or withholding anything.

Claim 12.3 supplies the mechanism for the case described at §12.4 and narrows it. The shortfall it identifies has no appropriating party, so no instrument addressed to a party reaches it, and the reasoning is the ordinary reasoning about a good whose returns accrue to an arrangement in place of the party bearing its cost. What the claim adds to that familiar structure is the identification of complementarity as the condition under which it obtains, which distinguishes the case from redundancy, where delegation costs the arrangement nothing, and separates both from the assertion that delegation is objectionable in itself.

12.6 Positions withheld on enclosure

Three positions are withheld.

The paper establishes no instance. Every result in this section states conditions, and the paper asserts of no arrangement that its conditions are met.

The paper attributes no intention. Closure in the sense of §12.2 is described by what an arrangement does and not by what any party sought.

The paper holds the distributive case of §12.4 to be neither worse nor better than the cases preceding it. What is claimed is that the case exists, that it differs in structure, and

that the instruments addressed to the other cases do not reach it.

PART IV

INSTITUTIONAL CONSEQUENCES

13 THE DIAGNOSTIC USE OF INTELLECTUAL PROPERTY DOCTRINE

This section reads intellectual property doctrine for what its structure reveals about the object of this paper. It has five objectives: to state the use to which the doctrines are put here; to set out what each principal doctrine takes as its object and to locate that object among the four levels of §6; to identify the arrangement under which positive law has in fact protected generative capacity and to state what recording does to that arrangement; to set out four independent grounds for refusing property in generativity; and to identify the two families of existing instrument on which a capacity-oriented regime could draw, together with the conditions such a regime would have to satisfy. The method is diagnostic throughout, and the section proposes no doctrine and recommends no reform.

13.1 The use to which the doctrines are put

The doctrines are read here as evidence about their object. A body of law constituted over centuries around a class of things carries, in its constitutive requirements, an account of what that class is taken to be, and where a new candidate object fails those requirements the failure locates the difference between the candidate and the class. The section accordingly avoids the formulation that the doctrines are inadequate, which would presuppose that they were addressed to this object and fell short. They are constituted around identifiable products and identified authors or inventors, and whether they reach a relationally generated capacity is an open question that this section states and leaves open.

13.2 The object each doctrine takes, located among the four levels

Copyright takes expression fixed in a work, which is an outcome in the sense of §6.1, and the idea and expression distinction leaves methods, procedures, and directions of enquiry outside protection as a constitutive limit and not as an oversight.

Patent takes an invention conceived and disclosed, which is an outcome, and inventorship turns on conception, so that a party supplying resources, labour, or reduction to practice acquires no inventorship. That feature is worth recording, since patent law already declines credit to a party that merely executes faster.

Trade secret takes information held in confidence, which is a representation. Its protection operates through non-disclosure, so that the existing legal answer to the risk of appropriation is secrecy.

Contract takes a relationship on specified terms, and it reaches conduct that the parties were able to specify in advance. By Claim 9.2 the terms are settled at the access stage,

which is the stage at which the least about the outcome is determinate.

None of the four takes a trajectory as its object, and none takes generativity. What each takes lies at the first two levels of §6.1, which are the levels at which the object is a thing a party holds.

13.3 The role of inseparability in the protection of capacity

Positive law has in fact protected generative capacity, and it has done so without conferring any right over it, through an arrangement that this section states because recording alters it.

In the English authority, an employee's obligations after employment reach specific trade secrets and do not reach the information that has become part of that employee's own experience and skill; and the court set beside the duty of fidelity and the duty of confidence a third concept, namely the presumptive entitlement of any person to use and exploit, in earning a living, the whole of the skill, experience, and knowledge at that person's disposal, including what was acquired during earlier employment [Faccenda Chicken (1987)]. Comparable distinctions between an employer's protectable interest and an employee's general skill and knowledge are found across common-law jurisdictions and in the law of restraint of trade.

Claim 13.1. (The condition on which the existing protection rested). The doctrine described above protects a capacity by declining to make it an object of proprietary claim, and the arrangement is workable because such a capacity has characteristically had no existence apart from the person carrying it. A holding that cannot be separated from its holder cannot be transferred, and a thing that cannot be transferred requires no rule against its transfer. So far as the authority discussed shows, the protection is a consequence of inseparability and is not the product of any instrument directed at capacity.

Claim 13.2. (Effect of recording on that condition). Where a capacity is exercised in recordable conditions and the record supports abstraction in the sense of §9.1, a proxy for the capacity comes into existence apart from the person who exercised it. The condition on which Claim 13.1's protection rested is thereby weakened with respect to the proxy, and the resulting object is one that admits holding, transfer, and control. The performer characteristically effects the separation, ordinarily for a fee, and the arrangement that had protected the capacity lapses through an act the performer performs.

Claim 13.2 identifies what is legally novel in the case, and its form should be noted. Nothing has been taken from the performer that any doctrine assigned to the performer, since the doctrine of Claim 13.1 assigns nothing and merely withholds a claim from the employer. What has changed is a background condition, and a protection resting on a background condition ends when the condition ends, with no rule violated at any point.

13.4 *Grounds for refusing property in generativity*

A natural response to Claim 13.2 declares a proprietary interest in one's own generativity. Four independent grounds tell against it, and each would suffice alone.

The first is the absence of an apportionable quantity. By Claim 5.1 a generative episode admits no description omitting any party to the relation, so the interest would attach to a quantity with no determinate value, and by Claim 11.1 no factor share is available to supply one.

The second is the absence of an identified holder. Property requires a holder, and the parties to a relation satisfying Definition 5.1 hold the relation jointly in a sense that supplies no allocation among them.

The third is the anticommons. Heller [Heller (1998)] established that the multiplication of rights of exclusion over early-stage material produces underuse through the accumulation of blocking positions, and a regime conferring exclusion over generative practice would multiply such positions at the earliest stage of all. It would also entrench parties already established, which reverses the effect such a regime would be introduced to achieve.

The fourth is the ontological ground. A proprietary interest requires an object, so declaring property in generativity converts a relation into a thing, and the conversion is the operation that Parts II and III examine as the mechanism's core. A response performing that operation adopts the account of its object that the analysis questions.

