Civilization Causality Theory: Causal Incompatibility and the Necessity of TCS

Chenliang Zhao

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Abstract

This paper develops the second component of **Civilization Causality Theory (CCT)**.
We show that independently evolved civilizations are **causal systems without alignable semantic substrates**, implying that **direct communication is structurally impossible**. To overcome this, we introduce the concept of a **Third Causal System (TCS)**—a neutral, jointly constructed causal substrate that functions as the *minimal shared semantic layer* between two civilizations. Human cases involving cross-language acquisition and cross-cultural communication provide empirical analogues of TCS formation. We conclude that all feasible cross-civilizational communication must occur **through** such a jointly evolved causal system rather than direct signal interpretation. This result reframes the structure of inter-civilizational contact and provides a foundational explanation for the Fermi paradox [1].

1. Introduction

This paper is **part** of the Civilization Causality Theory (CCT) series, but is written **fully self-contained**. CCT defines a *civilization* not as a biological or technological category but as:

> **A stable, self-consistent causal system capable of generating behavior and propagating information within its own internal causal structure.**

Under this definition, two civilizations that evolve independently will develop **incompatible causal architectures**. This paper proves that such systems **cannot align semantics directly**, and therefore **cannot communicate directly**. We then introduce the concept of a **Third Causal System (TCS)**—a jointly constructed, neutral causal substrate that enables minimal semantic bootstrapping between civilizations.

2. Civilizations as Causal Systems

A civilization may be modeled as a coherent causal network. Such a network consists of internal variables whose states evolve according to well-defined transition rules. These transitions create stable pathways through which information can propagate, and over time the system develops an emergent semantic layer grounded entirely in its own internal causal relations.

This conception makes no commitment to any particular physical or biological realization. It does not presuppose chemistry, neural tissue, digital computation, or even a specific kind of embodiment; what matters is the internal coherence of the causal structure itself.

Any structure capable of maintaining and updating a stable causal network satisfies the definition.

3. Why Independently Evolved Civilizations Cannot Align

3.1 Lack of shared semantic primitives

Two civilizations that arise without any shared evolutionary history, environmental pressures, perceptual architecture, or developmental pathways will, almost inevitably, develop causal abstractions that share no common grounding. Their internal variables, the transitions that govern those variables, and the higher-level semantic structures built upon them have no common grounding and therefore no natural point of alignment.

3.2 Direct communication requires semantic grounding

A signal becomes meaningful only when the receiving system can identify what variable it encodes, situate that variable within its own causal architecture, and update its internal state in a way that remains coherent with that architecture. Civilizations that evolve independently possess no reliable mechanism for performing this kind of mapping. As a result, direct semantic alignment between independent causal systems is not realistically achievable within any finite amount of interaction.

Evidence from Earth reinforces this structural limitation. Humans are unable to form deep semantic alignment with any non-human species despite sharing a physical environment and long co-existence. Even among humans, adults whose languages have no shared lineage cannot bootstrap rich communication without prolonged immersion or the construction of a shared framework. Every successful communicative system ultimately rests on a substrate that is either shared from the start or co-evolved through extensive joint interaction.

3.3 Structural alignment vs. projection alignment

Cases on Earth sometimes appear to show that communication barriers can be overcome through repeated exposure or large-scale learning. Adults can, after sufficient effort, learn an unrelated language; machine translation systems can map between linguistic domains; and pattern-recognition models can approximate semantic correspondences that were not explicitly designed.

These examples, however, concern only projection alignment—the alignment of surface-level outputs rather than the underlying causal structures that generate them. Projection alignment can succeed when two systems already share deep structural commonalities, as humans do: similar perceptual systems, overlapping conceptual primitives, and a shared embodied environment. Under these conditions, surface patterns carry enough latent structural information that repeated correction, immersion, and statistical learning can eventually uncover usable correspondences.

None of this generalizes to independently evolved civilizations. Their internal variables, causal transitions, and high-level abstractions need not overlap in any principled way. Without shared deep structure, surface signals lose their interpretability; attempts at projection alignment become indistinguishable from unconstrained curve-fitting, with no mechanism for verifying any inferred correspondence. Learning in such a context cannot converge, because there exists no shared causal substrate through which errors can be meaningfully corrected.

TCS addresses precisely this limitation. It does not align projections but aligns structures: it provides a causal space jointly accessible to both civilizations, within which semantic relations can be created, tested, and revised. In this sense, TCS is not an alternative to learning-based approaches; it is the structural condition that makes any form of learning or convergence possible in the first place.

This distinction becomes essential when evaluating claims about learnability, translation, or emergent communication systems: such mechanisms presuppose shared deep structure and therefore cannot generalize to independently evolved civilizations.

