Gaps That Observation Cannot Close: Distributed Relations and Institutional Facts

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November 7, 2026

Abstract

Institutions and the people who design them habitually treat every shortage of knowledge as a shortage of information, to be remedied by observing more, recording more, auditing more, or asking more. This essay argues that the assumption is false for an important class of cases. Not knowing a proposition and being unable to know it are different conditions, and they call for different action. Some gaps are closable by an actor through operations within that actor's reach. Others are structural: the proposition concerns a relation among several parties, and either no operation available to any single party can settle it, or it is not settled until the parties act. The argument separates hidden, dispersed, and constitutive gaps, shows that well-known impossibility results in distributed computing are structural gaps in a precise sense, and explains why escalating observation is the wrong remedy where the gap is structural. It then considers how action should proceed under each kind of gap, with particular attention to the rationality of waiting, which is sound for closable gaps and futile for structural ones. The essay does not claim that structural gaps are common in every domain. It claims that the distinction must be drawn before a remedy is chosen.

1 Introduction: Two Ways of Not Knowing

An officer asks whether a payment has been authorized. The question sounds like a request for information, and in many cases it is: the approval exists in a file somewhere, and a diligent search will find it. In other cases the same question has no such answer waiting to be found. The payment requires the concurrence of two signatories, one of whom has signed, and the other of whom has not yet decided. The fact that the officer is asking about does not exist in any file, and no further searching, however thorough, will turn it up, because it will not exist until the second signatory acts. The officer, the auditor, and

the system that tracks approvals can all be perfectly diligent and still fail to find what is not there.

The two situations produce the same sentence, "I do not know whether it has been authorized," and the sentence conceals a difference of the first importance. In the first situation the person lacks something that exists. In the second, the thing lacked has not been constituted, or is constituted only across relations that no single party can survey. Remedies appropriate to the first, such as searching, logging, auditing, and requesting records, do nothing for the second. Worse, an institution that diagnoses the second as the first will respond by intensifying observation, and will find that the gap persists however much observation increases. The result is a familiar institutional pathology in which ever more information is collected about a question that information cannot settle.

The thesis of the essay is that the distinction between not knowing and being unable to know must be made before a remedy is selected, and that being unable to know has structurally different sources, of which the most important for institutions is the dependence of a proposition on relations among several parties. The argument proceeds by stating the distinction with care, presenting a test that separates informational gaps from relational ones, examining three structures of gap with examples, and showing that results from the theory of distributed computation supply exact instances of structural gaps. It then draws consequences for action, and in particular for the question of when it is rational to wait.

2 Not Knowing and Not Being Able to Know

Let $K_i P$ express that actor i knows proposition P. The first condition is

$$\neg K_i P,$$

which says that i does not currently know P. Nothing follows from this about whether i could come to know P. The second condition is stronger. It says that, given the structure of the situation, i cannot establish P, and a first attempt to write it uses a possibility operator:

$$\neg \Diamond K_i P.$$

The attempt requires care, because the unrestricted modal reading is a trap. A well-known argument in the logic of knowledge shows that if every truth is knowable then every truth is known, since a truth of the form "P is true and nobody knows it" cannot be known without ceasing to be of that form [2]. The lesson for present purposes is that the possibility of knowing should not be read as bare logical or metaphysical possibility. A reading that permits any imaginable change in the world trivializes the notion, since almost anything

could be known if circumstances were changed enough.

The notion needed is relative to an actor and to a stock of operations. Let $\mathrm{Op}_i(h)$ be the operations available to actor i at history h: observations, queries to other parties, requests for records, joint acts with others, and acts of waiting. The relevant question is whether some adaptive sequence of such operations would settle the matter.

Definition 1. Proposition P is *closable for i at h* when there is a strategy composed of operations in Op_i such that, however the world responds within the situation as it is structured, the strategy terminates in an evidential state from which P or $\neg P$ is derivable by a procedure i is entitled to use. The gap is *structural for i at h* when no such strategy exists, so that no sequence of operations available to i leads to an evidential state from which either P or $\neg P$ is derivable.

The definition has several features worth marking. It is relative: a gap that is structural for one actor may be closable for another, as when a supervisor can compel a response that a subordinate cannot. It is relative to operations, which include operations that are permitted but exclude operations that would violate governing rules, so that a gap can be closable by an act that is forbidden and structural for any actor who observes the prohibition. It concerns settling, which requires more than collecting. And it is indexed to a history, since a gap that is structural at one history may become closable at the next, for instance when the missing party acts. The distinction between not knowing and being unable to know thus becomes a distinction between gaps for which a closing strategy exists and gaps for which none does.