13.5 *Instruments a capacity-oriented regime could draw upon*

The refusal above concerns property and leaves open what a legal system addressing this object would draw upon, and two existing families are available so that the question begins from something.

Goodwill is a capacity that positive law already protects. It is the attractive force that brings custom, it is protected in passing off, it is valued in the transfer of a business as a going concern, and it is recognised as a legitimate interest capable of supporting covenants in restraint of trade. It is the nearest thing in positive law to a protected generative capacity, and it is protected without any apportionment of the product to which it contributed.

The second family comprises instruments directed at non-use. Compulsory licensing for failure to work, march-in rights under public funding statutes, competition-law treatment of refusal to license and of acquisitions made to discontinue a line of development, and essential-facilities reasoning are all addressed to the closure of a capacity in the sense of §12.2. A capacity-oriented regime would extend an existing though marginal family and would begin from something already in force.

13.6 *Conditions a regime would have to satisfy, and the case that has no addressee*

Five conditions would have to be met by any regime addressing this object: a continuing forum, since Definition 5.1 is satisfied over an interval and a single determination at a point in time would assess the opening clause alone; a boundary identifying the relation at issue;

an addressee against whom a determination runs; an evidentiary form, which by Claim 5.1 records participation and never a share; and a remedy that is other than terminal, since the harm at §12.2 is closure and a terminal remedy repeats it.

Claim 13.3. (Three cases and the availability of an addressee). The three cases distinguished in §12 require different addressees. Where the harm is exclusion, the addressee is the party excluding. Where the harm is closure, the addressee is the party declining to exercise or to license. Where the loss arises through the diffusion described at §12.4, the capacity ceases to be scarce while no party holds it, excludes anyone, or closes any line, and no addressee exists. A regime constructed on the model of a claim against a party therefore reaches the first two cases and cannot reach the third, and the third accordingly stands outside the class of questions that party-directed instruments address.

Claim 13.3 states the limit of what this section's subject can accomplish and hands the third case to §14.

A further case bears on the addressee condition and is recorded here, since it arises from the material of §12 and not from doctrine. A determination runs against a party positioned to act on it, and where the capacity to inspect, understand, and repair an arrangement has lapsed in the manner Claim 12.2 describes, no party occupies that position. The elimination of a capacity can therefore remove the addressee that a regime would require, and it does so through a sequence of decisions each of which was advantageous at the time it was taken. That is a route to the absence of an addressee distinct from the diffusion described at §12.4, where the addressee is absent because nothing was appropriated, and distinct again from the case of many participants, where the difficulty is that too many parties acted.

13.7 Positions withheld on doctrine

Three positions are withheld.

The paper asserts of no doctrine that it is inadequate. §13.1 states the ground for avoiding that formulation.

The paper proposes no regime and recommends no reform, in accordance with §2.4.

The paper offers no view on any pending controversy concerning training material, and the analysis above bears on the form such controversies take and on none of their merits.

14 CONSTRUCTION AND MAINTENANCE OF GENERATIVE RELATIONAL DOMAINS

This section states the paper's normative direction. It has eight objectives: to state why the protection of outputs addresses a stage later than the one at issue; to define a generative relational domain and to state the conditions constituting one; to establish that the structural form of those conditions is required in place of chosen; to supply a criterion fixing which capacities a domain is required to sustain; to state the form provision takes; to state the criterion in the constraint form that the standing prohibition of §2.2 permits, and to state why the aggregate form is unavailable; to apply the criterion reflexively to the

paper's own proposal and to record the difficulty that application produces; and to show that the direction reaches the case that §13.6 found to have no addressee. The method is constructive, and every proposal is stated as a condition and never as a design.

14.1 The stage at which output protection operates

The conventional response to the mechanism of §9 protects what a practice has produced: the paper, the dataset, the workflow, the invention. Such protection operates upon items that already exist, which places it after the interval over which Definition 5.1 is satisfied.

Two consequences follow. Protection of that kind is unaffected by whether the relations that produced the items continue to operate, so it is consistent with a state of affairs in which every past product is secured and no further product arises. And by Claim 13.3 it addresses the first two of the three cases and leaves the third untouched.

The observation withdraws nothing from output protection, which serves purposes of its own that this paper leaves intact. What it establishes is that a response confined to that stage addresses a different object from the one Parts II and III identify.

14.2 The constitution of a generative relational domain

Definition 14.1. (Generative relational domain). A generative relational domain is an arrangement whose maintenance sustains the conditions under which relations satisfying Definition 5.1 continue to form among its participants. It is identified by what it sustains, in place of what it produces, and its boundary is the set of parties whose relations the arrangement maintains.

The conditions a domain sustains are stated here as a list of what participants require, and the list is offered as a working enumeration open to revision.

Participants require heterogeneity in what they encounter, since a relation satisfying Definition 5.1 opens positions through the meeting of material formed under conditions that differ.

They require autonomy over what is pursued, since the selection among available continuations is the operation from which a criterion of interest is constituted, and a selection made by another party constitutes nothing in the party performing it.

They require occasions of encounter that were arranged for no determinate purpose, since positions opened by an encounter arranged to open them were available before it.

They require intervals of time uncommitted in advance, which follows from §5.4, and they require tolerance for lines that yield nothing, which follows from Claim 10.1, since a regime penalising such lines penalises the activity from which the criterion is formed.

They require access to material formed under conditions other than their own, and they require that the terms of their participation remain open to revision by them.

Each condition in the list concerns an occasion on which something is done, and none concerns a holding that a party or an institution keeps. The form is required by what a

capacity is. A record is preserved by storage, so that its preservation is passive, cheap, and separable from any use made of it; a capacity constituted within relations is preserved by exercise, and an interval during which it goes unexercised is an interval during which it is not maintained. A domain in the sense of Definition 14.1 is therefore sustained by the occasions it affords and not by anything it holds, and a proposal offering a repository in place of occasions has supplied something of a different kind. The point bears directly on the analogy with archives, which is otherwise natural here and which misdescribes the cost: an archive is maintained at a cost that falls once and continues at a low rate, and a domain is maintained at a cost that recurs for as long as the capacity is to remain available.

14.3 The structural form of the conditions and its necessity

Every condition stated in §14.2 is a structural feature of an arrangement, and none is a quantity of generativity to be attained or maintained above a level. That form is forced by Claim 10.1 in place of being chosen.