4. The Third Causal System (TCS)

4.1 Definition

A Third Causal System (TCS) may be understood as a neutral causal system jointly created and jointly shaped by two civilizations. It provides a state space that both parties can observe, a set of manipulable causal transitions, and an interpretability structure that does not privilege either civilization's endogenous semantics. Crucially, a TCS is not a

communication channel or a protocol in the conventional sense. Instead, it serves as a minimal shared causal substrate—a domain in which both civilizations can observe and modify states, test tentative interpretations, and determine whether semantic relations hold consistently across interactions.

4.2 Conditions for TCS existence

Several structural requirements follow naturally from the definition. The TCS must present a state space available to both civilizations' modes of observation, and each side must be able to intervene in that space in ways the other can reliably detect. Its causal evolution cannot carry built-in biases or assumptions inherited from either civilization, since any asymmetry of this kind would collapse the neutrality required for joint semantic formation. Most importantly, whatever semantic structures eventually emerge within the TCS must be learnable and verifiable by both participants through interaction with the system itself.

If any of these conditions fail, meaningful convergence cannot occur. Thus, all viable forms of cross-civilizational communication ultimately amount to co-evolving a TCS. No alternative mechanism offers the structural guarantees required for stable semantic alignment.

5. Human Analogues of TCS Formation

Although humanity has no contact with external civilizations, Earth offers instructive parallels for understanding how a Third Causal System could arise. These examples do not rely on speculative assumptions; they simply reveal how semantic alignment behaves when independent causal systems attempt to communicate.

5.1 Failed alignment among isolated adult groups

When two adult communities share neither a language nor a prior history of interaction, they are unable to establish deep semantic communication through signaling alone. Even if signals can be exchanged, there is no mechanism through which either side can verify that an interpretation is correct, nor any shared structure within which meanings can gradually converge. In such cases, communication fails not because of unwillingness or lack of intelligence, but because no jointly constructed causal substrate exists.

This phenomenon anticipates the structural difficulty faced by independently evolved civilizations: without a shared developmental space, nothing anchors semantic alignment.

5.2 Co-evolved semantics: the jointly raised child

A clearer analogue appears when two unrelated linguistic groups jointly raise a newborn child. In this arrangement, the child begins from a neutral developmental state and acquires its linguistic and cognitive structures through the combined influence of both communities. Over time, the child becomes a system whose internal variables, behavioral transitions, and emergent semantics are jointly shaped. Each group can observe and modify the child's learning trajectory, and—crucially—both can interpret the structures that result.

The child thus functions as a genuine shared causal substrate: a system co-evolved from minimal priors, accessible and semantically transparent to both sides. Its development provides a stable reference frame within which meanings can be created, tested, and refined. This is precisely the role played by a Third Causal System in cross-civilizational contexts.

By contrast, humans and non-human animals cannot generate such a shared substrate. Their developmental causal structures diverge too sharply to provide a jointly accessible substrate for semantic co-evolution. The failure here mirrors the difficulty that independent civilizations would face without a TCS: absent a space that both parties can shape and understand, sustained semantic exchange cannot emerge.

5.3 Limits of human analogies and the lower bound of alignment difficulty

It is important to emphasize that these human examples serve only as structural analogues. They illustrate why semantic alignment requires a jointly shaped causal substrate and why direct communication between independently developed systems fails, even when they share biology, perception, and environment. If such difficulties already arise within a

single species on a single planet, whose members possess broadly compatible cognitive architectures, then the challenge facing independently evolved civilizations—who share none of these background structures—must be strictly greater. The human case therefore functions as a lower bound on the difficulty of cross-civilizational communication, not a model of its full complexity.

These examples do not suggest that extraterrestrial civilizations resemble humans; they illustrate only the structural constraints inherent in semantic alignment.

6. Structural Consequences

These considerations have several structural consequences. First, no civilization can directly interpret the signals of another, because no interpretation is verifiable without a shared causal substrate. Second, whenever a TCS is absent, all putative communication collapses into guesswork, regardless of the technology involved. Third, the Fermi paradox acquires a natural explanation: what appears to be cosmic silence may simply reflect our inability to achieve causal compatibility with independently evolved systems [1] [2].

These conclusions arise from the structure of causality itself, rather than from contingent astrophysical, biological, or sociological assumptions.

7. Conclusion

This chapter has argued that the existence of a Third Causal System (TCS) is not merely advantageous but structurally required for any form of communication between independently evolved civilizations. Once civilization is understood as a self-sustaining causal system, it follows that independently evolved systems will possess no shared semantic primitives and no natural way to interpret each other's causal transitions. Under these conditions, direct communication becomes infeasible in practice. Only by jointly creating a neutral causal substrate—one whose states can be observed, influenced, and interpreted by both sides—can meaningful alignment emerge. Human cross-cultural and cross-linguistic experience offers a limited but illuminating analogue of how such joint semantic construction operates.

The broader theoretical program continues beyond this foundational result. Future work will develop a formal account of causal alignment, specify constructive procedures for generating TCS-like systems, articulate a general Causal Incompatibility Theorem, and explore the observational implications for SETI, astrobiology, and other inquiries into civilizational contact.

References

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