Information and Causal Access

What counts as information in a probe-limited world

Distinguishability, transmission constraints, and manifestation under causal structure

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Executive Summary (Non-Technical)

The word **information** is used too loosely. Sometimes it means data. Sometimes it means signal. Sometimes it means meaning, reduction of uncertainty, causal influence, or computable description. This note argues that in the current theory program, information should not be treated as a free-floating substance.

Instead, information should be understood as **structured distinguishability under a probe and causal access regime**. A difference only counts as usable information if some interaction channel can in principle register, preserve, or transmit it. This immediately explains why information is never wholly independent of probe, coupling, and timing.

This also changes how to think about speed limits. The statement that information does not travel faster than light should not be read as a mystical claim about "information-stuff." It should be read as a claim about **causal accessibility**: no physically usable distinction can outrun the causal structure of the world that would be required to carry it.

This is why the light-speed question matters in the present framework without making light itself magical. If a world carries a distinguished causal speed limit, then that limit acquires importance because it bounds when a distinction can become operationally available somewhere else as information rather than remaining only a latent difference.

The note therefore places information between manifestation and causality. Before a distinction becomes information, it must be made legible by a probe. Before it becomes transferable information, it must be carried by a causal channel. And before it becomes knowledge, it must be stable enough to support reliable reuse.

This paper does **not** claim to settle the physics of relativity, derive quantum-information theory from scratch, or replace Shannon theory. Its narrower contribution is to give the repo's deep theory line a cleaner concept of information: not as a magical primitive, but as accessible, transmissible distinction in a constrained world.

Abstract

We propose a manifestation-and-causality view of information. The motivating problem is that the term information is used for several different objects at once: raw differences, symbols, messages, semantic content, causal signals, and epistemic gain. The present note isolates the common

structural core relevant to the repo's broader theory program. Our main claim is that information should be understood as distinguishability that is accessible under a probe and transmissible under a causal channel. In this language, information is not a free substance but a constrained relation between structure, interaction, and access.

This framing clarifies why speed limits matter. The statement that information cannot travel faster than light should be interpreted as a constraint on usable causal access, not merely as a slogan about abstract bit strings. The paper also distinguishes three levels: latent difference, accessible information, and stabilized knowledge. This provides a cleaner bridge from physical interaction to observation, symbol, and later knowability. The note is conceptual rather than theorem-complete, but it defines a clear downstream program for relating information, causality, probe design, and cross-level manifestation.

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1. Introduction

1.1 The Basic Problem

The current theory line already treats probe, resolution, manifestation, and knowability as central objects. That immediately raises a natural question:

$$\text{what is information in such a world?} \tag{1}$$

If all differences were already information in the same sense, probe choice would not matter. But in the current framework probe choice matters deeply. Some differences are invisible to one interaction channel and visible to another. Some are locally present but not transmissible. Some are transmitted but not stably recoverable.

So the guiding doctrine is not that information is a primitive free substance. It is that information is a role a distinction acquires once probe access and causal transfer become possible.

1.2 Main Claim

The main claim of this paper is:

> Information is not a free-floating substance. It is distinguishability that has become accessible under a probe and transmissible under a causal structure.

This claim has three immediate consequences.

First, not every latent difference is yet information for a given observer or channel.

Second, not every accessible distinction is yet stable knowledge.

Third, causal constraints belong inside the definition of transferable information, not outside it.

1.3 Scope and Non-Claims

This note does **not** attempt:

- to replace Shannon information theory,

- to settle relativistic physics in full,
- to derive quantum-information theory,
- or to reduce semantics to one scalar.

Its narrower role is to place information correctly inside the repo's manifestation framework.

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2. Three Levels: Difference, Information, Knowledge

The present framework suggests three different layers that are often conflated.

2.1 Latent Difference

At the deepest level, the underlying object may contain many distinctions or variations. But these are not yet information in a useful operational sense merely because they exist.

$$\text{latent difference} \neq \text{automatically accessible information.} \tag{2}$$

2.2 Accessible Information

A distinction becomes information for a given system when an available probe can register it. In this language, information is probe-relative:

$$\text{information for } p \iff \text{the relevant distinction is accessible through } p. \tag{3}$$

This is the point where information joins manifestation. A difference becomes informational when it becomes legible.

2.3 Stabilized Knowledge

Even accessible information is not yet knowledge unless it can be retained, checked, reused, or integrated into some lawful closure. So the deeper epistemic ladder is:

$$\text{difference} \longrightarrow \text{accessible information} \longrightarrow \text{stable knowledge.} \tag{4}$$

This distinction matters because many confusions arise from treating all three as one object.

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3. Information as Probe-Relative Distinguishability

Let $\mathcal{U}$ denote an underlying object and let p be a probe. A first crude idea is:

$$\mathcal{I}_p(\mathcal{U}) = \{\text{distinctions in } \mathcal{U} \text{ that can be resolved by } p\}. \tag{5}$$

This is not yet a full theory, but it fixes the right direction. Information is tied to what can actually be distinguished under a concrete interaction channel.

This also explains why different probes yield different information surfaces. A photon-based probe, a mechanical contact probe, and an abstract symbolic parser are not interchangeable. They do not reveal the same distinction class.

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4. Why Speed Limits Matter

The common slogan that information cannot travel faster than light is often stated too bluntly. The present framework suggests a cleaner reading.

4.1 Transfer Requires a Channel

To say that information travels is already to say more than that a difference exists somewhere. One is saying that a usable distinction is carried from one place to another through a channel.

So the relevant object is not abstract information in general, but:

$$\text{transferable information} = \text{causally carried accessible distinction}. \tag{6}$$

4.2 Causal Structure as Constraint

If the physical world imposes a causal structure with a maximal signal speed, then the speed limit applies to the transfer of usable distinction, not merely to metaphoric "bits." In that sense, the light-speed constraint matters because it limits when two places can stand in the right causal-access relation for one to inform the other.

This does not mean information is "nothing but" light. It means causal accessibility is part of what makes information operationally real.

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5. Information Inside the Repo's Theory Stack

The current deep-theory stack can now be read as:

$$\text{being} \longrightarrow \text{difference} \longrightarrow \text{accessible information} \longrightarrow \text{manifest form} \longrightarrow \text{stable knowledge}. \tag{7}$$

In this view:

- meta_theory_one_behind_everything handles manifestation, form, objecthood, and chaos,
- meta_theory_quantized_observation handles lens, quantizer, and symbolic instability,
- the current paper supplies the missing information layer between latent difference and manifested access.

This is why the paper is best understood as a bridge note rather than as an isolated standalone ontology.

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6. Open Program

The strongest next moves now seem to be:

1. define a sharper probe-relative information object,
2. separate accessible information from semantically interpreted information,
3. formalize causal-access constraints in a minimal way,
4. connect this note explicitly to meta_spectral_theory_of_knowability,
5. and later ask how information becomes objective enough to count as shared knowability.

This note should also eventually connect to:

- physics-facing work on causality,
- observer-relative measurement,
- and system-level intelligence, where useful information is not only received but actively selected.

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7. What This Paper Does Not Claim

This paper does **not** claim:

- that information is only physical signal traffic,
- that semantics disappears,
- that every distinction matters equally,
- or that causal speed limits exhaust the theory of information.

Its narrower claim is that information becomes conceptually cleaner when treated as accessible and transmissible distinction rather than as a mysterious free substance.