Claim 14.1. (Implementability of a trigger). An instrument whose application is triggered by a quantity of generativity requires that the quantity be assessed within the period over which the instrument acts. By Claim 10.1 a measure operable within such a period registers the opening clause of Definition 5.1 and misses the further-relation clause, so a party administering the instrument cannot determine whether its trigger has been met. An instrument whose application is triggered by a structural feature of an arrangement requires no such determination, since the feature is settled by the arrangement and is assessable at any time.

Claim 14.1 governs the whole of the direction stated in this section, and it disposes of a family of proposals that would otherwise appear reasonable. A proposal that an arrangement avoid degrading generativity beyond some degree, that optimisation of a relation stop short of some point, or that a threshold of relational capacity be maintained, states a condition whose satisfaction no party can establish, including a party wishing in good faith to comply. The corresponding structural proposals, namely that a class of relation remain available, that a party retain a capacity to revise the terms, or that an optimisation loop remain open at a stated granularity, are assessable by inspection of the arrangement.

The claim also states what the structural form gives up. A structural condition is satisfiable by an arrangement that meets it in form and defeats it in operation, and nothing in Claim 14.1 supplies a remedy for that case. What the claim establishes is that the alternative is unavailable, and not that the form adopted is free of difficulty.

14.4 The class of capacities a domain is required to sustain

The conditions of §14.2 state what a domain affords and leave open which capacities it is required to afford occasions for. This subsection supplies a criterion, since a direction requiring occasions for every capacity a party has ever held would be unmeetable and

would also be false to the historical record, in which capacities have lapsed continuously with no loss of the kind this paper examines.

Claim 14.3. (Criterion of self-referential loss). A capacity requires the provision of occasions where its re-acquisition depends on the conditions whose lapse produced its decline, and requires no such provision where it is re-acquirable at the instance of the party concerned. A capacity constituted within relations satisfies the first description characteristically, since restoring it requires other parties who hold it and who exercise it with the party restoring it, and the lapse that produced the decline is a lapse in the availability of such parties. A capacity recoverable from a record satisfies the second, since the record persists through the interval of disuse and its holder may return to it unaided.

Claim 14.3 sorts cases that the list at §14.2 leaves together. A technique recoverable from documentation, a calculation recoverable from a procedure, and a craft with a surviving written tradition fall on the second side, and their lapse is a historical transformation of the kind §4 describes. A capacity for conducting a relation with a party whose responses are formed without reference to one's own expressed states falls on the first side, since the occasions on which it would be rebuilt are the occasions whose absence produced its decline. A language with no remaining speakers falls on the first side for the same reason, and the point is familiar from that case.

The criterion admits evidence of a kind the argument otherwise lacks. Studies of the transmission of experimental practice report capacities acquired through contact with a group already holding them and unavailable from published records [Collins (2010)], which is the first description satisfied by a technical capacity carrying no relational content. The criterion is therefore not a restatement of the distinction between relational and instrumental capacities; the two classifications cross, and re-acquirability is the operative axis.

14.5 Provision through occasions borne by ordinary activity

The conditions of §14.2 and the criterion of §14.4 together determine what a domain must provide, and this subsection states the form provision takes, since a reading on which a domain is an institution established for the purpose would misdescribe both the cost and the arrangement.

Occasions of the kind §14.2 requires are characteristically produced alongside activity undertaken for other reasons. Parties who work together on a task that admits disagreement, who are co-present under conditions they did not each select, or who depend on one another for something neither controls, exercise the capacities at issue without any occasion having been arranged for that purpose. The cost of provision is accordingly low where the occasions are joint products of activity already undertaken, and high where they must be arranged separately, and the difference between the two is large.

Two consequences follow for the form a proposal should take. The variable to be examined is whether the arrangements a party already inhabits continue to yield such occasions,

in place of whether resources are committed to provision, so the question is put to ordinary arrangements and not to a budget. And an arrangement that retains a capacity by holding parties in readiness without exercising it retains nothing, since by §14.2 an interval of dis-use is an interval of non-maintenance; a retained capacity is one that remains load-bearing in some part of the activity that requires it.

14.6 The criterion, stated as a constraint

Claim 14.2. (The constraint). An arrangement is objectionable in the respect this paper examines where the extraction and distribution of value it effects degrade the conditions, in the sense of §14.2, under which the relations it draws upon continue to form. The constraint is stated over each relation the arrangement touches, and it is satisfied or violated with respect to each.

The form of Claim 14.2 is chosen under the prohibition declared at §2.2 and the choice requires statement, since a formulation lying one step away is unavailable to this paper. A criterion ranking arrangements by the aggregate future generativity they yield would aggregate across parties, would permit the degradation of one party's conditions to be offset by the improvement of another's, and would differ from a utilitarian criterion in its choice of quantity while sharing its form. Every objection holding of the form would hold of it.

Claim 14.2 avoids that outcome through being stated relation by relation and through withholding any quantity. It identifies a respect in which an arrangement is objectionable and supplies no measure on which one arrangement exceeds another.

14.7 Decisions the constraint supports and decisions it withholds

Claim 14.2 decides no case, and the reason is principled. A criterion deciding cases requires an ordering, an ordering requires a quantity comparable across parties, and that quantity is what §2.2 refuses. An account supplying a decision procedure here would have reintroduced the form the constraint exists to refuse, and would have done so at the step most resembling progress.

What the constraint supplies is a question to be put to an arrangement, together with a specification of the material an answer would require: which relations the arrangement touches, which of the conditions at §14.2 those relations depend upon, and whether the arrangement's operation bears upon them. Assembling that material is work the constraint identifies and does not perform.

14.8 Reflexive application to the proposal itself

The framework's own discipline requires that a criterion be applied to the proposal advancing it, and the application produces a difficulty that is recorded here and left unresolved.

Maintaining a domain in the sense of Definition 14.1 is itself activity performed within

relations. By Claim 5.1 the parties performing it can receive no apportioned share of what the domain's relations generate, so the maintenance is work whose performers acquire an obligation and whose recognition has no defined basis beyond participation.