3 Information Gaps and Relational Gaps

A test separates informational gaps from relational ones. Imagine an observer with complete access to every record, communication, and internal state of every party, past and present. If such an observer could settle P, the gap is informational: the fact exists, and the difficulty is access. If such an observer could not settle P, because the fact is not determined by the states and records of the parties taken separately or together at the present history, the gap is relational or constitutive. The test is a thought device, and it is used to classify questions, not to propose that such an observer could exist.

Two refinements apply. First, a gap may be informational in this sense and still structural for a particular actor, because that actor cannot assemble the information. The omniscient observer test classifies the question; the closability definition classifies the actor's position. A question that passes the test may fail the definition, and the failure is exactly the situation the earlier discussion of distributed evidence addressed, in which material is present in an organization and no one is placed to put it together. Second, there are

questions on which the external observer would see a fact that no party inside the system can establish. That the parties do not have a certain mutual awareness can be plain to the external observer and impossible for any party to remedy, and such cases are taken up below.

Institutional facts are often relational in the strong sense. That a contract has been formed, that a motion has carried, that a person has consented, that two officers have jointly authorized an act: each is a fact whose truth conditions concern what several parties have done and how those acts relate. Legal analysis has long treated normative positions as correlative and two-sided, so that one party's right is another's duty and one party's power is another's liability [6]. Constitutive accounts of institutional facts make the same point from another direction, since a fact of the form that something counts as something else in a context depends on collective acceptance of the rule that makes it so [8]. In neither account is the fact located in the state of any one party. It lies in a pattern across parties, and the pattern can be absent, incomplete, or in the process of forming, in which case there is nothing to find.

4 The Two-Signature Case

The payment case can be developed to show the three structures on which the essay turns. A payment above a stated threshold requires approval by two designated officers. Each officer signs separately, and the payment is released once both signatures are on record.

Suppose first that both officers have signed, and the page bearing one signature has been misfiled. The proposition that the payment has been authorized is true and its truth-maker exists. The question of whether it has been authorized is informationally gapped: a search of the files, or a request to the officer, would settle it. This is a hidden gap. The remedy is observation, and the observation is within the reach of the person asking.

Suppose next that the signatures are held in separate systems, one under the control of the finance department and one under the control of the legal department, and neither department may disclose to the other the status of an unreleased approval. Both signatures exist; no single party can see both; and the rule against disclosure prevents the joint examination that would settle the matter. This is a dispersed gap. The fact is present across the parties and the omniscient observer would settle it at once, yet the gap is structural for each of them given the rule, and it can be closed only by an authorized act of composition, such as a designated third party with standing to see both systems. The remedy is to supply a warrant for aggregation, which is a different thing from collecting more information, since the information is already there.

Suppose finally that one officer has signed and the other has not yet decided. The

proposition that the payment has been authorized is, at this history, false, and it is also not yet determinate in the sense that matters for planning, since the second officer's act is still open. A supplier who asks whether the payment is going ahead is asking a question about the future of a process in which a free act is outstanding, and to treat it as a request for existing information is to misdescribe it. The omniscient observer test returns a negative answer: no observer, however informed about present states, can settle whether the second officer will sign, except by predicting a decision not yet made. This is a constitutive gap. The remedy is for the relevant relation to be constituted, which is to say that the second officer must act, or that the process must be redesigned so that the outcome does not depend on the unconstituted fact.

The three structures differ in what they ask of the person who seeks the answer. The hidden gap asks for search. The dispersed gap asks for an authorized composition. The constitutive gap asks for an act by someone else, or for a change in what is being asked.

5 Structures of Gap

The three structures can be stated more generally.

A hidden gap concerns a fact that exists at the present history in the state of some party or record, and that the inquirer can access by an available and permitted operation. Closing it is a matter of observation, and the principal limits are cost and time. Most of the ordinary activity of search, audit, and inquiry addresses gaps of this kind, and for them the instinct to gather more information is sound.

A dispersed gap concerns a fact that exists across several parties, in the sense that its truth-makers are located in different places, while no single party has access to all of them under the prevailing rules and capabilities. The fact is determinate and the omniscient observer would settle it. Closing it requires an operation of composition: bringing the pieces together, establishing that they are compatible, and having the result issued by a role with standing to issue it. The principal limits are authority and independence, and in particular whether the pieces are jointly usable and whether they are independent enough to count as separate support.

A constitutive gap concerns a proposition that depends on relations among parties which have not yet been constituted, or are in the course of being constituted. Closing it is not a matter of finding anything. It requires the parties to act, or requires an institutional rule that supplies a determination in the absence of their action, such as a default or a tie-breaking provision. Questions of this kind are often posed in the grammar of ordinary inquiry ("has it been approved?", "do they agree?") and the grammar misleads, because it suggests that an answer is waiting.