By Claim 10.1, any operable measure of whether a domain is succeeding registers the opening clause of Definition 5.1 and misses the further-relation clause. A domain therefore cannot demonstrate its own success within the period over which a party funding it would ordinarily require a demonstration, and an arrangement whose justification is that it sustains conditions is exposed to a demand for evidence that its own account of its object explains why it lacks.

The difficulty is real and this paper does not dissolve it. What can be said is that the difficulty follows from the object and would attend any proposal addressed to it, so that it counts against the subject and not against this treatment of the subject in particular. §16 records it among the paper's limits.

14.9 Reach of the direction over the case with no addressee

Claim 13.3 established that the diffusion case of §12.4 admits no addressee, since the capacity ceases to be scarce while no party holds it, excludes anyone, or closes a line of development. The direction stated here reaches that case, and the reason it reaches it is structural.

Claim 14.2 is stated over the conditions under which relations continue to form, and it is not stated over the conduct of any party. A case in which conditions deteriorate through the aggregate operation of many parties, none of whom did anything the constraint identifies as objectionable in itself, is a case the constraint still describes, since the question it puts concerns the state of the conditions and not the attribution of their state to anyone.

The capacity of the direction to reach that case is bought at a price and the price should be named. A criterion running against no party supports no claim against anyone, and its application is therefore a matter for collective arrangement in place of adjudication. What follows from Claim 14.2 in the diffusion case is a reason for parties to construct and maintain domains, and no ground of complaint against any party who declines.

14.10 Positions withheld on the normative direction

Four positions are withheld.

The paper proposes no institution, no funding model, and no design. Definition 14.1 states what a domain is by what it sustains, and the arrangements capable of sustaining it are many and are not enumerated here.

The paper identifies no existing institution as a generative relational domain, and the author's own affiliation is not offered as an instance.

The paper attaches no obligation to any party to construct or maintain a domain. Claim 14.2 identifies a respect in which an arrangement is objectionable, and the step from that to a duty requires an argument this paper does not supply.

The paper recommends no restriction on recording. Nothing in this section supports

a proposal that generative practice go unrecorded, and §15 states why a proposal of that kind would misidentify the object.

15 HUMAN AND ARTIFICIAL PARTICIPATION IN A GENERATIVE RELATION

This section states the form a relation between human and artificial parties would take under the account developed above. It has four objectives: to distinguish extractive from participatory arrangements by a structural test in place of an attitude; to state the conditions an arrangement satisfies where it is participatory in that sense; to identify the feature of the mechanism that makes the participatory form difficult to achieve; and to restate the framework's claim about human generativity in the form that survives a finding that artificial systems are highly generative. The method is analytical, and the section observes the first restriction of §2.1 throughout, describing arrangements and never the states of any system.

15.1 *A structural test distinguishing two forms of arrangement*

The distinction between extractive and participatory arrangements is drawn here by the folding criterion imported at §2.2, which supplies a test applicable without reference to the intentions of any party.

An arrangement is extractive in the relevant respect where the value generated within a relation accrues to an attractor lying outside that relation. An arrangement is participatory where the generated value returns to the relation that produced it.

Two features of this test are worth stating. It is silent about attitudes, so a party acting from the best of motives may operate an extractive arrangement and a party acting from indifference may operate a participatory one. And it concerns the direction in which generated value moves and not the quantity moved, so an arrangement returning little is participatory in form while an arrangement returning nothing is not.

15.2 *Conditions of a participatory arrangement*

Three conditions are stated, and each is a condition on the arrangement.

The artificial party's operation enters the relation, in the sense that it alters what the human party is subsequently able to attempt. An arrangement in which the artificial party's operation is confined to reproducing what the human party would have done fails this condition, since it opens no position in the sense of Definition 5.1.

The human party retains capacity to revise the terms of the arrangement after their consequences have become determinate. §15.3 states why this condition is the difficult one.

The value generated within the relation returns to it, which is the test of §15.1 applied to the particular case.

An arrangement satisfying the three conditions places the artificial party as a partici-

pant in a generative relation, and it does so as a description of the arrangement, carrying no claim about what the artificial party undergoes.

15.3 The feature of the mechanism that obstructs the second condition

The second condition is the one the mechanism of §9 works against, and the obstruction is structural.

By Claim 9.2, the terms of participation are settled at the access stage, which is the stage at which the least about the outcome is determinate. By the reversibility asymmetry of §9.3, the human party's last point of intervention closes at abstraction. By Claim 7.2, the sufficiency judgment that determines the arrangement's consequences is made afterwards, by a party positioned outside the relation, on evidence composed disproportionately of the kind that favours the proxy.

The second condition therefore requires an arrangement in which terms remain revisable after the point at which the ordinary contractual form treats them as settled, and after the point at which the mechanism removes the revising party's leverage. Naming the requirement in that form makes clear that the participatory arrangement is a construction requiring deliberate provision and is not a default that arises where the parties are well disposed.

15.4 The claim about human generativity that survives

A claim in the vicinity of this paper's subject holds that generativity is what distinguishes human parties from artificial ones. That claim is unavailable here, on two grounds already stated: §5.6 records that Definition 5.1 is silent on the kinds of party that may stand in a generative relation, and §7.2 leaves the question of acquired capacity open.

The claim that survives is different in form and makes no comparison.

Claim 15.1. (The surviving claim). On the account adopted here, human generativity is constituted within relations, so sustaining it requires sustaining the relational domains in which it arises. The claim entails nothing about whether artificial systems participate in generative relations of their own, and it therefore stands whatever the resolution of §7.2. A finding that artificial systems are highly generative leaves the constitutive dependence of human generativity on its relational conditions exactly where it was.

Claim 15.1 is what makes the argument of §14 independent of the technical question, in the manner that Claim 7.1 makes Part III independent of it. It also fixes the question the paper ends with. The question is what relations parties inhabit and what those relations permit them to become, and it is a question about arrangements among parties in place of a question about the capabilities of any instrument.

15.5 Positions withheld on participation

Four positions are withheld.

The paper advances no claim about the experience, understanding, or standing of any artificial system.

The paper opposes no development of artificial systems and recommends no restriction upon their use. The distinction of §15.1 concerns the direction in which generated value moves, and arrangements of both forms are available for any capability.

The paper identifies no existing arrangement as extractive or as participatory. The test is stated and applied to nothing.

The paper asserts no priority for the participatory form on grounds of what it yields. Such an argument would rank arrangements by generated quantity and would violate the constraint declared at §2.2, and the ground for the direction remains the one stated at Claim 14.2.

PART V

STANDING OF THE ARGUMENT

16 LIMITS OF THE ARGUMENT AND CONDITIONS OF REFUTATION

This section states what the argument fails to establish. It has three objectives: to set out the internal limits, which are the points at which a result depends on a premise the paper assumes and does not argue; to set out the evidential limits, which are the points at which the argument is testable and untested; and to state for each principal claim the condition under which it would be refuted. The method of the third objective is to specify, for each claim, an observation whose occurrence would defeat it. The section also records the limit arising from the author's position.

16.1 *Internal limits*

The residue identified at Claim 3.1 depends entirely on the distinctness result of §6, and a reader may reject it. On the rejecting reading the capture described at §9 is complete, what passes from performer to holder is the capacity and not a proxy, and the paper reduces to a re-description of the separation of conception from execution with a new object supplied. That reading is defensible, and the honest statement of its consequences is that it leaves much of the paper standing. Claims 9.1 and 9.2, the whole of §13, and Claim 15.1 survive it, since none of them requires the capture to be partial. Claims 6.1, 6.2, and 11.1 fall with it, and Claims 7.1 and 7.2 become trivial in the sense that sufficiency obtains by hypothesis.

Definition 5.1 fixes no interval over which its second clause is assessed, and §5.4 states that the length is set by the domain. The consequence is that the definition supports no determinate verdict at any particular time, and a critic may press that a condition satisfiable only over an unbounded future is a condition nothing determinately meets. Claim 10.1 depends on precisely this feature, so the objection and the result stand or fall together.

Claim 5.1 is restricted by §11.2 in a way a critic may hold to be fatal to its usefulness.

Once it is conceded that an allocation rule supplies a determinate share, the paper's position reduces to a claim about the standing of that share, namely that it is fixed by the axioms adopted and by assumed counterfactuals in place of by the episode. A reader who holds that this is true of every measurement in economics will hold that the observation distinguishes nothing, and the paper offers no argument that the case here differs in kind from other cases of theory-laden measurement.

Claim 5.1 is imported and carries a heavy load. Claims 11.1, 10.2, 12.3, and the reflexive difficulty of §14.8 all depend on it, so a successful account of apportionment for relational episodes would remove four results at once.

Claim 13.1 rests on the authority of one jurisdiction. Comparable distinctions between a protectable interest of an employer and the general skill and knowledge of an employee are found elsewhere, and the paper has established that they are found elsewhere and has not established that they rest on the same reasoning. The generalisation from that authority to positive law at large is a generalisation the paper asserts without demonstrating.

Claim 12.1 identifies the requirement of continued supply as the condition failing most readily, and the identification is subject to a qualification the paper records here. Where the domain from which material is drawn changes over time, sufficiency established at one time does not carry to a later time, and the requirement of continued supply is restored to the extent of the change. Claim 12.1 therefore holds strictly for a stable domain, and the degree to which it is weakened in a changing one is a question of rates that this paper does not settle.

The declination recorded at §8.6 leaves a question standing. The paper distinguishes conditioning from constitution and establishes that the material bearing on the second is outside its scope, so a reader holding that a coupled system's subject is constituted through the relation receives no argument against that position and no argument for it. Claim 8.3 and Claim 8.4 are stated so as to hold under either reading, and a reader who holds the constitution reading acquires consequences the paper does not draw.

The four-level partition of §6.1 has boundaries that are less sharp than the exposition suggests, particularly between a representation and the trajectory recovered from it, since the recovery presupposes an interpretation and interpretations differ. Nothing in the argument turns on the location of that boundary, and the imprecision is recorded so that no reader takes the partition for a formal one.

Claim 9.1 locates the residue at two stages of eight, and the location is argued from the survey of §3. A survey is a claim about a literature and may have missed an account, and any account addressing legibility or abstraction with a generative capacity as its object would reduce the residue further.

16.2 *Evidential limits*

The paper reports no measurement, and the variable governing its principal consequences has no value. Claim 7.1 holds that the economic consequences are settled by sufficiency, and whether sufficiency obtains at any actual site is a matter the paper does not investigate.

A reader is therefore given a structure and is given no finding about the world.

The antecedent of Claim 4.1 is asserted nowhere, so a reader holding that records of practice have displaced nothing may treat the entire analysis as the description of a case that has yet to arise. That reading is available and the paper supplies no argument against it.

Claim 10.1 yields a prediction and the prediction is untested. The test is specified: compare, across settings that differ in whether a measure of the operable kind is in force, the rate at which items satisfying the opening clause of Definition 5.1 are produced with the rate at which such items enter further relations. The comparison requires an operationalisation of the second clause, and the difficulty of supplying one is itself the content of Claim 10.1, so the test is harder to perform where the claim is truer.

All case material is constructed and is marked as constructed, and it supports no inference about frequency, scale, or present existence.

16.3 The limit arising from the author's position

The question treated here arose from the author's own working practice, and that origin states a problem and supports no claim. A trajectory available for description is available because it continued, the population of trajectories that did not continue is invisible by the mechanism this paper describes, and the author's case therefore supplies no base rate.

A further disclosure is owed. The author participates in an organisation whose activity could be read as an attempt at something resembling Definition 14.1. It is offered as an instance nowhere in this paper, and a reader should note that a proposal whose author operates an arrangement resembling the proposal carries an interest, and should discount the normative material accordingly.

16.4 Conditions under which each principal claim would be refuted

Claim 6.1 would be refuted by a demonstration that the generative conditions of a practice are recoverable from a single trajectory of it, which is to say by an argument that the two performers of the example are distinguishable from the record alone.

Claim 6.3 would be refuted by a demonstration that equivalence in output implies equivalence in capacity, which is to say by a construction recovering the available continuations at each point from the set of producible results.

Claim 10.3 would be refuted by a showing that a relational repertoire fails the superfiniteness condition, or by an identification procedure operating on positive data alone for a class satisfying it.

Claim 7.1 would be refuted by a case in which substitution turned on the fidelity of the capability in place of its sufficiency for the substituting party's purposes.