A fourth structure sits beside these and deserves separate mention, namely the attainment gap, in which the proposition concerns a state that the parties are trying to reach and that their means of communication cannot reliably deliver. Mutual awareness of a fact, where each party knows that the other knows, and knows that the other knows that they know, to all depths, is a state of this kind. It is the topic of the next section.

6 Impossibility Results as Structural Gaps

Results in the theory of distributed computation offer exact instances of structural gaps, and they show that the notion is not merely a convenience of exposition.

The first is the problem of coordinated action over an unreliable channel. Two parties must agree to act at the same time, and can communicate only by messengers who may be lost. Whatever protocol of messages and acknowledgments is adopted, the last message may not arrive, and the sender of that message cannot know whether it did. It follows that no finite exchange of messages can give both parties the state of mutual knowledge that would justify acting together with certainty [4]. The theory of knowledge in distributed systems explains why: coordinated action of this kind requires common knowledge, meaning that each party knows the fact, knows that the other knows it, and so on without end, and common knowledge cannot be attained by communication over a channel that may fail [5, 1]. The gap here is structural for each party. More messages narrow the practical risk, and the gap never closes. An observer standing outside the system could see exactly what each party believes, and that would not help the parties, since the missing state is something they would have to attain together.

The second is the difficulty of telling a slow party from a failed one. In a system in which messages may be delayed without bound, no procedure can distinguish between a process that has stopped and a process that is merely slow, and this indistinguishability has the consequence that no deterministic protocol can guarantee agreement among the remaining processes if even one may fail [3]. The point to take from the result is not its technical conclusion. It is that a party waiting for a response cannot tell whether the response is coming. The gap between “not yet heard” and “will never be heard” is not closable by waiting, since waiting is the very operation whose outcome is indistinguishable across the two possibilities.

The third concerns order. In a system with no common clock, whether one event occurred before another is determined only where there is a chain of causal influence from the first to the second, and for events with no such chain there is no fact of the matter about order that the system itself could establish [7]. Any total ordering that a system imposes is a convention constituted by the system, and the ordering is, in the vocabulary of this essay,

a constitutive fact and not a hidden one.

Each of these results has an institutional counterpart. Parties to an agreement who must be sure that they are agreed face the problem of mutual awareness, and institutions respond with formal acts, such as signatures, filings, and ceremonies, that constitute the awareness publicly and do not rely on private exchange. Organizations that wait for a counterparty to respond face the problem of the slow and the absent, and they respond with deadlines, defaults, and rules for the effect of silence. Disputes about which of two decisions came first, in a setting where there is no single record keeper, are resolved by a rule of precedence, which is a constitutive act and not a discovery. In each case the institutional device works by supplying what observation cannot supply.

7 Why More Observation Is the Wrong Remedy

The point of the distinction is practical. If a gap is structural, then observation applied to it either does nothing or does harm, and several characteristic pathologies follow from missing the difference.

The first is escalation. An institution that diagnoses a constitutive gap as a hidden one will collect more data, and since the data cannot close the gap, will conclude that it has not collected enough. The remedy is repeated at greater cost. Logging, auditing, and monitoring are all of this kind: each is a legitimate response to hidden gaps, and each becomes a way of avoiding the real question when applied to constitutive ones. The accumulation of records about a question that records cannot settle gives a spurious sense of progress.

The second is the displacement of the gap onto the wrong party. When two parties must jointly constitute a fact and neither can establish it alone, the institution may demand that one of them produce proof. The demand cannot be met, and the party is held answerable for failing to meet it. A responsibility is thereby assigned in a form that no action of the responsible party could discharge.

The third is false closure. Faced with a structural gap and pressure to act, an institution may treat the best available proxy as the missing fact. The existence of a message is treated as proof of receipt, the lack of an objection as proof of consent, or the passage of a period as proof of agreement. In some of these cases a rule may legitimately make the proxy decisive, and then the proxy has constitutive force by the rule. Where no rule does so, the proxy is a substitution of the same kind as those examined in other contexts, in which a result under one relation is treated as sufficient for a determination under another.

A modern variant arises with automated assistants and agents. An agent asked whether something has been agreed, approved, or committed to may search every accessible source

and return a confident answer, and the answer may be a report of what the sources say, correctly gathered, about a fact that the sources do not contain. A system that cannot distinguish a hidden gap from a constitutive one will answer both with the same assurance, and its users will have no means of telling which kind of answer they have received.