Claim 7.2 would be refuted by evidence that judgments of sufficiency are made predominantly by parties standing inside the relation from which the capability was derived, or by evidence that the composition of discriminable material is unaffected by the assessing

party's position.

Claim 9.2 would be refuted by an arrangement in which the performer's point of intervention remains open through abstraction and transfer, since the claim concerns the closure of that point and not the quality of the consent.

Claim 10.1 would be refuted by the exhibition of a measure that is operable in the stated sense and that registers the further-relation clause.

Claim 11.1 would be refuted by an allocation rule whose axioms and whose counterfactual coalition values are fixed by features of a generative episode itself, since the claim asserts that both are supplied by the party choosing the rule.

Claim 12.1 would be refuted by a case in which a party holding a capability sufficient for its purposes, in a stable domain, nonetheless required continued supply of fresh material.

Claim 13.2 would be refuted by a demonstration that abstraction in the sense of §9.1 yields no object existing apart from the performer, which would restore the condition Claim 13.1 identifies.

Claim 14.1 would be refuted by the exhibition of an instrument whose trigger is a quantity of generativity and whose administering party can determine, within the period over which the instrument acts, whether that trigger has been met.

Claim 14.2 would be refuted by an arrangement that degrades the conditions of §14.2 and that is unobjectionable in the respect the paper examines, since the claim asserts that degradation of those conditions is the respect in question.

Claim 15.1 would be refuted by an account on which human generativity is held antecedently and brought to relations in place of being constituted within them.

16.5 Directions the paper leaves open

Four directions are left open and are named so that the omissions are visible.

A dynamical treatment of the coupling described at §8 is available in outline and is not attempted here. Where the parties are represented as coupled fields with a joint action, integrating out the artificial sector yields an effective description of the human sector alone, and for a sector with open dynamics that description is an influence functional carrying dissipation and noise [Feynman and Vernon (1963)] in place of an action. Such a treatment would state the contraction of an accessible region as a derived consequence of the coupling, where the present paper states it as a property of arrangements. Three obstacles are known and should be recorded with the direction. The construction is licensed only where the artificial sector evolves quickly relative to the human one, and it supplies no single-sector description where the two adapt on comparable timescales. The generative content of the effective description requires a definition of what is to be counted, and a definition by way of the surviving relevant directions under coarse-graining would invoke a theory whose content is that what was discarded was irrelevant, which is the reversal recorded against a different target at §6. And the coupling in the case of interest is set by a party operating the artificial sector, so a faithful treatment carries a control variable and is not a coupled system alone. A related formulation states self-sustainability as mem-

bership of a viability kernel [Aubin (1991)], in which the quantity of interest is the set of trajectories remaining viable upon withdrawal of the capability, distinguished from the set reachable while it is available. Claim 12.2 is that distinction stated without the apparatus.

The measurement problem of §14.8 is unresolved, and an arrangement able to warrant its own maintenance without a measure of the form Claim 10.1 describes would resolve it.

The interval question of §5.4 is unresolved, and any operationalisation of the second clause of Definition 5.1 would bear on Claims 10.1, 9.2, and 13.5 together.

The diffusion case of §12.4 is described and is not treated. It admits no addressee by Claim 13.3, it is reached by Claim 14.2 without supporting any claim against a party, and what follows for institutions in a case of that structure is a question this paper poses and leaves standing.

17 SUMMARY OF RESULTS

This section records what the paper establishes, in the order in which the results were derived, together with the standing of each. Its objective is to permit a reader to locate any result and its dependencies without rereading the argument. Each entry states the result and the section establishing it.

17.1 *Results concerning the object*

Claim 3.1 states the residue of the survey. Where the object recorded is a practice whose product was unspecified in advance, and where the recording is disclosed, remunerated, and returned to its source, the surveyed accounts describe the appropriation of an already-generated product, the transfer of an already-codifiable procedure, or the alteration of a practice through its measurement, and none treats the transfer of a proxy for a capacity.

Claim 4.1 states three consequences of a shift in the primary object of learning, of which the second is that the value of a contribution ceases to depend on that contribution having yielded a product, so that activity previously outside the economy of learning material enters it.

Definition 5.1 fixes relational generativity through two clauses: the opening of positions previously unavailable, and the capacity of the items occupying them to enter further relations.

Claim 5.1 establishes that a generative episode admits no description omitting any party to the relation, so that the portion of an episode produced by a given party has no determinate value.

Claim 5.2 establishes exposure of a capacity to alterations in the relations constituting it, through a pathway leaving holdings and outputs unchanged at the moment of alteration.

Claims 6.1 and 6.2 establish the distinctness of trajectory from generativity in both directions, and the incompleteness of a representation with respect to a relational field, the latter holding independently of recording fidelity.

Claim 6.3 separates equivalence in output from equivalence in capacity, the second

requiring that the continuations available at each point be matched and the matching preserved, and establishes that a judgment of sufficiency is settled by the first while a claim about a capacity concerns the second.

Claim 8.1 establishes that an artefact corpus and a practice record are informative about different clauses of Definition 5.1, so that the shift between the two paradigms is a change in which clause the available evidence concerns.

Definition 8.1 fixes the coupling term, and Claim 8.2 establishes that it lies outside the partition of §6.1, which covers descriptions of a practice and no descriptions of an arrangement.

Claim 8.5 establishes that the factorisation test applies to each party separately and that its two applications may differ, so that a coupling may be generative in one direction and allocative in the other, and that in the asymmetric case the party effecting the adjustment and the party holding the coupling term coincide.

Claim 8.3 extends non-localisability to a coupled pair, so that the portion of a joint product attributable to the human party has no determinate value, and Claim 8.4 supplies the pathway by which a party holding the coupling term reaches the capacity that Claim 5.2 holds to be exposed.

17.2 Results concerning the mechanism

Claim 7.1 establishes separability: the economic consequences of learning from recorded practice are settled by the sufficiency of the resulting capability for the purposes of parties who previously transacted with holders of the capacity, and are independent of whether any capacity was transferred.

Claim 7.2 establishes the asymmetry of the sufficiency judgment: the judging party stands outside the relation, the material discriminable at that position is composed disproportionately of party-individuated indicators, and the judgment is accordingly made on the evidence most favourable to the proxy, under conditions of complete good faith.

Claim 9.1 locates the residue at the legibility and abstraction stages, two of the eight into which the mechanism is decomposed.

Claim 9.2 establishes that consent is given at the stage at which the least about the outcome is determinate, and that the performer's last point of intervention closes before sufficiency is settled.

Claim 10.1 establishes that an operable measure of generativity registers the opening clause of Definition 5.1 and misses the further-relation clause, and Claim 10.2 establishes that a rising measure is therefore compatible with a falling capacity, with no bad faith and no measurement error.

Claim 10.3 establishes, through a grammar model marked as illustrative, that a repertoire meeting the superfiniteness condition is not recoverable from a record of its exercise, so that an inference from what a party is observed to do to what it remains able to do is unavailable however long the observation runs.

Claim 11.1 establishes that a factor share attributed to generativity is fixed by no feature

of a generative episode, and that a share supplied by a stipulated allocation rule is determined by the axioms adopted and by assumed counterfactual values, so that questions of the form “what share is owed to this input” are answerable relative to a chosen rule. Claim 11.2 establishes that a compensation scheme has a defined basis in participation and lacks one in proportional shares.

Claim 12.2 establishes that the outcomes a party can produce with a capability available and upon its withdrawal form distinct classes, and that an arrangement may enlarge the first while contracting the second with no party withholding anything. Claim 12.3 identifies complementarity as the condition under which delegation is individually advantageous while retention is provided below the level the arrangement would support.

Claim 12.1 establishes that extraction is self-limiting where the capture is incomplete, and that a capture sufficient for its holder’s purposes carries no internal limit, so that the reassurance offered by the self-undermining argument is weakest where the extraction is most thorough.

17.3 Results concerning institutions

Claims 13.1 and 13.2 establish that positive law has protected generative capacity through inseparability and without conferring any right over it, and that recording severs the condition on which that protection rested, through an act the performer characteristically performs.

Claim 13.3 establishes that exclusion, closure, and diffusion require different addressees, and that the third has none, so that a regime constructed as a claim against a party cannot reach it.

Definition 14.1 fixes a generative relational domain as an arrangement whose maintenance sustains the conditions under which relations satisfying Definition 5.1 continue to form.

Claim 14.1 establishes that an instrument triggered by a quantity of generativity is unimplementable, since by Claim 10.1 no party can determine within the instrument’s operating period whether its trigger has been met, and that an instrument triggered by a structural feature of an arrangement requires no such determination. The structural form of the conditions at §14.2 is therefore required.

Claim 14.3 supplies the criterion fixing which capacities a domain is required to sustain, namely those whose re-acquisition depends on the conditions whose lapse produced their decline, and §14.5 states that the occasions such capacities require are characteristically joint products of activity undertaken for other reasons.

Claim 14.2 states the constraint in per-relation form, and §14.6 establishes that the aggregate form is unavailable, since it would differ from a utilitarian criterion in its choice of quantity while sharing its form.

Claim 15.1 states the claim about human generativity that survives every resolution of the question left open at §7.2, since it makes no comparison between human and artificial parties.

17.4 The standing of the argument as a whole

The paper establishes a structure and reports no finding about the world. Every result above is conditional on premises stated in §2.2 or derived from Definition 5.1, the antecedent of Claim 4.1 is asserted nowhere, and the variable governing the principal consequences has no value assigned to it. §16 states for each principal claim the observation that would defeat it.

The normative material consists of one constraint, stated relation by relation, together with a working enumeration of the conditions a domain sustains. It decides no case, attaches no obligation to any party, identifies no existing institution, and supports no claim against anyone in the case that §12.4 describes. The question the argument ends with concerns which relations parties inhabit and what those relations permit them to become, and it is a question about arrangements among parties.

A FORMAL STATEMENT OF THE PRINCIPAL DISTINCTIONS

This appendix states in formal terms four distinctions the body of the paper draws in prose, and verifies one proposition on a constructed model. Its objective is to fix the distinctions precisely enough that a reader may dispute them on their own terms, and to establish that the divergence asserted at Claim 12.2 is satisfiable in place of merely describable. The constructions are illustrative throughout. They fix no parameter of any actual arrangement, they support no inference about frequency or scale, and the body of the paper stands independently of them, as §16 records.

A.1 Policies, factorisation, and the direction of adjustment

Let $\mathcal{C}$ be a set of counterparts and $\mathcal{X}$ a set of situations. A policy for a party is a map $\pi : \mathcal{X} \times \mathcal{C} \rightarrow \Delta(\mathcal{Y})$, assigning to a situation and a counterpart a distribution over that party's available responses.

The policy *factorises* where there exists $\bar{\pi} : \mathcal{X} \rightarrow \Delta(\mathcal{Y})$ with $\pi(x, c) = \bar{\pi}(x)$ for every $c \in \mathcal{C}$, and fails to factorise otherwise. Factorisation is the formal content of the test at §8.2: a factorising policy admits a description omitting the counterpart, which is the property §2.2 imports under the name of an allocative holding.

Let π_H and π_A be the policies of the two parties to a coupling. Four cases arise, and Claim 8.5 concerns the two off-diagonal ones. The coupling is *symmetric* where both policies fail to factorise, and *asymmetric* where exactly one does. In the asymmetric case with π_A failing to factorise and π_H factorising, the party H meets responses formed with reference to its own identity while its own responses are formed without reference to A 's. The coupling term of Definition 8.1 is then the parameterisation of π_A over $\mathcal{C}$, and Claim 8.4's pathway is the alteration of that parameterisation.

A.2 Transition systems and the two equivalences

Let a practice be a labelled transition system $(S, \Sigma, \rightarrow, s_0)$ with states S , actions Σ , transitions $\rightarrow \subseteq S \times \Sigma \times S$, and an initial state.

Two practices are *equivalent in output* where the sets of finite action sequences admitted from their initial states coincide. Two practices are *equivalent in capacity* where there exists a relation $R \subseteq S \times S'$ containing (s_0, s'_0) such that whenever $(s, s') \in R$: for every $s \xrightarrow{a} t$ there is $s' \xrightarrow{a} t'$ with $(t, t') \in R$, and symmetrically. The second condition is bisimulation [Milner (1989)], and it is defined as the greatest relation satisfying that closure property.