8 Acting Under Each Kind of Gap

The distinction bears most directly on the question of whether to wait. Waiting is a perfectly reasonable response to a closable gap when the cost of delay is lower than the cost of proceeding on incomplete grounds, since the passage of time or the arrival of further information can be expected to close it. Waiting is also a reasonable response to a constitutive gap in one special case, namely when the parties whose act would constitute the relation are free to act and have reason to do so, as with the second signatory who will sign when they have reviewed the papers. In this case waiting is not collecting information. It is leaving room for an act.

Waiting is futile where the gap is structural in the strong sense. A party that waits for common knowledge over an unreliable channel, or for a response whose absence is indistinguishable from slowness, will wait without end, and each additional interval of waiting leaves it exactly as uncertain as before. Futility of this kind is easily overlooked because waiting looks prudent from the outside and is costless in the immediate case.

Where the gap is structural, the available courses involve not a search for the missing fact but a change in the decision problem. Several recur in institutional practice.

An institution may constitute the relation by a rule that does not depend on the unobservable. A rule that silence after a stated period counts as acceptance, or that a motion carries on a stated majority, or that in a tie a designated person decides, supplies a determination where observation cannot. These rules are constitutive in the sense discussed above: they make the fact, and they do so openly, so that all parties know which rule governs.

An institution may redesign the action so that it does not depend on the missing fact. A commitment may be made provisional, conditional on a later act, or reversible within a period. A payment may be placed in escrow, so that it moves only when the relation is constituted, and the party who relies on it relies on the escrow and not on the absent proposition.

An institution may designate a decider. Where no single party can establish the relevant fact and the parties cannot be relied upon to constitute it, a role with standing to decide, and a rule for its use, converts a structural gap into an exercise of authority. The decision does not close the gap in the sense of discovering anything. It substitutes a determination for a discovery, and the decision is legitimate to the extent that the role is.

An institution may accept that the matter cannot be settled and act under a stated rule for uncertainty. This is the least comfortable course, and sometimes the only honest one, since the alternative is to pretend that the fact has been found.

Each course requires that the gap be recognized as structural. An institution that has recognized the kind of gap it faces can choose among them. One that has not will keep looking.

9 Objections and Limits

It may be objected that the distinction depends on how operations are individuated, and that any gap can be turned into a closable one by adding a sufficiently powerful operation. The objection is correct as stated and supports the account. Closability is relative to what the actor can do, and part of institutional design consists in deciding what operations to confer. A supervisor with power to compel a response has operations that a subordinate lacks. The point is that conferring such operations is a design choice with consequences for authority and responsibility, and not a technical matter of gathering more information.

It may also be said that constitutive gaps are not gaps at all, since they concern a future fact and ignorance of the future is not a gap in present knowledge. Part of this is right. The proposition that the second officer will sign is a proposition about the future, and the proposition that the payment has been authorized is, at the present history, false. The reason to treat the case as a gap is that the question is routinely posed, and the answer routinely demanded, as though a present fact were at issue. The gap lies in the presupposition of the question, and noticing that is the first step toward giving a useful answer, such as stating what act remains outstanding and whose it is.

A further objection holds that the notion of a structural gap risks excusing inaction, since any institution can say that a fact cannot be established and decline to act. The reply is that the definition is demanding. A gap is structural only if no available strategy settles the matter, and claiming that it is requires showing that. The classification also does not license inaction. It redirects effort from observation to the courses listed above, each of which is a way of acting, and it identifies waiting as futile where waiting is futile.

Finally, the results from distributed computing are exact in idealized models and give only guidance in institutions, where channels are less adversarial and parties can often talk and agree outside the formal system. The analogy is meant to show that structural gaps exist and have a precise character in some settings, and does not claim that every institutional difficulty is an impossibility theorem. Institutions have means that formal models lack, such as shared practice, trust, and the ability to rely on conventions that no protocol could establish, and these are part of why they work in the cases where the models

say that nothing can be done.

10 Conclusion

The sentence with which the essay began, "I do not know whether it has been authorized," covers cases that differ in kind. In some a record is missing and can be found. In some the pieces exist and no one is placed to assemble them. In some the fact has not been constituted, and in others the parties are trying to reach a state of shared awareness that their means of communication cannot deliver. For the first, observation is the remedy. For the second, an authorized act of composition is. For the third, an act by someone else, or a rule that supplies a determination. For the fourth, a public act or convention that does the work that private exchange cannot.

An institution that treats all four as the first will search, record, and audit without end, will assign responsibility for results that no action could produce, and will occasionally close its gaps by treating proxies as facts. An institution that distinguishes among them can ask, of any question that it cannot answer, whether the gap is one that observation could close, and if not, which act or rule would constitute what observation cannot find. The distinction is simple to state, and its value is that it must be drawn before the work of closing a gap can begin.

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