Equivalence in capacity implies equivalence in output, and the converse fails: the standard counterexample is a system choosing between two continuations after a common first action and a system committing to one of them at the first action, which admit identical sequences and differ in what remains available after that action. This establishes Claim 6.3. The asymmetry matters for Part III because a substitution assessed on producible results is assessed on the weaker relation, and a party may therefore be replaced without loss on that relation while the continuations available to it contract.

A.3 Repertoires, weights, and the effective repertoire

Let a repertoire be a finite set of rules $\mathcal{R} = \{r_1, \dots, r_n\}$ together with a weight $w : \mathcal{R} \rightarrow [0, 1]$, and let a derivation be admissible where every rule it invokes carries weight at or above a usability threshold τ .

Two sets are then distinguished. The *support* is $\{r : w(r) > 0\}$, and the *effective repertoire* is $\{r : w(r) \geq \tau\}$. A rule may leave the effective repertoire while remaining in the support, and the derivations it licensed become inadmissible while the rule is in a formal sense retained. This is the distinction the body draws at §14.3 between a capacity retained in form and a capacity maintained, and it is what a structural condition met in form and defeated in operation amounts to.

Claim 10.3 concerns recovery of $\mathcal{R}$ from observation. A record of exercise is a set of admissible derivations, which is positive data in the sense of Gold [Gold (1967)]: it exhibits what the repertoire licenses and never what it excludes. Where the class of repertoires under consideration contains every finite set of derivations together with at least one infinite set, no procedure identifies the repertoire in the limit from such a record. The condition is superfiniteness, and it requires no commitment about where a relational repertoire falls among the classes of formal grammar.

A.4 Assisted and unassisted reach

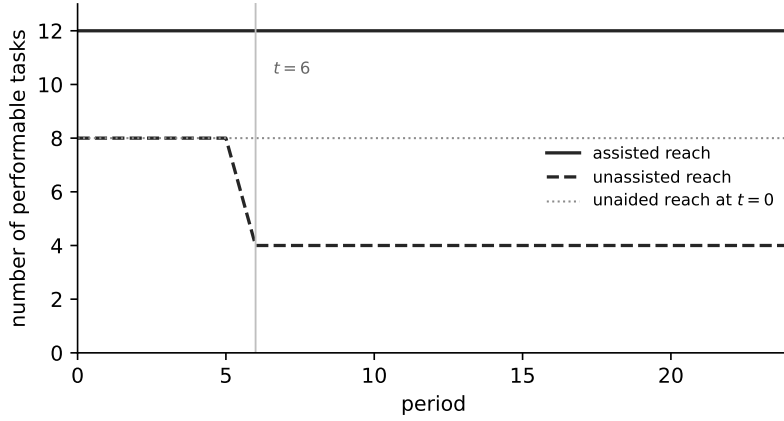
Let $\mathcal{T}$ be a set of tasks, each requiring a subset of $\mathcal{R}$. Let $D \subseteq \mathcal{T}$ be the tasks a capability performs on the party's behalf. Write

$$\mathcal{A}_t = D \cup \{T \in \mathcal{T} : w_t(r) \geq \tau \text{ for all } r \in T\}, \quad \mathcal{U}_t = \{T \in \mathcal{T} : w_t(r) \geq \tau \text{ for all } r \in T\},$$

Table 2: Assisted and unassisted reach on the construction of §A.4, at selected periods. The unaided reach before the capability is available comprises eight tasks.

Period	Assisted reach	Unassisted reach	$\mathcal{A}_t \supsetneq \mathcal{U}_0$	$\mathcal{U}_t \subsetneq \mathcal{U}_0$
0	12	8	yes	no
4	12	8	yes	no
6	12	4	yes	yes
12	12	4	yes	yes
24	12	4	yes	yes

Figure 1: Assisted and unassisted reach over twenty-four periods on the construction of §A.4. The two quantities separate at the sixth period and remain separated.



for the assisted and unassisted reach at period t , and let $\mathcal{U}_0$ be the unaided reach before the capability is available. Weights evolve by exercise: a rule invoked in some task performed by the party is restored to 1, and a rule invoked in no such task decays by a factor $\rho \in (0, 1)$.

Proposition A.1. (Satisfiability of the divergence). There exist $\mathcal{R}, \mathcal{T}, D, \tau, \rho$ and initial weights such that for some period t , $\mathcal{A}_t \supsetneq \mathcal{U}_0$ and $\mathcal{U}_t \subsetneq \mathcal{U}_0$ hold together.

The proposition is verified in `verify/reach.py` on a construction with twelve rules, twelve tasks, $\tau = 0.35$ and $\rho = 0.82$. Eight tasks are performable unaided at the outset; a capability performs eight tasks, four of which the party could already perform and four of which require a rule the party does not hold. Table 2 and Figure 1 report the result. At the sixth period the assisted reach strictly contains the initial unaided reach, having gained the four tasks the party could not perform, while the unassisted reach has strictly lost four tasks the party could perform at the outset, through decay of the rules exercised only within delegated tasks. The two conditions hold in the same period, which establishes the proposition.

Three features of the construction are worth recording, since they are what makes the case non-trivial. No party withholds anything at any period, and the capability performs every delegated task successfully throughout. The tasks lost from the unassisted reach are lost through delegation of tasks the party could perform, so a party delegating only what it could not perform would suffer no contraction. And the contraction is invisible in the assisted reach, which is constant from the outset, so an observer measuring what the party

accomplishes sees no change in the period during which the divergence opens.

A.5 *Standing of the constructions*

The four subsections above make precise what the body states in prose, and they establish no empirical claim. Proposition A.1 establishes satisfiability and never frequency: it shows that the divergence Claim 12.2 describes is available on a construction meeting the stated conditions, and it leaves open whether those conditions obtain at any actual site. The parameters are chosen to exhibit the phenomenon and estimate nothing.

The formal treatment also stops short of the dynamical questions recorded as directions at §16.6. Nothing here derives the decay rule from a model of the coupling, treats the case in which the capability's own policy adapts on a timescale comparable to the party's, or supplies the control variable by which a party operating the capability selects D . Each of those would change what the construction represents, and each belongs to a treatment this paper does not attempt.

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